

the visual inspection trials and by $20.1 \pm 11.0\%$ in the anatomically positioned trials ($p > 0.482$). Variability in changes in SmO_2 from baseline were not different between visual placement versus anatomic positioning (ΔSmO_2 difference $-3.5 \pm 16.6\%$ vs $-1.3 \pm 12.8\%$, $p = 0.182$). However, Bland-Altman analysis showed greater variation using visual placement (CI -36.4 to 29.3) vs measured placement (CI -26.2 to 23.6). Based on these data, it should be possible to find a 10% difference in SmO_2 between a population with impaired uptake using a sample of 38 subjects (19 impaired, 19 unimpaired). **CONCLUSIONS:** These data provide a basis for detecting abnormal metabolic responses for the 6-min walk test in clinical populations. These devices may be used diagnostically by clinicians during exercise (e.g. to determine impaired O_2 peripheral uptake).

2088

Aging-dependent Responses To Mechanical Loading In C2c12 Myotubes

Evangelos Tolis, Spiliotis Efstratiou, Eirini Chatziniakita, Athanasios Moustogiannis, Maria Maridaki, Michael Koutsilieris, Anastassios Philippou, FACSM. *National & Kapodistrian University of Athens, Athens, Greece.*
(No relevant relationships reported)

Introduction: Aging is associated with impaired myogenic potential and altered transcriptional responses to mechanical stimuli in skeletal muscle cells. Although mechanical loading can stimulate myogenic signaling, a potentially senescence-related differential regulation of key myogenic and muscle atrophy genes under mechanical loading remains unclear. **Purpose:** This study examined and compared the effects of a specific cyclic mechanical loading protocol on the expression of myogenic regulatory factors MyoD, Myf5, Myogenin, and Myostatin in control and aged myotubes. **Methods:** Control and replicatively aged (after 80 population doublings) C2C12 myoblasts were differentiated into myotubes (Day 10 of differentiation) and subjected to a cyclic mechanical stretching protocol of 15% elongation at 1 Hz for 12 hours using the Flexcell Tension System. Gene expression responses to mechanical loading were analyzed using Real-Time PCR. Comparisons between transcriptional responses in stretched and non-stretched conditions were performed using the Student's t-test with the statistical significance set at $p < 0.05$. **Results:** In control myotubes, mechanical loading caused non-significant changes in gene expression (fold changes compared to non-stretched cells: Mean $\pm$ SE) of MyoD (1.33 ± 0.70 ; $p > 0.05$) and Myf5 (2.12 ± 1.03 ; $p > 0.05$), while in aged myotubes the post-loading expression responses were 12.72 ± 6.09 ($p > 0.05$) and 6.15 ± 3.87 ; ($p > 0.05$), respectively. Similarly, mechanical loading-induced Myostatin expression responses in both control (1.32 ± 1.09 ; $p > 0.05$) and aged (2.05 ± 1.55 ; $p > 0.05$) myotubes did not reach statistical significance ($p > 0.05$). In contrast, the expression of the late differentiation factor Myogenin was significantly elevated post-loading in control myotubes ($p < 0.05$), while this increase was higher compared to the aged cells (35.76 ± 6.95 vs 1.81 ± 0.59 ; $p < 0.05$). **Conclusion:** Mechanical loading selectively upregulated Myogenin expression in control myotubes, confirming the enhancement of myogenic differentiation in these cells. Interestingly, in the aged myotubes, the mechanical loading protocol utilized did not induce significant alterations in the genes examined. These findings might indicate an impaired myogenic responsiveness of aged myotubes to mechanical loading.

2089

The Acute Effects Of High-pressure Blood Flow Restriction On Muscle Strength And Power

Robert W. Sallberg¹, Yujiro Yamada¹, William B. Hammert¹, Ryo Kataoka², Emily E. Metcalf¹, Anna Kang³, Jeremy P. Loenneke, FACSM¹. ¹The University of Mississippi, University, MS. ²University of Southern Mississippi, Hattiesburg, MS. ³Northern Arizona University, Flagstaff, AZ.
rsallber@go.olemiss.edu
(No relevant relationships reported)

Few studies have examined whether combining blood flow restriction (BFR) with high-loads can acutely enhance performance. Existing studies indicate that applying high-pressure BFR (150% AOP) during high-force contractions acutely enhanced muscle strength and power. Of note, these data were observed during multi-joint exercises and are possibly due to a rebound effect. This rebounding effect occurs when the compression of the cuff itself enhances the outcome (strength or power). In contrast, when low-pressure BFR ($< 60\%$ AOP) was applied to single-joint movements without a rebound effect, there was no enhancement.

PURPOSE: To determine if high-pressure BFR can acutely augment strength and power using a single-joint movement, where there is no rebounding effect.

METHODS: 25 resistance-trained individuals (14 males and 11 females) enrolled in a replicate cross-over trial, in which three paired cycles were completed (i.e., 6 experimental visits). Each paired cycle consisted of two visits, completed in random order, and included maximal strength and power testing (i.e., 3 maximal concentric knee extension repetitions for both) at either 150% of resting arterial occlusion pressure (150% AOP) or 2 mmHg (sham). The strength test, assessing peak torque, was performed first and consisted of an isokinetic muscle action set at 30 per second. The power test, measuring peak power and angular velocity, consisted of an isotonic muscle action with a resistance set at 70% of the participant's peak isokinetic strength (relative to each visit). T-tests based on differences per cycle were used to determine if conditions differed. A meta-analysis on the replicate-averaged treatment effect was used to assess whether the effect was similar across participants. Data are presented as means (95% CI).

RESULTS: High-pressure BFR reduced torque [-17.3 (95% CI: -22.0 , -12.7) Nm] and power (-33.9 (95% CI: -48.1 , -19.7) Watts). Angular velocity saw no effect of BFR [2.21 (95% CI: -4.9 , 9.3) deg/sec]. There was evidence of heterogeneity (τ) for torque [13.9 (95% CI: 8.1 , 22.4) Nm], but not for power or angular velocity.

CONCLUSIONS: High-pressure BFR showed no acute augmentation in strength and power outcomes compared to a sham. This suggests that previous results may have been due to the rebounding effect rather than the pressure of BFR per se.

2090

The Influence Of Age And Physical Maturation On Athletic Performance In Youth Athletes

Tyler Goslinga¹, Courtney D. Jensen², Chad Poole³, Marie R. Jensen⁴. ¹Therapy Partners Group, Ripon, CA. ²University of the Pacific, Stockton, CA. ³Ripon Unified School District, Ripon, CA. ⁴Golden Bear Physical Therapy, Stockton, CA.
tgoslinga@tpgpt.com
(No relevant relationships reported)

Youth sports rely on age-based categorizations to ensure fair competition and appropriate opportunity for skill development. However, physical maturation, which varies within age groups, may substantially influence athletic capacity. **PURPOSE:** To compare the influence of age and body size on various performance metrics among youth athletes. **METHODS:** We enrolled 13 males (ages 11-17) who compete in youth sports. We assessed countermovement jump (CMJ) height and peak take-off force using Vald ForceDecks force plates. We captured 40-yard dash and 5-10-5 agility shuttle times using Vald SmartSpeed pulsed laser. We measured quadriceps strength and torque using a Vald Dynamo dynamometer; we calculated limb symmetry index (LSI) based on these values. Linear regressions evaluated relationships between maturation variables (age, height, and weight) and performance outcomes; Spearman rank correlations were used where assumptions were not met. All analyses were performed on SPSS version 29.0; significance was set at $p < 0.05$. **RESULTS:** Subjects were 14.5 ± 2.3 yr, height was 169.4 ± 16.6 cm, weight was 59.6 ± 18.3 kg, CMJ height was 31.4 ± 6.5 cm, peak take-off force was 21.9 ± 1.7 N, 40-yard dash was 5.9 ± 0.5 sec, 5-10-5 agility shuttle was 5.3 ± 0.4 sec,

quadricep strength was 40.7 ± 19.1 kg, corresponding LSI was $16.0 \pm 10.9\%$, and quadricep torque was 2.6 ± 0.8 Nm with a corresponding LSI of $15.8 \pm 10.8\%$. Height was related to 40-yard dash ($p = 0.010$; 95% CI of β : -0.035, -0.006), quadricep strength ($p = 0.029$; 95% CI of β : 0.086, 1.305), quadricep strength LSI ($p = 0.011$; 95% CI of β : -0.770, -0.126), and quadricep torque LSI ($p = 0.013$; 95% CI of β : -0.755, -0.109). Weight was related to 40-yard dash ($p = 0.005$; 95% CI of β : -0.032, -0.007) and quadricep strength ($p < 0.001$; 95% CI of β : 0.453, 1.250); trends were found with quadricep strength LSI ($p = 0.055$; 95% CI of β : -0.658, 0.008) and torque LSI ($p = 0.061$; 95% CI of β : -0.645, 0.017). Age was related to CMJ jump height ($r_s = 0.582$, $p = 0.037$), 40-yard dash ($r_s = -0.762$, $p = 0.002$), and quadricep strength ($r_s = 0.731$, $p = 0.005$) and torque ($r_s = 0.621$, $p = 0.024$); there was a trending relationship with CMJ peak take-off force ($r_s = 0.534$, $p = 0.060$). **CONCLUSION:** These findings suggest that assessing maturation through athlete size could offer a valuable complement to age-based grouping in youth sport participation.

2091

Effects Of Unilateral Lower Limb Suspension On Quadriceps Size And Function In A Transgender Man

Lance M. Bollinger¹, Jordan Hughes¹, Masafumi Uchiumi¹, Jack McArdle¹, John Caruso², Srikanth Nithyanandam¹, Stuart Best¹.

¹University of Kentucky, Lexington, KY. ²University of Louisville, Louisville, KY. (Sponsor: Jody Clasey, FACSM)

lance.bollinger@uky.edu

(No relevant relationships reported)

Purpose: NASA's Artemis missions aim to send a diverse crew to the lunar surface, yet muscle remodeling effects of microgravity in transgender people remains unexplored. **Methods:** 7F (24.1±5.0y), 5M (37.4±9.7), and 1 recreationally resistance trained TGM (26y) taking 50mg/wk cyproionate underwent 13d of unilateral lower limb suspension (ULLS) - a ground analog of microgravity exposure. Maximal voluntary isometric contraction (MVIC) and femoral-nerve stimulated interpolated twitch (ITT) were assessed pre- and post-ULLS. MRI of the mid-thigh was used to assess quadriceps cross-sectional area (CSA) post-ULLS. **Results:** MVIC was similar between limbs at baseline all subjects (M: 215.7±65.1 > TGM: 176.1 > F: 152.5±29.4Nm). Post-ULLS, MVIC was lesser in the unloaded compared to the loaded leg in all subjects (M: -26.9±21.0 > TGM: -17.1 > F: -15.6±13.9%). Post-ULLS, quadriceps CSA was lesser in the unloaded (M: 81.6±10.7 > TGM: 66.8 > F: 59.8±6.5cm²) compared to loaded (M: 85.9±17.0 > TGM: 74.2 > F: 62.4±7.9 cm²) leg. Normalizing MVIC to CSA revealed lesser specific tension in the unloaded (M: 45.9±24.0, TGM: 42.7, and F: 49.2±12.4 N·cm⁻²) compared to the loaded (M: 58.2±18.8, TGM: 47.1, and F: 56.0 N·cm⁻²) leg. Peak Twitch Torque (PTT) was similar among all subjects post-ULLS (M: 18.9±2.3, TGM: 18.4, and F: 18.4±2.1N·cm⁻²) and was not different between limbs after normalizing to quadriceps CSA. Similar null effects were noted for RTD (M: 373.9±22.1, TGM: 391.7, and F: 413.6±76.8 N·cm⁻²·s⁻¹). PTT and RTD were greater in the potentiated (PTT: 5.4%; RTD: 7.3%) than unpotentiated states for all subjects and was not affected by ULLS or sex. **Conclusions:** Normalizing voluntary and femoral-nerve stimulation responses to quadriceps CSA, revealed similar contractile function among cisgender men and women and TGM pre- and post-ULLS indicating that differences in muscle strength among genders and with ULLS may be due to muscle size rather than contractile function. Supported by: KY Space Grant Consortium: RIA-22-043

2092

Jump Mechanic Differences Between Female And Male High School Athletes

Chad Poole¹, Courtney D. Jensen², Tyler Goslinga³, Marie R. Jensen⁴. ¹Ripon Unified School District, Ripon, CA. ²University of the Pacific, Stockton, CA. ³Therapy Partners Group, Ripon, CA. ⁴Golden Bear Physical Therapy, Stockton, CA.

cpoole@riponusd.net

(No relevant relationships reported)

Understanding how biological sex influences athletic performance can aid in the management of equity in youth sports. **PURPOSE:** To measure sex-based differences at the high-school level in various metrics of human performance. **METHODS:** We tested 16 high school athletes (8 male, 8 female) in counter-movement jump (CMJ) height, CMJ peak take-off force, mean quadricep strength, mean quadricep torque, 40-yard dash, and 5-10-5 agility shuttle. All data were collected by trained physical therapists. CMJ height and peak take off force were captured using Vald ForceDecks plates. Each athlete performed 3 standardized jumps, and peak performance was exported. Quadricep strength and torque were assessed with Vald Dynamo dynamometers. After standardized instructions, subjects performed 3 trials; peak performance was exported. For the 40-yard dash and 5-10-5 agility shuttle, athletes followed Vald's protocol, and times were recorded with a Vald SmartSpeed pulsed laser. We compared sex differences in all metrics using independent-samples t-tests; where assumptions were not met, we used Mann-Whitney U tests. Simple linear regressions measured the effect of sex on all performance outcomes that met assumptions. **RESULTS:** Subjects were 16.0 ± 0.5 yr; there was no difference between sexes in age ($p = 0.278$). CMJ height was 28.2 ± 7.4 cm, peak take-off force was 22.9 ± 2.4 N, mean quadricep strength was 42.9 ± 15.3 kg and torque was 2.5 ± 0.7 Nm, 40-yard dash was 5.8 ± 0.5 sec, and 5-10-5 agility shuttle was 5.2 ± 0.4 sec. T-tests revealed male performances to be 8.9% better in the 40-yard dash ($p = 0.032$), 36.4% better in CMJ height ($p = 0.002$), and they had 29.5% higher quadricep torque ($p = 0.026$). There was no difference in 5-10-5 performance ($p = 0.261$). CMJ peak take-off force and mean quadricep strength did not meet parametric assumptions; Mann-Whitney U comparisons found a difference in quadricep strength ($p = 0.050$) but not CMJ peak take-off force ($p = 0.878$). In regression analysis, sex was a significant predictor of 40-yard dash ($r^2 = 0.287$; $p = 0.032$), CMJ height ($r^2 = 0.508$; $p = 0.002$), and quadricep torque ($r^2 = 0.307$; $p = 0.026$). **CONCLUSION:** Among high school athletes, males performed better in some assessments. These findings may help contribute to evidence-based eligibility criteria and regulations for sex categories in competitive sport.

2094

Mitochondrial Atp-sensitive Potassium Channel-mediated Protection In Reoxygenated Respiratory Muscle Of Po₂-cycling Smoking Mice

Li Zuo. The University of Texas and UT Health Rio Grande Valley, Edinburg, TX. (Sponsor: Alex Zuo, FACSM)

(No relevant relationships reported)

Chronic obstructive pulmonary disease (COPD) subjects may experience reoxygenation damage and decline in diaphragm function after sustained hypoxia. PO₂ cycling has been shown to protect the diaphragm during reoxygenation by repeatedly exposing tissue to low and high O₂ levels for brief periods of time. In mice with COPD caused by smoking, the protective mechanism for the diaphragm has not yet been determined. **PURPOSE:** To test the hypothesis that mitochondrial ATP-sensitive potassium channels (mK_{ATP}) contribute to protective effect of PO₂ cycling during reoxygenation in smoking-induced COPD mice. **METHODS:** Male C57BL6 mice were subjected to cigarette smoking for two hours per day, five days a week, for three continuous months to induce the onset of COPD symptoms. Following their sacrifice, the smoking mice's diaphragms were removed for examination of muscular function. Every muscle strip was placed in a contractile chamber and subjected to five PO₂ cycling cycles or to the appropriate mitoK_{ATP} inhibitors (Carboxyatractylolide (50μM) + Glibenclamide (100μM); n=6) or activator (diazoxide (100μM); n = 6) for 30 min before PO₂ cycling. After equilibration, muscle strips underwent 30 minutes of hypoxia followed by 15 minutes of reoxygenation. During the middle of the reoxygenation interval (5-10 minutes), each muscle was electrically stimulated for 5 minutes with square-wave pulses (70 Hz,