3250 Board #71 May 29 1:30 PM - 3:00 PM

Anthropometric Characteristics And Training Behaviors In Advanced And Elite Rock Climbers

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(No relationships reported)

PURPOSE: The purpose of this study was to quantify training volumes and modalities in a sample of advanced and elite climbers.
METHODS: An online survey was distributed through various climbing-related social media platforms. Questions included demographics, climbing ability and style, training modalities used, and weekly volumes of training.
RESULTS: Of 595 initial participants, 92 boulderers (B) (63 men, 29 women) and 71 sport-lead (SL) climbers (49 men, 22 women) were identified as advanced or elite (A/E) using the IRCRA (International Rock Climbing Research Association) Red Point Scale of which 69% had entered at least one competition. Among A/E women and men SL climbers there was a moderate inverse relationship between BMI and SL climbing ability ($r = -0.56$ and $r = -0.39$, respectively), this was not observed among women B and diminished in men B ($r = 0.12$ and $r = -0.25$). Anthropometric and training data is reported in Table 1. Mean exercise volume among A/E was 470 ± 263 min/week, with 333 ± 202 min/week as climbing specific training. Women SL climbers reported spending more time each week training specifically for climbing compared to women B ($p<0.05$) but total training time did not differ between groups or genders ($p>0.05$). 70% and 35% of A/E climbers reported weekly aerobic and resistance exercise, respectively, with no differences between genders or SL and B.
CONCLUSION: To our knowledge, this was the first study to quantify training volume and modalities in A/E climbers.

Table 1. Characteristics of advanced/elite (A/E) women and men boulderers (B) compared to A/E women and men sport lead (SL) climbers (mean ± standard deviation).

Characteristic	A/E B n=29(w); n=63(m)	A/E SL n=23(w); n=49(m)
Age (years)	28.8 ± 7.1*; 29.5 ± 7.1**	37.6 ± 8.3; 35.6 ± 8.8
Height (cm)	165.9 ± 6.7*; 178 ± 5.8	160.8 ± 6.1; 179 ± 6.3
Weight (kg)	57.9 ± 7.4*; 69.9 ± 9.3	52.7 ± 5.9; 69.3± 6.2
BMI (kg/m^2)	21.0 ± 2.2; 22 ± 2.3	20.3±1.6; 21.5 ± 1.1
Years climbing	6.9 ± 5.8*; 10.1 ± 8.9**	12.1 ± 7.9; 14.1 ± 8.8
IRCRA boulder ability	20.1 ± 2.6; 23.2 ± 2.3	20.7 ± 3.4; 23 ± 2.5
IRCRA sport-lead ability	14.8 ± 5.4*; 19.5 ± 4.3**	22.0 ± 3.2; 24 ± 1.9
Climbing volume (min p/week)	278 ± 187*; 305 ± 201	378 ± 220; 376 ± 198
Indoor climbing (% total climbing) Total exercise volume	80% ±19%*; 74%± 25%** 421± 251; 438 ± 269	50% ± 27%; 37% ± 31% 504 ± 237; 523 ± 268
% Participating in aerobic exercise	69%; 70%	64%; 75%
% Participating in anaerobic exercise	17%; 24%	32%; 31%
% Participating in resistance exercise	41%; 33%	36%; 31%

BMI, body mass index; IRCRA B and IRCRA SL, bouldering and sport lead climbing ability, respectively, based on International Rock Climbing Research Association conversion scale.* Significant difference between groups within females; ** significant differences between groups within males $p<0.05$.

3251 Board #72 May 29 1:30 PM - 3:00 PM

The Immediate Effects Of Abdominal And Core Exercise On Balance For College-age Dancers

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(No relationships reported)

Balance is defined as the ability to maintain a stable position while remaining steady. Balance is extremely important to dancers to help prevent injury and to maximize aesthetic and athletic performance. While other studies support the improvement of balance among dancers following a core exercise training program, the effects immediately following one core exercise session are less clear.
PURPOSE: The purpose of this study was to examine the immediate effects of a core and abdominal exercise program on balance for dancers, with the hypothesis that a core exercise program would cause an immediate improvement in balance for college-aged dancers.
METHODS: Eighteen female collegiate dancers (19.83 ± 1.58 years, 7-18 years of dance experience) completed two sets of eight exercises, engaging the upper and lower abdominal, obliques, gluteals, and erector spinae muscles. Two static balance tests, the Balance Error Scoring System (BESS) test and the Stork Balance Standing test, and two dynamic balance tests, the Y Balance test and the Pirouette test, were conducted prior to and after the core exercises.
RESULTS: The core exercise program significantly improved balance results for the Y Balance Test composite score (86.0 ± 6.3% pre vs 88.4 ± 5.3% post, $p<0.05$) and the BESS Test (22.7 ± 8.0 errors pre vs 16.1 ± 7.0 errors post, $p<0.05$). There were no significant differences between pre and post intervention scores of the Stork Balance Standing test or the Pirouette test.
CONCLUSIONS: Including core exercises in a dancer's warm-up before practices and performances may have an acute positive effect on balance for dancers, which could translate to improvements in performance. It is unclear if a core exercise program can acutely improve dance skill-specific balance, such as during pirouettes.

3252 Board #73 May 29 1:30 PM - 3:00 PM

Weighting The Swing: The Mechanical Changes That Emerge When Loads Are Applied To Baseball Bats

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(No relationships reported)

Success in baseball batting relies on a union of swing power and accuracy. Off the field, training commonly employs weighted loads replicating hitting mechanics. On the field, immediately prior to a plate appearance, batters sometimes place a weighted ring on the bat to warm up their swing. Although common, these traditional training methods lack investigation.
PURPOSE: To observe differences of baseball swing characteristics in response to applied bat resistance.
METHODS: We tested 14 NCAA baseball athletes using Proteus technology (Proteus Motion, USA). Participants completed 5 sets of 6 swings at increasing loads of magnetic resistance. Each set increased in weight by 2 lbs, ranging from 1-9 lbs. Measurements computed by Proteus were peak power, peak force development rate (PFDR), braking, consistency, endurance, velocity, and range of motion (ROM). Paired-samples t-tests compared swing characteristics of the 1 lb resistance to the mean of 3, 5, 7, and 9 lb. MANOVA with repeated measures observed the differences of swing variables in response to resistance increases. Linear regression tested the effect of different loads on performance parameters.

RESULTS: The 1 lb resistance differed from the mean resistance in peak power ($p<0.001$), PFDR ($p<0.001$), braking ($p<0.001$), ROM ($p=0.017$), and velocity ($p=0.063$), but not in consistency ($p=0.110$) or endurance ($p=0.375$). The mean values of consistency ($p=0.985$) and endurance ($p=0.530$) could not predict outcomes for 1 lb performance, but did predict ROM ($p=0.002$) and braking, power, PFDR, and velocity ($p<0.001$). As resistance levels increased, there were significant differences in swing power ($F=317.297$, $p<0.001$), PFDR ($F=141.797$, $p<0.001$), braking ($F=91.011$, $p<0.001$), ROM ($F=6.067$, $p=0.013$), and velocity ($F=2.5122$, $p=0.039$), but not measurements of consistency ($F=0.911$, $p=0.480$) or endurance ($F=2.156$, $p=0.070$).
CONCLUSIONS: As bat resistance increased, players made acute responses that compromised recruitment characteristics (consistency and endurance). Training and warm-up techniques that employ loaded swings may alter mechanics accordingly.

F-55 Free Communication/Poster - Blood Flow Restriction

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3253 Board #74 May 29 2:30 PM - 4:00 PM

The Acute Effects Of Volume-Matched Resistance Exercise With Blood Flow Restriction Versus Traditional Exercise On Arterial Elasticity And Hemodynamic Variables

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PURPOSE: To investigate the acute effects of varying intensities of volume-matched lower body resistance exercise sessions with and without blood flow resistance (BFR) on hemodynamic variables and arterial compliance.
METHODS: Seventeen males and fifteen females completed six separate volume-matched sessions of lower body resistance exercise of 4 sets of leg curl and leg extension at 40 (T40), 60 (T60), and 80% (T80) of 1RM without BFR and 25 (BFR25), 35 (BFR35), and 50% (BFR50) with BFR. Blood pressure, arterial elasticity, and hemodynamic variables (mean arterial pressure (MAP), stroke volume (SV), stroke volume index (SVI), cardiac output (CO), cardiac index (CI), large arterial elasticity (LAE), small arterial elasticity (SAE), systemic vascular resistance (SVR), total vascular impedance (TVI) and cardiac ejection time (CET)) were measured at baseline, immediately postexercise, 10 min, 20 min, and 30 min-post exercise using a oscillometric blood pressure module and a piezoelectric pressure sensor.
RESULTS: One-way ANOVA found no significant differences between group means at baseline resting values. Repeated measures ANOVA found significant condition main effects ($p<0.05$) for HR, LAE, SAE, and TVI post exercise. Post-hoc pairwise comparisons found that BFR25 caused significantly greater HR than BFR50 ($p<0.04$) at 10 min-post exercise and T80 at 0 and 10 min-post exercise ($p<0.02$). BFR25 also resulted in significantly greater ($p<0.03$) LAE compared to BFR50 at 10 min-post exercise (20.8± 1.7 vs. 16.4± 0.7 ml/mmHg×10). SAE was significantly lower ($p<0.05$) following BFR50 (8.4±0.4 ml/mmHg×10) compared to T40 (10.7±0.7 ml/mmHg×10). TVI was found to be significantly lower in BFR25 than BFR50 ($p<0.01$) and BFR35 ($p<0.02$) at 10 min-post exercise (87.2±5.9 vs. 111.2±5.8 and 103.7±5.8 dyne·sec·cm^{-5}, respectively).
CONCLUSIONS: The current results indicate that higher intensity BFR groups may not be favorable for acute post exercise arterial elasticity. The changes in hemodynamic and arterial elasticity responses to volume-matched lower load exercise during the BFR25 session demonstrate the possibility of improving cardiovascular health and function. Future studies should determine the effects of BFR and non-BFR training methodologies on chronic adaptations in cardiovascular system.

3254 Board #75 May 29 2:30 PM - 4:00 PM

Cardiovascular Response To Unilateral, Bilateral, And Alternating Exercises With Blood Flow Restriction

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(No relationships reported)

The cardiovascular response induced by resistance exercise with blood flow restriction (BFR) seems to be lower or comparable to traditional exercise in healthy individuals. However, the potential for BFR to be used for at risk populations highlights a need to further attenuate the cardiovascular response, potentially via the modality of exercise.
PURPOSE: To compare the cardiovascular response to unilateral (UN), bilateral (BI), and alternating (AL) BFR exercise.
METHODS: 13 males and 7 females performed four sets (30 seconds rest) of UN, BI, and AL knee-extensions to failure with 30% one-repetition maximum and 40% arterial occlusion pressure. Pulse wave analysis was measured before and after exercise. Data, presented as mean (SD), were analyzed using Bayesian RMANOVA.
RESULTS: AL caused greater changes in: aortic systolic [ΔmmHg: AL=21 (8); UN=13 (10); BI=15 (7); BF_{10}=29.63], diastolic [ΔmmHg: AL=13 (8); UN=7 (10); BI=8 (7); BF_{10}=5.13], and mean arterial [ΔmmHg: AL=19 (8); UN=11 (10); BI=13 (7); BF_{10}=48.39] blood pressures. Brachial [ΔmmHg*bpm: AL=4945 (2340); UN=3218 (1412); BI=3461 (1430); BF_{10}=31.74] and aortic [ΔmmHg*bpm: AL=6134 (2479); UN=4200 (1722); BI=4525 (1664); BF_{10}=114.83] rate pressure product as well as heart rate [Δbpm: AL=26 (14); UN=18 (8); BI=19 (11); BF_{10}=5.82] were also greatest with AL. Augmentation pressure [ΔmmHg: UN=-3 (5); BI=-2 (6); AL=-1 (6); BF_{10}=0.19], pulse pressure [ΔmmHg: UN=6 (6); BI=7 (7); AL=8 (5); BF_{10}=0.27], augmentation index [Δ%: UN=-6 (12); BI=-7 (11); AL=-6 (16); BF_{10}=0.16], wave reflection magnitude [Δ%: UN=-5 (8); BI=-5 (7); AL=-4 (7); BF_{10}=0.15], forward wave height [ΔmmHg: UN=8 (6); BI=8 (6); AL=8 (4); BF_{10}=0.15], and reflected wave height [ΔmmHg: UN=1 (3); BI=2 (4); AL=3 (3); BF_{10}=0.31] were not different between conditions. Exercise volume was greater in AL [kg: AL=1835 (1725); UN=915 (312); BI=893 (313); BF_{10}=29.17]. Ratings of perceived exertion (BF_{10}=3.99e+144) and discomfort (BF_{10}=2.0e+73) increased with sets. AL had an elevated discomfort (BF_{10}=5548.97).
CONCLUSION: The greater cardiovascular response following alternating BFR exercise in healthy individuals, suggests those at risk of a cardiovascular event should choose unilateral or bilateral BFR exercise until further work determines the degree to which this modality can be tolerated.

3255 Board #76 May 29 2:30 PM - 4:00 PM

Effect Of Aerobic Exercise With Blood Flow Restriction On Substrate Utilization And Energy Expenditure

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(No relationships reported)

Blood flow restriction (BFR) added to aerobic exercise has the potential to elicit physiological adaptations. However, the acute effects of BFR on substrate utilization and energy expenditure (EE) remains unclear.
PURPOSE: The purpose of this study was to examine the effects of intermittent BFR compared to low- (LIIE) and high-intensity interval exercise (HIIE) on EE and substrate utilization during exercise and recovery.
METHODS: Participants randomly performed 3 interval (INT) exercise protocols: BFR, LIIE and HIIE. BFR and LIIE consisted of 10 INTs of 2-min of work at 70% of ventilatory threshold (VT) and 1-min of recovery (20 watts; W). During BFR, the cuffs were inflated to 80% of limb occlusion pressure (154 ± 17 mmHg) during each work INT and deflated during each recovery INT. HIIE consisted of 5 INTs at 140% of VT and 1-min of recovery (20 W). Breath by breath pulmonary oxygen uptake (VO_2) and carbon dioxide production (VCO_2) were recorded during a