Stress fractures (SF), common injuries among athletes, have been reported in up to 20% of track and field athletes. Typically, after a period of unloading and gradual return to weight-bearing activities, athletes return to unrestricted participation in their given sport 12-14 weeks after SF diagnosis. However, the time course of the recovery of mechanical competence of the bone is not well characterized, and reinjury rates are high. **PURPOSE:** To determine changes in bone microarchitecture and estimated bone strength over 12 months following tibial SF diagnosis. **METHODS:** We enrolled 30 women, ages 18-35, with a tibial SF (grade 2 or higher) for this prospective observational study. Participants completed a baseline visit within 3 weeks of SF diagnosis. At baseline, 6, 12, 24, and 52 weeks following SF diagnosis, we collected high-resolution peripheral quantitative computed tomography images of the distal tibia (4% from the distal tibial plateau) before and after BCT and analyzed data on total, trabecular, and cortical volumetric bone mineral density (vBMD) increased significantly by 0.50-2.28% (all p<0.001) over the BCT period in women and by 0.32-1.84% (all p<0.001) in men. **CONCLUSIONS:** This preliminary view of data collected to date found that following BCT, both men and women mounted an adaptive response in tibial trabecular bone microarchitecture, indicative of de novo trabecular bone formation. The responses in tibial bone microarchitecture were of greater magnitude in women than in men, which may be due to lower average baseline values in bone microarchitectural properties in women, and therefore potentially greater loading stimuli. Other lifestyle and demographic factors may also influence the adaptive bone response to BCT and will be investigated in the larger sample following study completion.
An athlete’s diet and physical training have been reported to have direct positive influences on performance variables including strength and power which are strategic to athletic performance. According to nutritional recommendations, however, female athletes consume far less total calories, carbohydrates, and proteins when compared to male athletes of similar lean body mass (LBMI). PURPOSE: To determine 1) whether collegiate volleyball players meet nutrition recommendations and 2) whether there are significant changes in macronutrient consumption and body composition after an eight-week, off-season resistance training program. METHODS: Eleven collegiate-level competitive female volleyball players were examined for total calorie, carbohydrate, and protein consumption using three-day food logs. A body height/weight scale and body composition device (BodPod) were used to compute body mass index (BMI), LBMI, and percent body fat (BF%). RESULTS: The volleyball players reported total calorie consumption of 15.06% and 10.79% below recommended guidelines before and after training, respectively, while carbohydrate intake was 7.27% and 4.77% below recommended guidelines before and after training, respectively. Protein intake levels met recommended guidelines and did not change throughout the training program. Paired samples tests showed increases in LBMI, and decreases in BMI and BF% following eight weeks of training (p<0.05 for all). CONCLUSION: Our study showed that despite positive improvements in body composition, collegiate volleyball players are not meeting current nutritional recommendations for optimal athletic performance. These findings may have important health and performance implications specific to collegiate female athletes.

Currently, there is inadequate literature existing for male athletes who participate in high-energy expenditure activities with decreased energy needs. Understanding the physiological demands and consequences of decreased energy availability (EA) in male athletes is critical for acute and long-term health and prevention of injuries and illness. PURPOSE: To examine the effect of EA on reproductive (Testosterone [T] and Luteinizing Hormone [LH]) and metabolic hormones (Insulin, Leptin, Cortisol, and Interleukin-6 [IL-6]) in male endurance-trained athletes. METHODS: A cross-sectional design on 14 endurance-trained male athletes (age: 26.4 ± 4.2 years; weight: 70.6 ± 6.4 kg; height: 179.5 ± 4.3 cm, BMI: 21.9 ± 1.8, Body Fat% (BF%): 13.6 ± 3.5%) were recruited from the local community. Participants completed 2 separate training weeks (low [LV] and high [HV] training volumes) and each week included: 7-day dietary logs, 7-day exercise logs, and 1 blood draw each week to determine concentrations for 6 hormones (reproductive and metabolic). Anthropometric measurements (height, weight, and body composition) were taken prior to data collection. LEA was defined as ≤ 20 kcal/kg FFM·d. Results: Participants at risk for LEA (41.2%; n = 7; HV: 50%; n = 4; LV: 33.3%; n = 3) had increased T levels (p < 0.02) and 21% (p < 0.05) (HV: 18.2%, n = 2; LV: 25%, n = 3) presented with low Leptin levels (p < 0.01). A significant difference was found between the 2 training weeks - Leptin (t(13) = 1.61 p < 0.01; HV: 78.6%, n=11; LV: 85.7%, n=12), EA - overall T (t(2) = 4.4, p < 0.004), and HV week - T (t(2) = 5.8, p < 0.02). A strong negative correlation was found for overall Leptin to BFP (r = -0.73, p < 0.001) and FMRI (F(1,23) = 16.23, p < 0.001). A weak negative correlation for T-EI (F(1,24) = 6.7, p < 0.02) and a strong positive correlation was found for overall T- BFP (F(1,24) = 51.9, p < 0.001). CONCLUSION: Overall, participants who demonstrated LEA, highlighted a significant negative relationship between LEA and Leptin. Due to Leptin’s negative response to EA (< 20 kcal/kg FFM·d), male runners should monitor their exercise expenditure and dietary intake to maintain appropriate levels of EA (> 20 kcal/kg FFM·d). Valid and reliable predictive equations for hormones should be examined to become useful tools for clinicians whom do not have access to blood work.
3253  Board #5  June 1 9:00 AM - 11:00 AM
Sources Of Nutrition Information And Knowledge For Ultra-runners
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PURPOSE: Ultra-marathon events (i.e., >42.2-km) continue to grow in popularity, however, little research exists on the typical dietary intake of ultramarathon participants, or the sources of information which influence their habits and beliefs. The objectives of this study were to characterize the acquisition of nutrition information among ultra-endurance athletes, and to determine the relationship between the use of different sources of information and nutritional knowledge (relative to current evidence-based recommendations). METHODS: Participants (n=196) were adults who had completed an ultramarathon at least once in the past 2 years. Measures included: a demographic questionnaire; the Sources of Nutrition Information (SONI) questionnaire, which included 7 major sources of nutrition information, as well as their credibility, accessibility, frequency, interest; and the General Nutrition Knowledge Questionnaire-Revised (GNKQ-R). Repeated measures ANOVA was used to analyze differences between items on the SONI scale. Spearman rank correlation was used to test for a relationship between sources of information and GNKQ-R score. RESULTS: 18% self-identified as vegan/vegetarian, 6% paleo/ketogenic, 20% traditional American diet, 54% “healthy” and 12% “other”. Peer reviewed literature was reported as the most frequently used (mean score=1.64, p<0.001), credible (3.02, p<0.001), and interesting (2.62, p<0.002). Social media was the most accessible (2.81, p<0.001), but the least credible (1.87, p<0.001). A modest, significant correlation (r=0.185, p=0.015) exists between use of peer-reviewed literature and nutrition knowledge. CONCLUSIONS: Ultrarunners report high usage of peer-reviewed literature for nutrition information, which is related with improved nutritional knowledge. Because of its accessibility, social media may be a promising tool to provide nutrition information to this population.

3254  Board #6  June 1 9:00 AM - 11:00 AM
Lack Of Nutrition Knowledge In Division II Athletes Associated With Limited Access To Registered Dietitians
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Limited nutrition knowledge is prevalent among all types of athletes, which is correlated with negative health consequences. Eating disorder (ED) etiology is the most documented, dire issue facing athletes, especially those in lean- or speed-oriented sports (LES) such as gymnastics and tennis, primary contributor to ED in LES is athletes’ lack of nutrition knowledge of carbohydrates (CHO), fats, and weight management (WM). PURPOSE: To assess NCAA Division II (DII) athletes’ knowledge in distinct domains: (1) CHO, (2) fats, and (3) WM. METHODS: The Macronutrient and Energy Metabolism Expertise Survey (MEMES) was created through modification of Calella et al.’s NET Survey. Changes included different domains (e.g. WM questions vs. Etiology) and expanding number of questions (5 to 10). An expert panel confirmed the face and construct validity of the MEMES before it was piloted. Athletes signed informed consent and then voluntarily completed the MEMES via Qualtrics in a designated computer lab on one test date. Email reminders were sent 1 month, 1 week, and 1 mouth. A validated nutrition knowledge survey (Calella et al., 2017) that contained both general- and sport nutrition-specific sections, was administered at different testing dates. The criterion for “Adequate Knowledge” (AK) was set at 70% for each domain and total score correct. Pearson product moment correlations were calculated between variables (e.g. percent correct, gender, sport). RESULTS: Eighty-eight males and eighty females completed the MEMES (35.8% return rate). Males scored significantly higher on CHO (p<0.007) and athletes (n=16) who reported having access to a Registered Dietitian (RD) scored significantly higher on the CHO and fat domains (p=0.00 and 0.042, respectively). The majority (28.6%) reported “experience as an athlete” as their primary source for nutrition knowledge. The least cited source was a RD (8.9%). Also, the athletes lacked knowledge: the mean total score was 14.4 correct out of 40 or 36%, falling below the established AK of 80%. The mean of correct scores were 29.1%, 37.0%, and 41.9% for fats, CHO, and WM, respectively. CONCLUSION: The results suggest that athletes are at a high risk of negative health consequences such as ED. Likewise, they are likely to be misinformed about sound sports nutrition by relying on their self-knowledge rather than a professional advice from a RD. This challenges the notion that experience as an athlete is a source of nutrition knowledge.

3255  Board #7  June 1 9:00 AM - 11:00 AM
Evidence Of A Relationship Between Dietary Fat Intake And Inflammation Among Professional Soccer Players
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Reducing background inflammation in athletes may be a medical and performance objective. Data describing the relationship between erythrocyte membrane fatty acids (EMFA) and low grade inflammation in soccer players are absent from the literature. EMFA reflects dietary fat intake in the weeks preceding the blood test. PURPOSE: To investigate the strength and reproducibility of the relationship between EMFA and inflammation in a group of professional soccer players. METHODS: We conducted an observational study, collecting venous blood samples measuring high-sensitivity C-reactive protein (CRP) and EMFA in the early season (T1) and late season (T2). A total of 47 blood samples were collected from 29 different athletes, with 25 athletes tested at T1, and 22 athletes at T2. A cut off point of >5mg/L was set to minimise the effect of acute inflammation, and these samples were removed from the analysis. Linear relationships between biomarker variables were examined using Pearson correlation tests. RESULTS: At T1, we report significant positive correlations between CRP and the following EMFA variables: Omega6:Omega3 ratio and the Arachidonic Acid: Eicosapentaenoic acid (AA:EA) ratio (0.566, p=0.003, and 0.582, p=0.002 respectively) and significant negative correlations with the Omega 3 index and the anti-inflammatory factors (AIAF) (0.485, p<0.001, and 0.466, p=0.018 respectively). However, at T2, the relationship between EMFA variables and inflammation had attenuated, with no strong linear correlations observed. The correlation analysis of all the blood samples collected (n=47) showed significant correlations between the Omega-3 Index, the AIAF and CRP (-0.319, p<0.028, and -0.299, p=0.040 respectively). CONCLUSION: There is a relationship between inflammation and EMFA variables in professional sports. However, the relationship appears to depend on the sampling occasion. Future research should explore augmenting EMFA as an anti-inflammatory strategy.

3256  Board #8  June 1 9:00 AM - 11:00 AM
Sex Differences in Nutrition Knowledge of Division I College Athletes
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Appropriate nutrition is imperative for participation in, and recovery from, exercise. However, many college athletes do not have a sufficient nutrition knowledge base to help them stay healthy during their physically taxing sports. PURPOSE: To assess the nutrition knowledge base of NCAA Division I college athletes using a validated nutrition knowledge survey. METHODS: Varsity athletes at a Division I university were recruited via word-of-mouth. A validated nutrition knowledge survey (Calella et al., 2017) that contained both general- and sport nutrition-specfic sections, was administered at different settings convenient to the athletes (e.g., team meetings or training table). Participants were asked not to share answers or use any outside resources (e.g., internet). Scores were summed as +1 for a correct answer or +0 for no answer, an incorrect answer, a double-answer, or the “I don’t know” option. The maximum possible score was 97. Nutrition was categorized as low (<33rd percentile), medium (33rd to 66th percentile), and high (>66th percentile). Frequencies of knowledge categories were tallied, and an independent t-test was run to determine sex differences. Alpha level was set at p<0.05. RESULTS: Athletes (n=128; n=70 female, n=58 male) from eight different sports completed the nutrition knowledge survey. Frequencies of each knowledge category were 42 (n=11 female, 31 male) with low knowledge, 24 (n=7 female, 17 male) with medium knowledge, and 62 (n=52 female, 10 male) with high knowledge. Average scores for female were 64.5 ± 21.1, and 84.5 ± 21.1 for the total survey, general nutrition, and sport nutrition sections, respectively. On average, males scored significantly lower, with scores of 43.6±15.1, 27.6±10.1, and 16.0±6.7 for the total survey, general nutrition, and sport nutrition sections, respectively (p<0.001). CONCLUSION: Based on survey results, the majority of NCAA Division I athletes assessed fell into the high nutrition knowledge category, with most in the category being female. Future research should expand on this to assess knowledge of specific nutrition concepts.
CONFIRMATION OF SELF-REPORTED AMBULATORY EXERCISE BOUTS DURING ECOLOGICAL MOMENTARY ASSESSMENT
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Ecological momentary assessment (EMA) is a method of self-report (SR) that can be used to examine how fluctuations in physical activity (PA) behavior are related to affective, contextual, and cognitive antecedents. Concurrent objective PA monitoring is recommended with EMA to supplement retrospective questions about PA. The objective PA data could be useful for confirming that SR bouts of ambulatory exercise occurred as described (timeframe, duration, intensity). To date, such a confirmation process has not been described in the literature. PURPOSE: Assess the use of accelerometer to confirm EMA of ambulatory exercise. METHODS: Participants (N=29, age 24±9y) completed four mobile surveys for 14-d (82% response rate) denoting exercise type and duration over the preceding 4-h. Throughout the 14-d period, participants wore an ActiGraph GT3X+ (AG) on the hip (14.0±3.5h/d). To confirm EMA reported exercise bouts, survey meta-data (date, time-stamp) and bout durations were used to guide visual inspection (VI) of AG data within the corresponding 4-h time blocks by two independent reviewers (inter-observer agreement=84% and after deliberations=100%). The Crouter 2-Regression Model (C2RM) was applied to AG counts to determine a min-to-min coefficient of variation (CV). SR bouts were confirmed when the C2RM CV ranged between 1% and 10%

RESULTS: At baseline, no statistically significant differences were observed between two groups in terms of demographic outcomes, fitness and the scores of QOL-DA. After 6 months of exercise intervention, there were significant differences found in systolic (F(2,166)=11.77), diastolic (F(2,166)=8.96), heart rate (F(2,166)=7.82), vital capacity (F(2,166)=3.08), flexibility (F(2,166)=13.85), aerobic endurance (F(2,166)=15.05). The results of QOL-DA showed that there were significant differences between experimental group and control group in psychological function (F(2,166)=9.71), symptom function (F(2,166)=6.42), social function (F(2,166)=14.91) and total score (F(2,166)=15.95). CONCLUSIONS: This study proved that the healthy-mind exercise was suitable for substance dependent individuals.

Purposes: To confirm EMA reported exercise bouts, survey meta-data (date, time-stamp) and bout durations were used to guide visual inspection (VI) of AG data within the corresponding 4-h time blocks by two independent reviewers (inter-observer agreement=84% and after deliberations=100%). The Crouter 2-Regression Model (C2RM) was applied to AG counts to determine a min-to-min coefficient of variation (CV). SR bouts were confirmed when the C2RM CV ranged between 1% and 10%

RESULTS: 93 of 128 bouts were confirmed, and the average SR bout duration (29±20min) was slightly greater than VI bouts (25±20min). Ten bouts were unable to be confirmed due to AG non-wear. In the 25 remaining unconfirmed cases, no continuous bouts matching the SR durations were observed. CONCLUSIONS: Processing AG data using C2RM allowed intuitive and reliable VI for confirmation of continuous ambulatory exercise bouts reported via standard EMG survey items. Feasibility of applying this process may be limited by large sample sizes.
aggregate. RESULTS: Seventeen adults (88% female; 71% NHB; 29% NHW, mean±SD age: 32.1±7.4 yrs.; body mass index: 26.2±3.6 kg/m²) completed the study. Five main themes were identified for regular GIC class participation in NHB and NHW, respectively: music selections (83 and 80%), studio atmosphere (67 and 40%), social support (67 and 80%), physical health (58 and 100%), and enjoyment/function (69 and 60%). CONCLUSIONS: The music (majority hip-hop and rap) in this studio may have played an integral role in attracting NHB to participate in GIC classes at this studio on a regular basis. NHW participants indicated physical health as a key motivator for class attendance. More research is needed to gain a deeper understanding of cultural relevance as it relates to motivational factors for exercise, which could inform future strategies for promoting regular exercise in various populations.

The field of cognitive enhancement has grown in popularity in recent years. Exercise and transcranial direct current stimulation (tDCS) are two approaches for which there is some evidence of transiently improved cognitive control. Yet, no research has systematically compared both approaches, so the degree to which these techniques influence similar mechanisms of improvement remains unknown. PURPOSE: We parametrically compared the acute effects of aerobic exercise and tDCS over left prefrontal regions on cognitive control. METHODS: 96 young healthy individuals (22.4 ± 4.1 years old) completed two testing sessions. The first session included baseline measurements of cognitive control on a flanker inhibition task and an n-back working memory task, followed by a maximal graded exercise test. During the second session, participants were randomly assigned to either 20 minutes of running on a treadmill at moderate intensity (60-70% of maximal heart rate) or 20 minutes of seated rest. After a 10-minute interval, participants were randomly assigned to receive 30 minutes of active tDCS (2mA anode over left prefrontal cortex; cathode over right bicep) or sham stimulation as they completed the flanker and n-back tasks. We compared the effects of Stimulation, and no interaction of Exercise and Stimulation. Specifically, the individuals who exercised were better able to discriminate n-back targets from nontargets compared to the seated group. We did not observe any effects of Exercise or Stimulation on flanker performance (accuracy and response times on incongruent or congruent trials). CONCLUSION: Whereas noninvasive brain stimulation produced no effects on cognitive control, acute aerobic exercise significantly improved working memory performance. This suggests that the neuroenhancement mechanisms impacted by short bouts of exercise and tDCS may be distinct. Further, this pattern hints that aerobic exercise may have broader effects on cognitive control than non-invasive brain stimulation.
fatigue with voluntary activation (VA%) calculated using the twitch interpolation method. Subjective measures included motivation (MS) and mood using the Brunel Mood Scale (BRUMS). RESULTS: Average power output (W) was reduced with a main effect of hypoxia (p = 0.02) and significantly increased with a main effect of music (p < 0.001). When combined the interaction was additive (p = 0.87). Average MVC force (N) was reduced in hypoxia (p = 0.03) but VA% of the biceps brachii was increased with music (p = 0.02). MS and BRUMS remained unchanged across all conditions (p > 0.06). Music reduced subjective scores of mental effort, breathing discomfort, and arm discomfort in hypoxia (p < 0.001). CONCLUSION: Music increased self-paced and maximal physical exertion through enhancing neural drive and diminishing detrimental mental processes, enhancing performance at both sea level and high altitude.

G-19  Thematic Poster - Endocrine Responses to Exercise and Occupational Stressors

Saturday, June 1, 2019, 9:00 AM - 11:00 AM
Room: CC-101B

3266  Chair: Jay Heaney, Naval Health Research Center, San Diego, CA.

(no relevant relationships reported)

Coupling of Adrenal and Gonadal Hormones: Potential Relationship to Occupational Demand

Matthew R. Schoenherr, Lisa M. Hernandez, Marcus K. Taylor, Ph.D., FACSM. Naval Health Research Center, San Diego, CA. (Sponsor: Marcus Taylor, Ph.D., FACSM)
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(no relevant relationships reported)

The positive coupling hypothesis describes the hypothalamic-pituitary-adrenal and -gonadal systems as parallel, cooperative processes that represent joint calibration to meet internal, and/or environmental demands. We recently tested this hypothesis in Naval Special Warfare (NSW) personnel and found positive coupling between the adrenal hormones, cortisol (CORT) and dehydroepiandrosterone (DHEA), and the gonadal hormone, testosterone (TESTO).

PURPOSE: To test the positive coupling hypothesis in Explosive Ordnance Disposal (EOD) personnel; a specialized military population whose mission is to ensure that hazardous explosives are rendered safe for unit preservation and security.

METHODS: Active duty U.S. Navy EOD operators (N = 64; mean ± SD age: 34 ± 6.0 years) self-collected saliva samples in a non-deployed, free-living setting on 2 consecutive weekdays at wake, wake + 30 min, wake + 60 min, 1600, and 2100 (10 samples total). Exclusion criteria included use of any anabolic supplements within the last 3 months. Coupling hypotheses (associations between CORT, DHEA, and TESTO summary parameters) were tested with Pearson product-moment correlation analyses. Established summary parameters were determined for each hormone: highest morning value, area under the curve (with respect to ground [morning values]), and averages of morning and evening values, respectively. RESULTS: DHEA was positively coupled with TESTO (r range: 28-61, p < 0.05) and also with CORT (r range: 50-57, p < 0.05) throughout the day. Positive coupling between CORT and TESTO was only observed in the evening (r = -32, p = 0.04). CONCLUSION: This study partially replicated our prior report in NSW personnel, which demonstrated that DHEA positively coupled with TESTO as well as CORT. The evening association of CORT and TESTO is also consistent with our previous findings and likely indicative of homeostatic processes. Unlike the previous study, however, the morning values of TESTO and CORT were not coupled in the present study. This inconsistency could potentially be explained by a warfighter’s specific operational demands. For example, positive coupling may be adaptive for duties that include direct engagement with the enemy. In contrast, uncoupling may be more conducive to ensuring unit safety and security.
Amassing evidence suggests that post awakening cortisol patterns are useful indicators of health status. Our lab established summary parameters of cortisol and reported excellent stability across 2 days of repeated sampling in 58 U.S. Navy SEALs. To confirm the generalizability of our original findings, there is a need to replicate procedures in another military population with unique operational demands.

**PURPOSE:** To establish the summary parameters of daily cortisol patterns, the stability of repeated sampling, and the impact of salivary sampling compliance in U.S. Navy Explosive Ordnance Disposal (EOD) operators.

**METHODS:** Seventy active duty, male EOD operators (mean ± SD age = 34.9 ± 6.5 y) self-collected saliva samples in a nondeployed, free-living setting. Samples were collected on 2 consecutive weekdays at Wake, Wake + 30 min, Wake + 60 min, 1600, and 2100. Three measures of magnitude and three measures of patterns were computed. The stability of each parameter was evaluated via correlational analyses and Cronbach's alpha (α). Compliance was evaluated via actigraphy using two alternate compliance criteria. **RESULTS:** Average salivary cortisol concentrations increased at Wake + 30 min (mean ± SE reactivity = 43.9 ± 6.8 μg/dl), followed by a swift recovery at Wake + 60 min. Approximately 17.4% (n = 12) were classified as negative-reactors (i.e., <50% change from Wake to Wake + 30 min). The three measures of magnitude demonstrated good stability across 2 days (r value range: 0.37-0.45, p < 0.01; α range: 0.54-0.62). Fifty-five percent of the sample was classified as compliant (defined as <15 min deviation from target sampling times) across both days; this decreased to 31% when compliance was refined to <5 min deviation. However, controlling for compliance did not convincingly influence any of the summary parameter estimations or their stability.

**CONCLUSIONS:** These findings demonstrate a thorough replication and refinement of our prior report, implying that these results are generalizable across diverse military populations. The noninvasive salivary sampling protocol used in this study yields stable estimations of daily cortisol patterns in specialized military men. This sampling protocol is recommended for use as an operational health surveillance instrument for chronically stressed military members.

**Objectively-Measured Physical Activity in Breast Cancer Patients Undergoing Chemotherapy**

**PURPOSE:** To determine the effect of demographic, health, and treatment factors on moderate to vigorous physical activity (MVPA) in breast cancer patients undergoing chemotherapy. **METHODS:** Breast cancer patients (N=66, M_age = 48.3±10.0 years) undergoing chemotherapy (CT) wore an accelerometer for 24-hours (worn on the hip during the day and wrist while sleeping) for ten consecutive days (3 days pre-, day of, and 6 days post-CT dose) during three treatment phases (beginning, middle, and end of chemotherapy). Mixed models were used to assess the effect of demographic, health, and treatment factors on MVPA. We assessed the effect of time point (burst), treatment status (i.e. pre-CT dose v. day of/post-CT dose), burst x treatment status interaction, age, body mass index, education, total number of comorbidities, disease stage, cumulative treatment days, number of self-reported pre-diagnosis days of MVPA, weekend v. weekdays, and self-reported health status on days of MVPA.

**RESULTS:** On average, breast cancer patients engaged in 28.0 minutes/day of MVPA across all bursts. Results indicate a significant decrease of 5.0 minutes/day of MVPA (95%CI:-6.5,-3.5) as time point increases, a 4.2 minute/day decrease in MVPA (95%CI:-5.8,-3.2) on day of CT dose or post-CT days compared to pre-CT dose days, a 0.9 minute/day increase in MVPA (95%CI: 0.5,1.3) as treatment cycle number increases, and a 2.2 minute/day increase in MVPA (95%CI:1.1,3.2) on weekends. **CONCLUSIONS:** Results from the current analysis suggest treatment-related factors, such as treatment day, post-treatment days, and time undergoing chemotherapy, had the greatest effect on MVPA in breast cancer patients, significantly decreasing minutes per day spent in MVPA over time. These results show the importance of tailoring future physical activity interventions to specific treatment factors in order to reduce the decline in MVPA during chemotherapy.

**Overcoming Fitness, Symptom, And Behavior Barriers After A Physical Activity Intervention With Fitness Graded Motion Exergames (PAfitME) Among Head And Neck Cancer Patients**

**PURPOSE:** Routinely engaging physical activity (PA) leads to better health outcomes in cancer survivors. Over 50% of head and neck cancer (HNC) survivors rarely engage in any type of PA because of the barriers of impaired fitness, severe symptoms, and poor self-efficacy (SE). A personalized telehealth Physical Activity intervention with fitness graded Motion Exergames (PAfitME) was designed to overcome these barriers. In our pilot study, we found the HNC patients fully adhered with the personalized exergame prescription in the 6-week PAfitME intervention. The purpose of this study was to examine changes in barriers: fitness (gait speed), symptoms, and SE among HNC patients participating in the PAfitME intervention.

**Abstracts were prepared by the authors and printed as submitted.**
Methods: A pre/post-test design was used to test the 6-week PAfitME intervention. Personalized exergame prescriptions were developed and progressed based on the social cognitive theory and exercise principal of adaptation. Fitness was measured by preferred gait speed (m/s). Symptom data were collected via the MD Anderson Symptom Inventory, Brief Pain Inventory, Pittsburgh Sleep Quality Index, General Anxiety Disorder scale, and Center for Epidemiologic Studies Depression Scale. SE was measured by the PA Self-Efficacy scale (0-100%). Descriptive statistics and paired t tests were applied.

Results: A total of 10 HNC participants were recruited. Two participants dropped out due to recurrence. The mean age was 58.2 years old (n=8). Seven (88%) were male. Three (38%) had oral cancer and 5 (63%) had laryngeal cancer. Three (38%) had a feeding tube and 2 (25%) had a tracheostomy. Four (50%) had stage III/IV cancer. Mean gait speed improvement was clinically significant (0.11m/s). There were positive improvements in 17 of 20 symptoms with significant decreases in pain (t=-2.34, p=0.05), in fatigue (t=3.64, p=0.008) and in difficulty with voice/speech (t=2.35, p=0.05). Seven participants (88%) had 100% SE to do their personalized exergame prescription in the post test.

Conclusions: This study shows HNC participants overcame their PA barriers after the PAfitME intervention. It also supports the need for a larger randomized clinical trial for efficacy testing. The positive impact from PAfitME will shift PA interventions from a standardized protocol to a personalized, behavioral telehealth approach.
PURPOSE: Meta-analyses have shown beneficial effects of exercise on quality of life (Qol.) and fatigue in breast cancer survivors. Methodological considerations, however, are drop-out after randomization to control caused by disappointment and contamination (controls adopting the behavior of the intervention group), since blinding in exercise trials is not possible. TwiCs (Trials within Cohorts) is an alternative for conventional randomized clinical trials and might overcome these disadvantages. We studied the 6-month effectiveness of a 12-week exercise program on the Qol. and fatigue in inactive breast cancer survivors using the innovative TwiCs design.

METHODS: The UMBRELLA Fit study is nested within the UMBRELLA cohort, including patients at the radiotherapy department of the UMC Utrecht. Patients were asked consent for prospective collection of medical data and patient reported outcomes, and to be randomized to future intervention studies. For UMBRELLA Fit, we randomized 260 eligible inactive (<150 min/wk moderate to vigorous leisure time and sports activities) breast cancer survivors, 12-18 months after cohort inclusion. Survivors randomized to the intervention group (n=130) were offered a twice weekly supervised moderate to high intensity aerobic and resistance exercise program. Survivors were also encouraged to be active for 30 min/day supported by a total activity tracker. The control group (n=130) was not informed and received usual care (UC). To evaluate effects on Qol. and fatigue by intention to treat ANCOVA regular cohort measurements (EORTC QLQ 30, MFI-20) were used.

RESULTS: Included breast cancer survivors aged 58±10 years and 52% (68/130) accepted the intervention. TwiCs accrual was efficient and no contamination was observed (median change in physical activity from baseline in controls was 0). At baseline, Qol. was comparable to Dutch reference values and no significant between-group changes were observed. Physical fatigue was significantly lower following the exercise intervention (effect size 0.2, p<0.05) compared to UC.

CONCLUSIONS: Physical exercise has beneficial effects on physical fatigue of inactive breast cancer survivors. Future instrumental variable analysis will show influence of non-acceptance on the intervention effect. The TwiCs design seems feasible for pragmatic trials.

CONCLUSIONS: Community-based soccer improved hip BMD, and men who played regularly for one year improved mental health, lost fat mass and had fewer hospital admissions.

We developed Exercising Together©, a partnered strength training program, as an exercise-based approach to improve patient, spouse and relationship health for couples coping with cancer. Exercising Together© may be most effective during cancer treatment, when couples experience the most stress, but the program has only been tested in couples post-treatment. PURPOSE: To determine the feasibility and acceptability of Exercising Together© during a course of radiation therapy for prostate cancer and the preliminary efficacy of the program on physical function, symptoms and dyadic coping in both the patient and spouse. METHODS: Couples were recruited from a radiation oncology clinic to participate in group classes of Exercising Together© 3x/week throughout his treatment. Classes consisted of moderate-intensity strength training performed by the couple who worked as training partners. The Physical Performance Battery (timed walk, stance and chair stand) and 400m walk time, and anxiety (SCL-90 ANX), depressive symptoms (CES-D), intimacy (Physical Intimacy Scale) and dyadic coping (active engagement and protective buffering) were assessed at baseline and at the end of radiation, with self-report measures assessed again 8 weeks after training stopped. Independent Wilcoxon-ranked sign tests were used to assess changes in QoL and fatigue. RESULTS: 10 couples were enrolled within 3-months. Retention was 100% and average adherence to prescribed classes was 78%. No adverse events occurred. Patients showed significant increases in 4m walk speed (p=0.017), reductions in anxiety (p=0.027) and more active engagement based on the dyadic coping scale (p=0.039) at the end of training. Spouses had improvements in PPI scores (p=0.023) and chair stand time (p=0.024) post-training. At 8-week follow-up no further changes occurred in men, but spouses had significant reductions in depressive symptoms (p=0.016) and nearly significant reductions in anxiety (p=0.066). CONCLUSION: Exercising Together© is feasible, acceptable and improved physical, mental and relationship health over a course of radiation therapy. Comparisons to a control group may further identify benefits; however, based on these data a larger, multi-site trial of Exercising Together© in the radiation oncology setting is warranted.

Physical exercise has been shown to improve quality of life, fitness, and physical function for men with prostate; however, research on effects of real-life interventions is warranted. PURPOSE: To evaluate the effects of one year of community-based strength training on bone mineral density (BMD), body composition, mental health, and hospital admissions. METHODS: Design, Setting and Participants: In a pragmatic, multicentre, parallel randomised controlled trial, 214 men with prostate cancer were included breast cancer survivors aged 58±10 years and 52% (68/130) accepted the intervention. TwiCs accrual was efficient and no contamination was observed (median change in physical activity from baseline in controls was 0). At baseline, Qol. was comparable to Dutch reference values and no significant between-group changes were observed. Physical fatigue was significantly lower following the exercise intervention (effect size 0.2, p<0.05) compared to UC.

CONCLUSIONS: Community-based soccer improved hip BMD, and men who played regularly for one year improved mental health, lost fat mass and had fewer hospital admissions.

CONCLUSIONS: Community-based soccer improved hip BMD, and men who played regularly for one year improved mental health, lost fat mass and had fewer hospital admissions.

G-21 Thematic Poster - Muscle Damage and Injury Saturday, June 1, 2019, 9:00 AM - 11:00 AM Room: CC-104B

Chair: Panagiotis Koutakis. Florida State University, Tallahassee, FL.

No relevant relationships reported

Skeletal muscle rapidly adapts to contraction-induced damage such that it is subsequently resistant to damage. This phenomenon is called the repeated bout effect (RBE). Interestingly, following damaging contractions on one muscle group the contralateral analogous muscle group also acquires resistance to damage. This is known as the contralateral RBE (cRBE). The mechanisms that underlie the acquisition of the repeated bout effect are not yet fully understood, yet some studies have shown that muscle immune cell accumulation and inflammation after the initial muscle damage is necessary for the RBE to be realized. T-cells are capable of generating immunological memory, an attribute that is central to their role in adaptive immunity. Additionally, a growing body of literature highlights an important role of T-cells in muscle healing following injury. Therefore, we hypothesized that T-cells could...
Contribute to the RBE in a way reminiscent to their role in adaptive immunity. In this study, in vivo lengthening contractions (LC) were used to model the RBE and the cRBE. Flow cytometry was used to characterize intramuscular T-cells following single and repeated bouts of LC. Herein, we also test the hypothesis that T-cells contribute to the RBE by immunological memory. Rats that did two bouts of LC separated by 2 weeks sustained less damage after the second bout. Rats that did a repeated bout of LC on the opposite limb were not protected from damage. CD4+, CD8+ and regulatory T-cells increased in muscle mass following repeated damage. In rats that were pre-treated from damage a minimal increase in T-cells was observed. Adoptive transfer of T-cells from rats that had previously done muscle-damaging LC did not confer damage protection to recipient rats. In conclusion, the RBE, but not the cRBE was observed in rats, and T-cells infiltrate muscle damaged by LC, but they do not appear to contribute to the RBE in the same way that they drive adaptive immunity.

**CONCLUSIONS:** Even though CT was lower following EIMD, IACT was not. Additionally, our results show no contribution of central or peripheral fatigue on torque production following EIMD. These findings suggest the loss in torque production following EIMD to be a factor of EIMD’s effect on muscular function and not the central and peripheral mechanisms of fatigue.

**METHODS:** Standard ultrasound (US) imaging can help determine structural alterations within muscle and tendon; however, it offers limited information about the intrinsic mechanical properties of muscle. Because muscle is compressible, but transversely isotropic, the most accurate measure is the shear modulus, and US correlates well with Young’s modulus. Shear wave changes should be useful for determination of muscle lesions or intrinsic changes. To date only a couple studies have observed SWE changes in an arm undergoing DOMS with varying results. Thus, the purpose of this study was to track the changes in biceps SWE changes in kilopascals (kPa), from baseline to 1 week post muscle damage protocol.

**METHODS:** Standard ultrasound (US) imaging can help determine structural alterations within muscle and tendon; however, it is limited in its ability to convey information about the intrinsic mechanical properties of muscle. Because muscle is compressible, but transversely isotropic, the most accurate measure is the shear modulus, and US correlates well with Young’s modulus. Shear wave changes should be useful for determination of muscle lesions or intrinsic changes. To date only a couple studies have observed SWE changes using velocity as the variable of interest in muscle undergoing DOMS with varying results. Thus, the purpose of this study was to track the changes in biceps SWE changes (kPa), from baseline to 1 week post muscle damage protocol.

**RESULTS:** All data were analyzed using a RMANOVA with post-hoc comparisons to determine significance between data points. VAS and SWE were significantly increased for the DOM group at 24 and 48 hours post exercise (P<0.001) with no significant difference between 24 and 48 hours for SWE (P=0.825), while VAS scores increased significantly from 24-48 hours post treatment (P=0.031). There was no significant difference between baseline VAS (P=0.196) or SWE (P=0.087) at 1 week.

**CONCLUSIONS:** SWE values increased significantly from baseline to 24 hrs and stayed elevated at 48 hours, which is contrary to data from a published study showing a decrease after 24 hours in the brachialis. This could be due to muscle position. SWE measures of the bicep in an extended position appears to follow VAS and muscle damage progression better than SWE measurements reported from DOMS in a resting position.

**Purpose:** The purpose of this study was to examine the effects of two weeks of left knee joint immobilization on vastus lateralis echo intensity and cross-sectional area. METHODS: Twelve healthy females (mean ± SD age = 21 ± 2 years) with a body mass index ≤ 30 kg/m² voluntarily underwent two weeks of left knee joint immobilization via ambulating on crutches and use of a brace. The brace was worn at all times except during sleep, and compliance was confirmed via accelerometers secured around both ankles. Before (PRE) and after the two-week period (POST), B-mode ultrasonography was used to obtain panoramic images of the left (immobilized) and right (control) vastus lateralis in the transverse plane. Images were taken from 50% of femur length. The same investigator performed all imaging. Images were analyzed at the end of the study with ImageJ software to quantify vastus condition (P<0.05) while decreases lasted up to 2-days in the stimulated condition (P<0.05). IACT was not significantly different following EIMD in either conditions (P>0.05). Non-dominant leg torque decreased following EIMD (P<0.05) and these results are the same for twitch torque (P<0.05). EMG RMS and twitch torque both showed a significant reduction during the voluntary CT test (P<0.05). There were no changes in low-frequency fatigue after the voluntary and stimulated conditions (P>0.05) or following EIMD (P>0.05).

**CONCLUSIONS:** Even though CT was lower following EIMD, IACT was not. Additionally, our results show no contribution of central or peripheral fatigue on torque production following EIMD. These findings suggest the loss in torque production following EIMD to be a factor of EIMD’s effect on muscular function and not the central and peripheral mechanisms of fatigue.
Pilot Data Suggest Negative Change In Bone Mineral Content Is Related To Self-report Musculoskeletal Injury In Infantry Marines
Karen R. Kelly, Brandy Niederberger, Dale Bergquist-Turori, Andrew Jensen, Jake Bernards, Jason Jameson. Naval Health Research Center, San Diego, CA. Email: karen.kelly8.civ@mail.mil
(No relevant relationships reported)

**Background:** Prevalence of musculoskeletal injury (MSKI) is greatest in young Marines due to the high volume of vigorous exercise, especially in early training. Fitness and body composition are known to be related to injury risk; however, understanding changes in such factors over a training cycle and the risk of injury are not well understood.

**Purpose:** The purpose of this study was to measure changes in body composition and bone density over the 40-day infantry training and its relation to MSKI.

**Methods:** Active duty, male, infantry students (n = 50) enrolled in the infantry training battalion located at School of Infantry-West (SOI-W) aboard Camp Pendleton were recruited to participate in this study. Pre- and post-SOI-W training (Day 1 and Day 40), Marines completed a whole body dual-energy x-ray absorptiometry (DXA); as well as, sleep, nutrition, and fitness questionnaires. Three months following graduation from SOI-W, a follow-up survey was sent regarding prevalence and type of MSKI.

**Results:** Of the original Marines in the study (n = 50), six Marines (12%) reported sustaining an MSKI within three months of completing SOI-W. Those that were injured showed decreased bone mineral content (BMC) in both the dominant and non-dominant leg as compared to the group average whom had an increase in BMC (injured vs. non-injured right leg: Δ-5.5% vs. Δ+3.3%; injured vs. non-injured left leg: Δ-3.8% vs. Δ+1.2%). Additionally, of the injured Marines, 50% reported “poor” sleep quality on the Pittsburg Sleep Quality Index and 67% reported “excessive sleepiness” on the Epworth daytime sleepiness scale at the follow-up time point. No differences in fitness levels or dietary consumption (milk, cheese, yogurt, ice cream) were present between injured and non-injured Marines at any time point.

**Conclusion:** These pilot data suggest that MSKI may be related to negative changes in BMC; as well as sleep quality and daytime sleepiness. Further work is needed to determine the relationship between MSKI and BMC and sleep to elucidate mechanisms or impact on injury risk.
Fat-free mass index (FFMI) is a body composition metric that has been employed to assess relative muscularity, with a 28.1 kg/m² upper limit reported in male athletes. FFMI is calculated by dividing fat-free mass by squared height, though further height corrections via linear regression may be required to normalize FFMI in taller individuals. To date, only two investigations have reported height-adjusted FFMI (FFMI_adj) in males. PURPOSE: The purpose of this study was to report height-adjusted FFMI data and natural upper limits of FFMI in male collegiate athletes. METHODS: The body composition of 209 male collegiate athletes from 10 sports (Mean ± SD; Age: 20.7 ± 1.9 years; Height: 182.9 ± 6.7 cm; Weight: 90.8 ± 16.8 kg; Percent Body Fat: 15.6 ± 5.3 %) was measured using dual-energy x-ray absorptiometry. The height adjustment was calculated by regressing unadjusted FFMI against height in all athletes above the median unadjusted FFMI. The slope of this line was used to adjust all FFMI values. The natural upper limit for FFMI_adj in this study was determined stepwise using linear regression analysis. RESULTS: Males produced significantly higher F_mean (p < 0.001) and F_peak (p = 0.608), compared to females. However, when adjusted for measures of body composition, FFMI was not significantly different between males and females (p = 0.694 and p = 0.136, respectively). CONCLUSIONS: Although gender differences were observed for mean and peak force production, results of the present investigation revealed that fat-free mass significantly contributed to force production, regardless of gender. Therefore, force production and sprint swimming performance may benefit from gains in muscle mass, although more research is needed in the form of training studies. Additional research should investigate the influence of the ratio of fat mass and fat-free mass on buoyancy, position, and the balance required to achieve optimal force production and sprint swimming performance.

3315

Board #3

June 1 8:00 AM - 9:30 AM

Fat-Free Mass Index in a Diverse Sample of Male Collegiate Athletes

Bradley S. Currier, Patrick S. Harty, Jessica M. Moon, Shane A. Ponder, Richard A. Stecker, Hannah A. Zabriskie, Andrew R. Jagim, Chad M. Kerkcsick, FACSM. Lindenwood University, St. Charles, MO.

(Full relationships reported)

Fat-free mass index (FFMI) is a body composition metric that has been employed to assess relative muscularity, with a 28.1 kg/m² upper limit reported in male athletes. FFMI is calculated by dividing fat-free mass by squared height, though further height corrections via linear regression may be required to normalize FFMI in taller individuals. To date, only two investigations have reported height-adjusted FFMI (FFMI_adj) in males. PURPOSE: The purpose of this study was to report height-adjusted FFMI data and natural upper limits of FFMI in male collegiate athletes. METHODS: The body composition of 209 male collegiate athletes from 10 sports (Mean ± SD; Age: 20.7 ± 1.9 years; Height: 182.9 ± 6.7 cm; Weight: 90.8 ± 16.8 kg; Percent Body Fat: 15.6 ± 5.3 %) was measured using dual-energy x-ray absorptiometry. The height adjustment was calculated by regressing unadjusted FFMI against height in all athletes above the median unadjusted FFMI. The slope of this line was used to adjust all FFMI values. The natural upper limit for FFMI_adj in this sample was determined by calculating the 97.5th percentile of all values. FFMI_adj data were assessed for normality using the Shapiro-Wilk test. One-way ANOVAs with Tukey post-hoc comparisons were used to determine between-sport differences. RESULTS: The slope of the line used in height adjustment was -0.014 (p = 0.631). A backwards stepwise linear regression analysis was used to determine the best height adjustment for males above the median unadjusted FFMI (F_adj) for mean and peak force production, results of the present investigation revealed that fat-free mass significantly contributed to force production, regardless of gender. Therefore, force production and sprint swimming performance may benefit from gains in muscle mass, although more research is needed in the form of training studies. Additional research should investigate the influence of the ratio of fat mass and fat-free mass on buoyancy, position, and the balance required to achieve optimal force production and sprint swimming performance.

3316

Board #4

June 1 8:00 AM - 9:30 AM

Gender and BMI Differences in Body Image Among College Freshmen

Ruth N. Henry, Matthew D. Ruiz, William C. Vantrease, David Bender. Lipscomb University, Nashville, TN. (Sponsor: Kent Johnson, FACSM)

(Full relationships reported)

Research in the area of body image has shown that females have more dissatisfaction with their bodies than males, but that males also have concerns with some aspects of body image. Instructors in wellness courses designed for college freshmen have the opportunity to address these challenges. Purpose: to determine which components of body image display gender differences, and whether gender differences in certain aspects of body image are related to BMI. Methods: The Body Self-Image Questionnaire was administered to students in a freshman Wellness course as part of their physical fitness assessment which included BMI (N = 130 F, 50 M). Data were analyzed with a 2 x 2 factorial ANOVA to evaluate both effects of BMI and Gender and their interactions. All nine subscales of the BSIQ were included: Overall Appearance Evaluation (OAE), Fatness Evaluation (FE), Health/Fitness Evaluation (HFE), Health/Fitness Influence (HFI), Attention to Grooming (AG), Social Dependence (SD), Height Dissatisfaction (HD), Negative Affect (NA), and Investment in Ideals (II). For the analysis, BMI values ≤25.0 kg/m² were classified as “normal” (NW); values ≥25.5 kg/m² were categorized as “overweight” (OW). Results: In SD, there was a significant main effect for gender, with females scoring higher in the factor of social dependence (p = 0.0138). There was a main effect for gender in HD, with males being more dissatisfied with their height than females (p = 0.0103). An interaction existed between gender and BMI for height dissatisfaction, with a greater gender disparity in HD in normal weight students (M-F) than in OW students, where differences almost disappeared. The main effect for gender in FE indicated that females view themselves as fatter than males (p = 0.015); not surprisingly, there was also a main effect in FE for BMI (p = 0.0011; Nor>OW; HD>FFI). In addition, the main effect for BMI in HFE was found to be significant for normal and overweight (p = 0.0001; Nor>OW); and NA (p = 0.0003; OW>Normal). A gender-BMI interaction existed in HFI (p = 0.0098) indicating that OW males felt that health and fitness influenced feelings about their bodies more so than OW females; and in Normal, gender differences were very small. Conclusion: The belief that females have more body image concerns than males is valid in some components of body image, and BMI attenuates some gender differences.

3317

Board #5

June 1 8:00 AM - 9:30 AM

Impact of Body Fat Percent on Heart Rate of Moderate-Intensity Aerobic Activity

Wen Hao Liu, FACSM, Istvan Kovacs, Austin McClinton. Slippery Rock University, Slippery Rock, PA. Email: wenhao.liu@sruden.edu

(Please report relationships)

PURPOSE: To better understand the relationship between body fat percent (%BF) and aerobic capacity, this study examined how %BF would impact heart rate (HR), maximal HR% (%HRmax) and HR reserve% (%HRR) when walking at 3.0 mph among young adults. METHODS: The three-site skinfold measure was administered to 176 university students (mean age: 20.82±1.49; 102 males and 74 females) in the US and converted to %BF using the conversion tables by Jackson et al. (1985). The ACSM satisfactory ranges of %BF (2014, 10%-22% for men and 20%-32% for women) were used to divide participants into three %BF groups: Normal, Lean, and Obese. HRmax was calculated with “220-age”, resting HR (after lying on the floor for five minutes) was measured using HR monitors (Sigma PC26;14, and HRR was calculated with “HRmax-resting HR”. Finally, HR at the end of a three-minute treadmill walking at 3.0 mph was measured, which was also used to compute %HRmax (HR ÷ HRmax × 100%) and %HRR [(HR - Resting HR) ÷ HRR × 100%] of the walking. One-way MANOVA was used to examine differences in HR, %HRmax, and %HRR of the three-minute walking among the three %BF groups. RESULTS: The slope of the line used in height adjustment was -0.014 (p = 0.631). A paired-samples t-test revealed a significant difference (0.041 kg/m², p < 0.001) between unadjusted and adjusted mean FFMI values. The overall mean FFMI_adj was 22.8 ± 2.8 kg/m². FFMI_adj was not normally distributed and was log transformed prior to analysis. Significant between-sport differences (p < 0.001) in FFMI_adj were identified. Upper limits (97.5th percentile) for FFMI_adj were found to be 28.32 kg/m² for the entire cohort while upper limits for rugby and baseball were found to be 29.1 kg/m² and 25.5 kg/m², respectively. CONCLUSION: This study reported FFMI_adj values in a diverse cohort of male collegiate athletes, providing data for the first-time in several sports. These values can be used to guide nutritional and exercise interventions and provide coaches with standardized information regarding the potential for further fat-free mass accretion in male athletes.
is not a leading contributor to faster swimming speeds. There exists a need to explore the association between anthropometric characteristics and performance among adult competitive swimmers.

**PURPOSE:** To evaluate the association between anthropometric characteristics of National Collegiate Athletic Association Division III (DIII) male and female swimmers and performance determined by qualifying for NCAA national competition.

**METHODS:** Seventeen male collegiate football players (21.9±0.43 y, 1.89±0.06 m, 106.7±15.3 kg) participated in a NFL combine preparation program. The combine preparation training consisted of 4 resistance training sessions per week and 6 days per week of position and combine test-specific training. Athletes recruited in their respective off- or pre-season. Lean mass was assessed via dual energy x-ray absorptiometry. Dynamic balance was assessed via lower quarter Y Balance test. The athletes then completed a 3200m test trial. Data were analyzed by separate regression analysis of variance (ANOVA) for each variable. Results suggest that greater SH and left HL have a positive effect on swimming performance but there was no association between any other anthropometric variable and qualification for Nationals. These findings suggest that differences in swimming performance among DIII swimmers are likely due to other factors, such as biomechanical, intrinsic physiological and psychosocial attributes.

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The NFL scouting combine and college pro-days implement a battery of anthropometric and performance tests to assess college football players attempting to play in the NFL. As such, athletes commonly undergo specific training and nutrition regimens to optimize combine performance to increase their chances of signing with an NFL team. **PURPOSE:** To observe body composition changes following a training program of different lengths designed to prepare athletes for NFL combine and pro-day performance. **METHODS:** Seventeen male collegiate football players completed 7-8 weeks of training (n=10) and, (2) those than completed 4-6 weeks (n=7) of training. The combine preparation training consisted of 4 resistance training sessions per week and 6 days per week of position and combine test-specific training. Athletes participating in this program were also provided dietary counseling by a nutritionist to improve dietary habits. Pre- and Post-training body mass (BM), body fat percentage (BF%), fat mass (FM), total body water (TBW), and lean body mass (LBM) were assessed via bioelectrical impedance analysis (BIA). Since all athletes did not join the program on the same date we divided athlete data into two groups: (1) those that completed 7-8 weeks of training (n=10) and, (2) those than completed 4-6 weeks of training (n=7). Data were analyzed by separate regression analysis of variance (ANOVA) for each variable. **RESULTS:** Regardless of the group, the combine preparation training program produced significant increases in body mass (p=0.004), Δ +1.14±1.36 kg), TBW (p=0.045, Δ +1.24±2.31 kg), and LBM (p=0.041, Δ +1.67±2.97 kg). No significant (p>0.05) main effect of time was observed for BF% or FM. Additionally, there were no significant differences between groups for variable. Of the 17 participants, 3 players were drafted and were on active rosters for the 2018 NFL season, 1 participant was drafted and signed a practice squad contract, with 5 other participants signing undrafted free agent contracts with various NFL teams. **CONCLUSION:** Data suggests that significant changes in body mass, TBW, and LBM can be achieved as a result of NFL combine training even when the training program is of short duration. Furthermore, in these highly trained athletes, even 8 weeks of training may be too short to observe significant improvements in FM or BF%.

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Introduction: Laterality, or lateral dominance may lead to asymmetry in muscle mass and strength, which in turn could lead to differences in stability and balance. Muscular asymmetry and dynamic balance asymmetry have been independently linked with increased injury risk. For example, athletes with >4cm anterior reach distance differences (AARD) were found to be at significantly higher risk to incur injuries. However, it is unknown if there is an association between muscle mass asymmetry and dynamic balance. Nor is it known if these factors change throughout the sport’s seasonal periods (i.e., off-, pre-, and post-season). The purpose of this preliminary analysis was to analyze differences between lower body lean mass and dynamic balance in collegiate athletes and to examine if associations exist between the two variables during different seasons. Methods: NCAA Division II student-athletes were recruited in their respective off- or pre-season. Lean mass was assessed via dual energy x-ray absorptiometry. Dynamic balance was assessed via lower quarter Y Balance Test and AARD was calculated. Pearson correlation was used to examine associations. Results: 109 athletes (67W/42M) from six sports have been recruited (see table). There were no significant correlations (p>0.05) between differences in lower body lean mass and AARD in either off- or pre-season (r=0.003 and r=0.001, respectively). 51% of athletes in off-season and 48% in pre-season exhibited >4cm AARD. Conclusion: In this preliminary report, no correlation was found between lower body lean mass asymmetry and dynamic balance asymmetry. Concerning was our finding that about half of the athletes showed dynamic imbalances, indicating higher injury risk. Further data collection will determine the extent of the changes in muscle mass and dynamic balance asymmetry over one full competitive season.

<table>
<thead>
<tr>
<th>Subject characteristics</th>
<th>Sport</th>
<th>n</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
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<tbody>
<tr>
<td>Football</td>
<td>18</td>
<td>185.8 ± 5.7</td>
<td>106.8 ± 18.1</td>
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<tr>
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<tr>
<td>Basketball (M)</td>
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<tr>
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<tr>
<td>Track &amp; Field (M)</td>
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<td>Volleyball (W)</td>
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<td>69.0 ± 8.1</td>
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<td>177.8 ± 8.2</td>
<td>74.5 ± 9.2</td>
<td></td>
</tr>
</tbody>
</table>

Greater levels of adiposity have traditionally been linked to a decrease in distance running performance, as excess weight and body fat have been seen to increase energy expenditure and power output necessary to complete the task of efficient locomotion.
**PURPOSE**: The aim of this study was to evaluate the effect of oral-contraceptive use on strength and body composition changes in trained women undergoing regimented resistance training (RT). **METHODS**: Twenty-three resistance-trained women (age 27.4±3.3 years; height 162.7±6.1 cm; body weight 60.5±7.8 kg; BMI 22.9±2.7 kg/m²) were randomized to either a non-oral contraceptive (n=11, NOC) or an oral contraceptive (n=12, OC) group. After a 5-week familiarization period, all participants performed four sessions of RT per week over the course of an 8-week non-linear program. Dual X-ray absorptiometry was used to measure lean body mass and fat mass. Muscle power was measured by the countermovement jump (CMJ) test using a jump contact mat, and maximal strength was assessed by the one-repetition maximum (1RM) test in the back squat (SQ) and bench press (BP).

**RESULTS**: OC significantly increased lean body mass [1.4±1.0(CI: 0.5, 2.3) kg; p= 0.007]; however, no changes were observed in the NOC group [0.7±1.2(-0.2, 1.5) kg; p= 0.074]. No significant changes were seen in regard to fat mass in both OC [0.4±1.8(-0.7, 1.5) kg; p= 0.437] and NOC [0.3±0.8(-0.2, 1.0) kg; p= 0.220]. Both OC and NOC increased upper-body IRM [6.7±3.6(4.4, 8.9) kg; p< 0.001] and [4.8±1.8(3.4, 6.1) kg; p< 0.01], respectively; likewise, increased lower-body IRM [11.9±5.0 (7.7, 16.2) kg; p< 0.01] and [15.6±5.4 (11.7, 19.4) kg; p< 0.01], respectively. No significant changes were found in both OC and NOC [0.7±1.1(-0.1, 1.6) cm; p= 0.911] and [0.7±1.1(-0.1, 1.6) cm; p= 0.69], respectively.

**CONCLUSIONS**: OC use in conjunction with RT produces similar increases in measures of strength and power compared to NOC in trained women and has potentially beneficial effects on lean body mass

**Supported by**: University of Málaga (Campus of International Excellence Andalucía Tech).

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**Board #10 June 1 8:00 AM - 9:30 AM**

**Effects Of Oral-contraceptive Use On Strength, Power And Body Composition In Trained Women**

Vargas Salvador1, Romance Ramón2, Petro Jorge L.1, Espinar Sergio1, Bonilla Diego A.1, Schoenfeld Brad J.1, Kreider Richard B., FACSM3, Benítez-Porres Javier1. 1EAE-University of Wales Trinity Saint David, Málaga, Spain. 2Universidad de Málaga, Málaga, Spain. 3Universidad de Colima, Monteria, Colombia. 4BetterScience, Málaga, Spain. 5Universidad Díaz Francisco Jr de Caldas, Bogotá, Colombia. 6CUNY Lehman College, New York, NY. 7Texas A&M University, Texas, TX.

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**No relevant relationships reported**

Oral contraceptives consumption has been identified as a usual strategy for birth control among athletes. Nevertheless, its impact on body composition and sports performance remains unknown due to the heterogeneity in the formulation of these products and individual factors such as the menstrual cycle, age or sports discipline.

**PURPOSE**: The purpose of this study was to examine the relationship between body composition measures, including body composition, inflammatory markers, dietary intake, stress, anxiety, and sleep. The current project aims to validate a new model of MF-BIA as a means of estimating body composition when compared to the more established technique relative to ADP, and does not have a substantial amount of validation. **PURPOSE**: To determine the correlation between ADP and a new model of MF-BIA. **METHODS**: The current study was a part of The RISE study, which is aimed at determining the associations between dietary supplement intake and biological and psychosocial measures, including body composition, inflammatory markers, dietary intake, stress, anxiety, and sleep. The current project aims to validate a new model of MF-BIA as a means of estimating body composition when compared to the more established method in adults who participate in the RISE study.
CONCLUSION: p < 0.01, ES = 0.92). Athletes between DEXA (28.5 ± 6.6%) and ADP (22.2 ± 7.1%) (p = 0.51). Additionally, a significant mean difference for BF% was found in the female athletes, and female BF% exhibited a significant p < 0.01, ES = 0.53). When factored for gender, male BF% showed higher REE (1656.0 ± 78.7 vs 1455.7 ± 157.8, p = 0.02) and higher VO2 (240.4 ± 1.16 vs 211.3 ± 22.9, P = 0.02) when compared to female GI. Only female GA showed a significant increase in baseline energy expenditure (1415.0 ± 226.7 vs 1656.0 ± 78.7, P = 0.03) and a significant decrease in baseline body fat percentage (26.4 ± 1.7 vs 22.2 ± 2.2, P = 0.05) between baseline and 4 weeks. In female GI, a significant, strong, positive correlation (r = 0.79, p < 0.01) between UBP and FFM for the entire group and genders. Separating the participants by gender produced a significantly, strong, positive correlation for the female population (r = 0.71, p < 0.01). Among male groups, male GA showed higher REE (2275.0 ± 78.7 vs 211.3 ± 57.3, P = 0.03) and greater VO2 (330.0 ± 41.2 vs 267.2 ± 48.6, P = 0.03) when compared to male GI after 4 weeks. But there were no differences for body composition and metabolic characteristics in the same male group, comparing baseline and 4 weeks evaluation. CONCLUSIONS: This study showed that 4 weeks of CrossFit training positively influenced REE and BF%, especially in female athletes when compared to beginners. Body composition was improved in both female groups. Among men, there were no differences and, probably, four weeks represent a short period to observe changes in body composition and resting energy metabolism in male groups.

CrossFit is a training program created by Greg Gussman in 1995 and consists of performing high intensity functional movements. Some studies have already reported reduction of body fat and increase of metabolic rate. PURPOSE: To investigate differences in body composition and resting energy expenditure (REE) in CrossFit beginners and athletes using electrical bioimpedance (BIA) and indirect calorimetry (IC), respectively. METHODS: 28 individuals (14 male aged 20-34 years were selected in CrossFit boxes and divided into two groups: CrossFit athletes (GA) and CrossFit beginners (GB). In baseline and after 4 weeks, participants were submitted to body composition and metabolic evaluation. Fat-free mass (FFM), fat mass (FM) and body fat percentage (BF%) were evaluated by BIA and REE and oxygen consumption (VO2) were investigated using IC. Participants continued to perform their CrossFit training, usually in accordance with the spreadsheet prescribed by their coaches. Statistical analyses used Kolmogorov-Smirnov and T of Student. RESULTS: There were no significant differences between groups in baseline. After 4 weeks, female GA showed a significant increase in baseline energy expenditure (1415.0 ± 226.7 vs 1656.0 ± 78.7, P = 0.03) and a significant decrease in baseline body fat percentage (26.4 ± 1.7 vs 22.2 ± 2.2, P = 0.05) between baseline and 4 weeks. In female GI, a significant increase in body fat mass (15.8 ± 5.7 vs 14.3 ± 5.7, P = 0.05) was observed, with no differences in others parameters. Among male groups, male GA showed higher REE (2275.0 ± 78.7 vs 211.3 ± 57.3, P = 0.03) and greater VO2 (330.0 ± 41.2 vs 267.2 ± 48.6, P = 0.03) when compared to male GI after 4 weeks. But there were no differences for body composition and metabolic characteristics in the same male group, comparing baseline and 4 weeks evaluation. CONCLUSIONS: This study showed that 4 weeks of CrossFit training positively influenced REE and BF%, especially in female athletes when compared to beginners. Body composition was improved in both female groups. Among men, there were no differences and, probably, four weeks represent a short period to observe changes in body composition and resting energy metabolism in male groups.

The sport of cheerleading requires extended bouts of great physical strength and coordination, particularly at the collegiate and 4 weeks. Upper body power (UBP) is vital to cheerleading performance, as many stunts require athletes to lift and propel themselves or teammates into the air. Additionally, large proportions of fat-free mass (FFM) may provide the ability for cheerleaders to execute advanced movements during competition. PURPOSE: The purpose of this study was to examine the association between UBP and FFM in Division-1 cheerleaders. METHODS: Male (n=12) and female (n=33) collegiate cheerleaders were assessed for height (cm), weight (kg), UBP, and FFM. UBP was determined using the medicine ball put test in which participants sat on an exercise bench at a 45-degree recline and were instructed to throw a medicine ball from the chest for maximum distance. Females and males used 15-lb and 20-lb medicine balls, respectively and completed two trials with a one-minute rest in between. FFM was assessed on the same visit to the laboratory via air displacement plethysmography. Spearman’s rho correlations were used to determine all associations between UBP and FFM in Division-1 cheerleaders.

RESULTS: Results indicated a significant, strong, positive correlation (r = 0.79, p < 0.01) between UBP and FFM for the entire group. Separating the participants by gender produced a significantly, strong, positive correlation for the female population (r = 0.71, p < 0.01); while the males demonstrated a non-significant, moderate correlation (r = 0.45, p < 0.05).

CONCLUSION: Results suggest that FFM and UBP are positively correlated in collegiate cheerleaders, although this relationship was exhibited particularly among females.

The demand of UBP associated with the sport may require greater amounts of FFM in order to properly execute advanced movements during competition.
Body composition can significantly impact performance and injury risk, particularly in cross country, where a small build and low percent body fat are typically desirable. Body composition goals for an athlete may vary year-to-year, depending on training goals, years of competitive training, and access to specialized training staff. Tracking body composition throughout a collegiate career is important for optimal health and performance. PURPOSE: To evaluate changes in body composition across a first, second, third, or fourth year of competition in Division I cross country runners. METHODS: Pre and post season measures of body composition were evaluated in first season (N~25), second season (N~24), third season (N~13), and fourth season (N~10) Division I National Collegiate Athletic Association cross country runners (Total: N~46; male~25; female~21) between the years of 2014 to 2017. Total and regional body composition (fat mass [FM], percent body fat [%BF], lean mass [LM], bone mineral content [BMC], and armLM, legLM) was assessed using dual-energy x-ray absorptiometry. RESULTS: First year runners significantly increased weight (change [Δ] ± SD; 1.6 ± 2.2 kg; p=0.001), LM (1.6 ± 1.3 kg; p<0.001), BMC (0.03 ± 0.05 kg; p=0.008), and armLM (0.1 ± 0.3 kg; p=0.047). Second year runners significantly increased weight (1.1 ± 1.8 kg; p=0.005), LM (1.2 ± 1.2 kg; p<0.001), armLM (0.1 ± 0.3 kg; p=0.019), and had a small but significant decrease in BMC (-0.02 ± 0.03 kg; p=0.002). There were no significant changes in body composition in third or fourth year runners. CONCLUSIONS: First and second season Division I cross country runners experience significant changes in body composition, primarily increases in LM, while third and fourth year runners experience minimal changes. Changes are likely influenced by the addition of strength and conditioning and nutrition staff that are not available in high school. The first two seasons may be key times for developing body composition characteristics in runners that can maximize performance and minimize injury throughout their career.
Body composition assessment has become an integral part of the year-round training schedule for athletes. This may be especially important in women athletes due to the potential for disordered eating. Development of low-cost bioelectric impedance analysis devices (BIA) make them attractive for determining changes in body composition over the year. The accuracy of these devices has been questioned, although questions remain concerning the accuracy of assessment methods.

**METHODS**: To compare various methods for determining body composition in male athletes, although questions remain concerning the accuracy of assessment methods. Assessment of body fat (%fat) is common across yearly training cycles for many athletes. To compare the accuracy of selected BIA devices compared to dual-energy X-ray absorptiometry (DEXA) as the criterion measure, had the closest %fat estimate (16.5 ± 3.0%) but a low correlation (r = 0.64) with actual %fat (DEXA: 18.0 ± 3.9%).

**RESULTS**: A phase x method factorial ANOVA of %fat with repeated measures over the second factor indicated that 2 BIA devices were not significantly different from corresponding DEXA values while all others significantly underestimated DEXA %fat. Lin’s concordance correlation between BIA devices and DEXA was varied at each phase from low of p = 0.17 to high of p = 0.84, with no consistency across time. Rank-order correlations of BIA devices with DEXA were also inconsistent across time ranging from r = 0.40 to r = 0.72. **CONCLUSIONS**: Compared to the DEXA standard, single-frequency BIA devices may not provide adequate tracking of %fat or FFM in women across a basketball season.

**Assessment of Body Fat (%fat) is Common Across Yearly Training Cycles for Many Athletes, Although Questions Remain Concerning the Accuracy of Assessment Methods.**

**PURPOSE**: To compare various methods for determining body composition in male soccer players across a yearly cycle. METHODS: 6 athletic SKF equations, and two bioelectrical impedance devices (arm: A-BIA; leg: L-BIA). SKF sites were measured by one experienced investigator throughout.

**RESULTS**: A phase x method factorial ANOVA of %fat with repeated measures over the second factor indicated all prediction methods significantly, but consistently underestimated DEXA %fat (average difference = 11.8 ± 2.1%) despite moderate to high correlations with DEXA (r = 0.57 to 0.81). Of the SKF equations, a 7-SKF model, previously produced in our laboratory using DEXA as the criterion measure, had the closest %fat estimate (16.5 ± 3.0%) but a low correlation (r = 0.64) with actual %fat (DEXA: 18.0 ± 3.9%).

**CONCLUSIONS**: All prediction techniques produced significantly lower estimates of %fat in male college soccer players across a year-long training cycle. Despite underestimation, each method provided consistent measure by phase and can be used to effectively track changes across a season. Prediction errors were typically greater at greater DEXA %fat and body mass values.
LM than women. A sex x sport multivariate ANOVA, with the influence of height and weight removed by covariance, revealed that men had significantly greater regional BMD (p<0.005) than women in the arms, legs, pelvis, and total body. XC and SW had significantly lower BMD than CON which were lower than SOC, HS, and BB with no significant difference among the latter groups. The sex x sport interaction was not significant (p = 0.15), except for leg BMD where women swimmers (1.153 ± 0.081 g/cc) had a significantly lower value than other groups (1.405 ± 0.151 gm/cc). BMD had a nonsignificant higher correlation with LM (r = 0.61) than with body mass (r = 0.58) when sex was held constant.

CONCLUSIONS: Regional BMD appears to be uniquely dependent on sport participation and sport-specific training, but the pattern of bone development appears independent of sex. Men and women athletes in sports that require more intense ground contact and perhaps more resistance training have greater regional and total BMD, suggesting varying levels of bone stress are associated with training for different sports. The degree of stress on bones of the arms does not seem sufficient to differentiate between these sports or inactive individuals.

3338 Board #26 June 1 8:00 AM - 9:30 AM Comparison of Abdominal Fat among Positions and Ethnicities in College Football Players Brianne R. Morgan1, Monica L. Hunter1, Richard M. Schumacher2, Laurel M. Wentz2, Jerry L. Mayhew2, William F. Brechue, FACSM3. Truman State University, Kirksville, MO.1Appalachian State University, Boone, NC. 2A.T Still University, Kirksville, MO.

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(No relevant relationships reported)

Body types in American football vary dramatically, but the underlying premise is one of achieving greater size within any position. In order to reach the theoretical size required for a given position, players may perform extensive resistance training and consume large quantities of food without much concern for body composition. Recent investigation has suggested that the accumulation of abdominal or visceral fat may have serious long-term health consequences. However, limited information is available on the extent of abdominal fat accumulation in collegiate football players. PURPOSE: To compare the level of android adiposity among Caucasian and African-American football players in different playing positions. METHODS: Backs (BA, n = 57) and linemen (LM, n = 47) were measured for body composition using by dual-energy x-ray absorptionmetry (DEXA). Android fat (AF) was identified as the region from the iliac crest to a height 20% distance below the chin. Ethnicity was categorized as Caucasian (CAU, n = 74) and African-American (A-A, n = 30) based on self-report. RESULTS: There was a significant difference (p<0.001) in %fat between linemen (27.4 ± 7.5%) and backs (16.8 ± 4.3%) but not between ethnicities (CAU = 22.1 ± 8.1% vs A-A = 20.4 ± 7.7%), with no significant interaction (p = 0.96). The same pattern was evident in AF with a significant difference between positions (LM = 3.03 ± 1.56 kg vs BA = 1.37 ± 1.75 kg), a non-significant difference between ethnicities (CAU = 2.32 ± 1.98 vs A-A = 1.63 ± 1.42 kg), and a non-significant interaction (p = 0.54). When body mass was held constant by covariance, there was no significant difference between positions (LM = 1.75 ± 1.95 vs BA = 2.26 ± 1.804 kg), ethnicities (CAU = 2.23 ± 1.35 vs A-A = 1.79 ± 1.371 kg), or for interaction (p=0.14). AF was more highly correlated with body mass in LM (r = 0.90) than in BA (r = 0.26) and more highly correlated with body mass in A-A (r = 0.91) than CAU (r = 0.63). CONCLUSIONS: These findings suggest that the amount AF in college football players is largely related to body size. Accounting for difference in body size eliminates the difference between playing positions and ethnicities. Further research should compare athletes to nonathletes of different ethnicities and sizes to determine if similar patterns exist.

3339 Board #27 June 1 8:00 AM - 9:30 AM Comparison of Various Body Composition Measures for Division-I Collegiate Male Athletes Gina R. Hogan, Michelle L. Eisenman, Emily L. Langford, Ronald L. Snarr, Greg A. Ryan. Georgia Southern University, Statesboro, GA.

(No relevant relationships reported)

Estimates of body composition are critical for athletic populations as variations in body fat percentage may affect performance, power, and general overall health. However, most laboratory and field-based devices estimate body composition using algorithms based upon and intended for general populations. Therefore, these algorithms may not be applicable to special populations, specifically male athletes. PURPOSE: The purpose of this investigation was to compare various field and laboratory measures of body composition in Division-I male athletes against a criterion of air displacement plethysmography (ADP). METHODS: Sixty-nine Division-I collegiate male athletes, from various sports, performed five body composition measures (i.e., bioelectrical impedance spectroscopy (BIS), hand-to-foot bioelectrical impedance analysis (HF-BIA), foot-to-foot bioelectrical impedance analysis (FF-BIA), three site skinfold (SF), and ADP). Each participant performed all measures on the same visit to the laboratory. A repeated measures ANOVA was used to determine differences between body composition measures (%fat) across the criterion of ADP. RESULTS: When compared to ADP (12.2±1.1%), results indicated a significant mean difference with BIS (18.1±6.8%; p<0.001) and HF-BIA (18.5±6.0%; p<0.001). There were no statistical differences between ADP and FF-BIA (12.1±6.5%; p=1.0) or ADP and SF (13.2±8.6%; p=1.0). CONCLUSION: Results indicate that field measures of body composition (i.e., FF-BIA and SF) may be applicable to athletic populations; whereas, laboratory measures (i.e., BIS and HF-BIA) may tend to overestimate body composition in male athletes. Therefore, new algorithms estimating body composition in athletes may be warranted for laboratory based devices.

3340 Board #28 June 1 8:00 AM - 9:30 AM Utility of Anthropometric Indices to Estimate Changes in Adiposity in Response to an Exercise Intervention Jacob E. Erickson1, Michael Fedewa2, Elizabeth Hathaway2, Simon Higgins1, Ellen Evans, FACSM3, Michael Schmidt4. University of Georgia, Athens, GA. 1University of Alabama, Tuscaloosa, AL. 2University of Tennessee-Chattanooga, Chattanooga, TN. 3Elon University, Elon, NC. Email: jericks219@gmail.com

(No relevant relationships reported)

In cross-sectional analyses, anthropometric measures are generally well correlated with clinical measures of adiposity such as those from dual-energy X-ray absorptiometry (DXA). However, it is unclear whether anthropometric measures are sensitive enough to accurately quantify longitudinal changes in central and whole-body adiposity in response to short term exercise interventions with minimal weight change. PURPOSE: To examine the relative agreement between anthropometric and DXA measures of change in adiposity following a 6-week cycling exercise intervention. METHODS: Overweight/obese women (n=51, 18-24 years old, 66% White, 17% Black, 17% Other) participated in the exercise intervention. Anthropometric measures included body mass index (BMI) and natural waist (NW) circumference. DXA measures included absolute trunk fat (TrkFat), whole body absolute fat (TotFat), and percent fat (%Fat). Baseline anthropometric and DXA measures were compared using Pearson correlations, as were changes (Δ) in each measure across the intervention. RESULTS: Mean ± SD at baseline for each of the measures were: NW (58.7±10.8 cm), BMI (30.5±5.0 kg/m²), TrkFat (1692.3±599.13 g), TotFat (35826.4±9813.2g), %Fat (44±5.8%). Δ for each of the measures were: NW (-0.8±0.4cm), BMI (-0.2±1.0kg/m²), TrkFat (-493.6±1773.6g), TotFat (3326.9±9813.2g), %Fat (6.8±15.3%). The association between baseline NW and TrkFat was much stronger at baseline (r=0.93, p<0.001) compared to the correlation between post-intervention Δ (r=0.57, p=0.01). Similarly, correlations between baseline BMI and DXA measures were stronger (TotFat: r=0.90, p<0.001; %Fat: r=0.68, p<0.001) than correlations between Δ measures (TotFat: r=0.68, p<0.001; %Fat: r=0.34, p=0.013). CONCLUSION: Anthropometric indices may not accurately reflect Δ in body composition during short duration lifestyle interventions. This may be due to factors such as cumulative intra-rater measurement errors when assessing waist circumference and the inability of BMI to differentiate changes in lean and fat mass over time. More direct measures (e.g., DXA) may be needed to accurately assess Δ in body composition, especially when these changes are of modest magnitude.

3341 Board #29 June 1 8:00 AM - 9:30 AM Body Composition Characteristics and Knee Injury Prevalence of NCAA Division I Women's Soccer and Lacrosse Gabrielle J. Brewer, Malia N.M. Blue, Katie R. Hirsch, Austin M. Peterjohn, Samantha A. Kelchner, Darin A. Padua, Abbie E. Smith-Ryan, FACSM. University of North Carolina - Chapel Hill, Chapel Hill, NC. (Sponsor: Dr. Abbie E. Smith-Ryan, FACSM)

Email: gbrewer@live.unc.edu

(No relevant relationships reported)

Body composition is directly linked to athletic performance and may influence injury risk and recovery. Female Division I soccer and lacrosse players are at a high risk for lower limb injuries specific to the knee joint throughout their competitive careers. Return to play criteria vary; evaluation of body composition may be an important element of clearance. PURPOSE: The purpose of this study was to characterize pre-season body composition and injury prevalence among female Division I soccer and lacrosse players using dual-energy x-ray absorptiometry (DEXA). METHODS: Sixty Division I Women’s Soccer (n=27) and Lacrosse (n=33) athletes (Mean ± SD: age:19.8 ± 1.4 yrs, height, 167.3 ± 6.2 cm, weight, 64.9 ± 8.0 kg), completed a whole body DEXA scan to determine fat mass (FM), percent body fat (%Fat), lean mass (LM), segmental lean mass (right leg lean mass (RLM); left leg lean mass (LLM)), and bone mineral content (BMC). History of lower extremity injury (ACL and other knee injuries) throughout a career was self-reported using a validated questionnaire. Measurements were taken pre-season (August 2018). RESULTS: Soccer and lacrosse

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While total lean body mass accretion (TLBM) has been shown to have a positive association with performance in professional baseball players (Hoffman et al., 2009), there is a paucity of data demonstrating the relationship between body composition with power performance in collegiate athletes. PURPOSE: To investigate the relationship between multiple body composition parameters with peak force and anaerobic power in division II collegiate baseball players. METHODS: This was a retrospective study in which four years of body composition data was analyzed to determine its association with peak force and anaerobic power performance for 95 collegiate baseball players (age: 21.1±1.0 yrs.; height: 1.84±0.05m; body mass: 87.9±11.1kg). Each subject performed a DEXA scan as well as a performance test of either a countermovement vertical jump (CMJ) (n=66) and/or a Wingate test (WIN) (n=43). Pearson’s correlation coefficient was used to analyze the association between body composition parameters (i.e., TLBM, lower body lean mass [LBM], body fat percentage [BF] and body mineral component [BMC]) with vertical jump peak force (CMJPF) and anaerobic power (i.e., absolute peak power [PP] and absolute average power [AP] on the Wingate test). RESULTS: TLBM was strongly correlated to WIN (PP: r=0.777; p<0.0001, AP: r=0.808; p<0.0001), but only moderately correlated to CMJ (CMJPF: r=0.488; p<0.001). LBM was also strongly correlated to PP (r=0.660; p<0.0001, AP: r=0.738; p<0.0001) but only moderately correlated to CMJ (CMJPF: r=0.467; p<0.002). BF had a weak correlation with WIN (PP: r=0.244; p=0.049, AP: r=0.295; p=0.042) and no significant correlation with CMJ (CMJPF: r=0.128; p=0.169). BMC was strongly correlated to WIN (PP: r=0.713; p<0.0001, AP: r=0.776; p<0.0001) and moderately correlated to CMJ (CMJPF: r=0.519; p<0.001). CONCLUSION: Our data suggests a strong positive relationship between lean body mass, including bone, with anaerobic power but only a moderate relationship with peak force. Moreover, BMC was strongly correlated to performance probably because athletes with more TLBM had greater BMC. Surprisingly, there was no association between body fat percentage and performance.

3345 Board #33 June 1 8:00 AM - 9:30 AM
Weight Change and Hydration Status in Elite Puertorrican Wrestlers in Preparation for the National Championship
Enid C. Rivera-Velázquez1, Carmen Nevárez-Alonso2, Farah A. Ramírez-Marrero, FACSMD1, Lucia del R. Martínez-Colón1
1University of Puerto Rico, Rio Piedras Campus, San Juan, Puerto Rico 2University of Puerto Rico, Medical Sciences Campus, San Juan, Puerto Rico. (No relevant relationships reported)

Rapid weight loss is a very common strategy used in weight class sports, such as wrestling. Risky weight loss methods like fasting, fluid restriction and increased sweating are very common practices used to attain competitive weight. Acute weight gain, as a recovery strategy, after the weigh-in day has also been observed. PURPOSE: To determine weight change and hydration status of elite Puertorrican wrestlers in preparation for the National Wrestling Competition. METHODS: Wrestlers of the national adult pre-selection (15 males, 9 females, ages 17-34 years) were evaluated. Body weight (BW) and hydration status based on urine specific gravity (USG) were determined one week before, the day of the official weigh-in and one hour before on the day of the competition. Questionnaires were administered to evaluate methods used to “make weight”. Repeated measures ANOVA (post-Hoc Bonferroni) was used to identify changes in BW and USG between these measurement times. Independent sample t-test was used to detect differences between sex.
RESULTS: Body weight decreased from 68.9±14.0 to 66.9±13.5 kgs from the week
before the competition to the day of the weigh-in, and then increased to 68.2±13.8 kg from weight-in to the day of the competition (F=27.33, p<.001). USG increased significantly from 1 week before to the weigh-in (1.024±0.06 vs. 1.028±0.07 g/ml) and decreased on the competition day (1.025±0.07) (F=4.32, p<.019). No differences were found between sex in relative weight change (%) and USG. More than 80% of the athletes were classified as significantly dehydrated (USG >1.020) during the evaluations. Fasting, exercise with plastic suits and fluid restriction, were among the most common weight loss methods reported. CONCLUSIONS: The results indicate that wrestlers of the national adult pre-selection of Puerto Rico did not accomplish adequate hydration status on the day of the competition, even though partial weigh gain was achieved. Education programs for adequate weight and hydration management is highly recommended.

Relative body fat (%BF) is a predictor of health status. Waist-to-height ratio (WHR) better indicates disease outcome and adiposity-related disorders than does BMI or waist circumference (WC). PURPOSE: Develop a %BF prediction equation from WHR, weight (wt), age and sex. METHODS: White, black, and Hispanic adults (70 men, 71 women; 30±10 yr; 79.6±20.5 kg; 171±12 cm) volunteered for the IRB-approved study. Participants gave written consent and followed pre-test guidelines. Duplicate measurements of WC (narrowest portion of torso), barefoot height (cm) and wt (kg) were averaged. Dry land residual volume (RV) was assessed via helium dilution; the average of 2 values ± 0.1L were used to correct body volume (Vb) from hydrostatic weighing (HW). The wt, water density, the average of the 3 heaviest underwater weights within 0.1 kg, and RV were included in the Vb calculation. Body density (dry weight/Vb) was converted to %BF using the Siri (1961) formula. A multiple regression analysis was performed to establish a prediction equation from WHR, wt, age and sex. Statistical analyses were conducted using R; p<.05 indicated significance.

RESULTS: WHR, wt, age and sex were significant predictors of %BF (p<.005). For each sex, %BF increased with each unit increase in WHR, kg body wt, and yr of age. WHR and %BF were negatively correlated with sex (r=-.145 men; r=-.135 women, p<.05). For the sample, %BF= 19.415 + 0.554*WHR + 0.130*wt + 13.650*sex (men = 0; women = 1) + 0.259*age. For the women, %BF was higher at all ages (b=13.65, SE=1.356, p<.001). Weight has a stronger effect (p<.001) and WHR has a lower effect (p<.01) on %BF in women than men and all participants combined. The resulting sex-specific equation for women is %BF = 31.65 + 0.42*WHR + 0.23*wt + 0.25*age. For the men, wt is a lower and age a stronger predictor of %BF than in women. The resulting sex-specific equation for men is %BF = 20.85 + 0.55*WHR + 0.08*wt + 0.27*age. CONCLUSION: Sex-specific %BF prediction equations for men and women have been established from WHR, weight, age and sex. These equations await validation with an independent sample. Regardless, %BF can be easily predicted from simple anthropometric data collected in most any setting by technicians needing minimal training.

Table 1. Comparison of the mean values of body composition and physical capacity of schoolchildren, according to compliance with the recommendation of physical activity. Mixed-Longitudinal Project of Growth, Development and Physical Fitness from Ilhabela, 2015-2018, SP, Brazil.

<table>
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<th>Measure</th>
<th>Combined</th>
<th>A (≥60 min/day)</th>
<th>B (&lt;60 min/day)</th>
<th>A vs. B (p-value)</th>
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<tbody>
<tr>
<td>Weight (kg)</td>
<td>34.3</td>
<td>34.7</td>
<td>33.9</td>
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<tr>
<td>Height (cm)</td>
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<td>141.2</td>
<td>140.8</td>
<td>0.94</td>
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<tr>
<td>BMI (kg/m2)</td>
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<td>16.9</td>
<td>17.0</td>
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<td>Sum of 7 skinfolds (cm)</td>
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<td>65.9</td>
<td>66.5</td>
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<tr>
<td>Upper arm lean mass (cm)</td>
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<td>18.0</td>
<td>18.5</td>
<td>0.76</td>
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<td>Flexibility (cm)</td>
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<td>24.3</td>
<td>24.1</td>
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<td>Agility (sec)</td>
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<td>12.5</td>
<td>12.8</td>
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<td>Speed (sec)</td>
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<td>10.1</td>
<td>10.1</td>
<td>0.98</td>
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<td>Acceleration strength (m/s²)</td>
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</table>

* Significant differences were found in upper limb mass (t-test, p<0.05) and trunk lean mass (TLM) with balance in archers.
**3348 Board #37 June 1 8:00 AM - 9:30 AM**

**Anthropometry Among Non-sedentary Elderly Tendency Analysis Of Adiposity Over Three Decades**

João da Silva Junior, Rafael Benito Mancini, Carolina Gonzalez Beltran, Tatiane Kosimenko Ferrari, Timoteo Leandro Araújo, Sandra M. Matsudo, José da Silva Guedes, Victor K. Matsudo, CEFAC-BCS, São Paulo, Brazil.

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Purpose: To analyze the adiposity tendency of non-sedentary elderly women over three decades. Methods: The study is part of the Mixed Longitudinal Project of Physical Fitness and Aging of SCS. Sample comprised female subjects, 50-years-old and older, involved in a PA program totaling 6367 individuals. It was measured subcapsular, tricipital and suprailiac skinfold, To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years and over.

**Statistics analysis:** Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable (Y) and the years of evaluation as independent variable (X). For each anthropometric variable, the model that presented the highest statistical significance (p) and the best accuracy measure (r) was selected. The trend was considered significant when the estimated model obtained p < 0.05. Results: Triceps skinfold presented a negative trend over the three decades analyzed. In the age group of 50 to 59 years, the mean triceps skinfold decreased 0.1 mm every year. In the age group of 60 to 69 years, there was a decrease of 0.09 mm every year. In the age group of 70 years and over, the mean decreased of 0.16 mm every year. In the age group of 60 to 69 years, the mean of 3 skinfolds increased 0.01 mm every year. In the age group of 70 years and over, the subcapsular mean increased of 0.16 mm in each year; while suprailiac presented an increase of 0.01 mm every year; and the 3 skinfold mean] increased of 0.01 mm every year. Conclusion: Elderly women of all age groups showed a tendency to increase central adiposity and decrease the peripheral region, suggesting that a central fat redistribution occurs with aging.

**3350 Board #38 June 1 8:00 AM - 9:30 AM**

**VO₂peak and Dual Energy X-Ray Absorptiometry Results in NCAA Division I Tennis Players**

Karina L. Wilson, Jason R. Lytle, Steven E. Martin, Stephen F. Crouse, FACSM, Texas A&M University, College Station, TX. (Sponsor: Stephen F. Crouse, FACSM)

Purpose: Describe VO₂peak and body compositions using dual x-ray absorptiometry (DXA) in NCAA Division I male tennis players.

Methods: Nine (9) male NCAA Division I tennis players (age 19.6 ± 1 yr, height 183.6 ± 5.9 cm, weight 75.6 ± 5.3 kg) who were in pre-season were tested as part of their athletic training program. Each subject underwent a DXA scan two weeks prior to their VO₂peak test. VO₂peak tests were conducted using the Bruce protocol (mL/kg/min). On the day of the test, athletes were instructed to consume their normal free-living breakfast and not engage in strenuous activity including team workouts prior to the test. Subjects ran to volitional exhaustion and peak exercise times and VO₂peak numbers were recorded. Blood pressures were monitored according to the ACSM guidelines before, during, and after the exercise. After the completion of the test, data were analyzed to determine VO₂peak, max heart rate (HR) which was recorded using a 12-lead ECG, and ventilatory threshold during exercise.

Results: Results shown in Table 1.

Conclusion: With respect to published norms for men that are matched to age, the players’ measured VO₂peak average would be ranked in the 95th percentile and deemed excellent for VO₂peak. Based on the ACSM guidelines, the average for the body fat percentage falls in the 85th percentile and is deemed fair. The leanest player of the group is in the 80th percentile and deemed excellent.

**3351 Board #39 June 1 8:00 AM - 9:30 AM**

**Effect of Moderate Intensity Physical Activity and Modality on Measures of Body Composition in Males**

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(No relevant relationships reported)

Exercise prior to body composition measures using air displacement plethysmography (ADP) and bioelectrical impedance (BIA) is generally contraindicated. Blood flow redistribution varies when using modalities such as treadmill walking (TW), leg cycling (LC) and arm cycling (AC) that may contribute to inaccuracies. Understanding the effect of physical activity using modalities on the accuracy of these devices have practical benefits. Purpose: To determine the effect of moderate intensity physical activity using different exercise modalities on body fat percent (BF%) measured by ADP, whole body bioelectrical impedance (WBIA), upper body bioelectrical impedance (UBIA), and lower body bioelectrical impedance (LBIA). Methods: Seventeen male participants (33.1 ± 9.3; 23.0%±4.9% body fat) were included in the study. Participants exercised using TW, LC, and AC (45%-55% heart rate reserve) for 30 minutes on different days including a control condition. BF% was measured pre-exercise (PreE), immediately post-exercise (PE0), 15 minutes post-exercise (PE15), 30 minutes post-exercise (PE30), 45 minutes post-exercise (PE45), and 60 minutes post-exercise (PE60) using ADP, WBIA, UBIA and LBIA at each time point. Results: No differences were found during the control for PreE BF% for ADP (18.2 ± 9.9%), WBIA (17.8 ± 7.6%), UBIA (17.8 ± 6.5%), and LBIA (15.6 ± 8.0%). There was no effect of the time during the control on BF% except when using UBIA (p<0.03). Using ADP, BF% at PE0 was significantly less than all other time points following TW and LC (p<0.05). Following AC, PE0 was significantly different from PE15-PE60, but not PreE (p=0.06). Using LBIA, after TW only BF% measured at PE15 and PE45 was significantly less than PreE (p<0.05). Conclusion: BF% measured by ADP after exercise decreases with all modalities, but generally returns to PreE measures within 60 minutes. LBIA BF% are not affected by exercise modality over time. However, LBIA BF% tends to decrease following TM but returns to PreE measures within 60 minutes.
**Board #41**
**June 1 8:00 AM - 9:30 AM**
**Agreement Between Two Bioimpedance Spectroscopy Devices and DXA for Body Composition**

Bjoern Hornikl,1 Zachary S. Cicone,1 Clifton J. Holmes,1 Bailey A. Welnbomb,1 Michael R. Esco,1 FACS,1 Jordan R. Moor,1 Todd Freeborn,1 1University of Alabama, Tuscaloosa, AL; 2Impedimed, Inc., Carlsbad, CA. (Sponsor: Michael R. Esco, FACS)

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(No relevant relationships reported)

Bioimpedance spectroscopy (BIS) has been used as an alternative to the more expensive and invasive dual-energy x-ray absorptiometry (DXA) to estimate body composition. PURPOSE: To determine the agreement between two BIS devices in comparison to DXA for measuring body fat percentage (%Fat), fat-free mass (FFM), and fat-mass (FM). METHODS: Ninety-five subjects (m = 35; f = 60; 30 ± 15 years; 170 ± 8.0 cm; 72.6 ± 14.8 kg) participated in the study. Both devices utilized whole body right side measurements, one device (BIS1) is in supine and the other (BIS2) in standing position. Measurements were taken during a single visit following an 8-12 hour fast. RESULTS: Bland-Altman analysis revealed BIS1 underpredicted values for %Fat (mean differences ± 95% limits of agreement: 3.09 ± 4.97%) and FM (2.85 ± 5.99kg) and significantly overpredicted FFM (1.15 ± 4.98kg) in comparison to DXA. When significantly underpredicted values for %Fat (1.69 ± 5.16%) and FM (1.81 ± 6.25kg). No significant difference existed between BIS2 and DXA for %Fat (0.08 ± 5.32kg). Correlations between values for %Fat (1.69 ± 5.16%) and FM (1.81 ± 6.25kg). No significant difference existed between both BIS and DXA for FM, FF, and %Fat were very strong (r ≥ 0.92). CONCLUSIONS: While BIS and BIS2 showed a similar bias when calculating FM, FF, and %Fat, the limits of agreement were fairly narrow, indicating both to be acceptable alternatives to DXA for clinical practice in males and females aged 18-82 years with BMIs 18-39.5 kg/m². This study was funded by Impedimed, Inc.

**Board #42**
**June 1 8:00 AM - 9:30 AM**
**The Effect of Acute Exercise-Induced Fluid Loss and Fluid Consumption on Percent Body Fat**

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(No relevant relationships reported)

Acute exercise fluid loss, as well as fluid consumption, have been shown to impact body composition assessment using multiple methods of assessment. However, to our knowledge no study to date has examined percent body fat (%BF) using skinfold measurements (SF), air displacement plethysmography (ADP), dual energy x-ray absorptiometry (DXA), and type-A ultrasound (US) under exercise conditions while also controlling for exercise-induced fluid loss. PURPOSE: To determine the effect of acute exercise-induced fluid loss and fluid consumption on %BF determined by SF, ADP, DXA, and US before exercise, after exercise, and after fluid consumption. METHODS: Thirty-two college-aged men (20.8 ± 1.1 yrs) participated in this study and were randomly assigned to one of three groups: one group consumed water during exercise and after exercise (with water; n=11), a second group consumed water only after exercise (without water; n=11), and a third group served as the control group (n=10). Participants reported in a dehydrated state (Usg <1.020). %BF was determined using SF, ADP, DXA, and US. Participants then performed 30 min. of exercise at 70% heart rate reserve (HRR) on a cycle ergometer in a room at 28.3-29.4°C. Twenty-thirty min. after exercise %BF was determined a second time. Water equal to the BM lost during exercise was consumed and %BF was measured a third time 60 min. later. RESULTS: Body mass (BM) was significantly reduced post-exercise in the without water group (79.7±9.4; 78.8±9.5 kg; p<0.001) but not in the group exercising with water (82.5±7.4; 82.3±7.3 kg; p=0.21). %BF was significantly less post-exercise compared to pre-exercise in the without water group (14.3±4.4; 12.6±4.9 %c; p=0.017) when using ADP. In both the with water (16.8±4.5; 18.8±4.2 %c; p=0.001) and without water (12.6±4.9; 14.7±5.0 %c; p=0.011) groups, %BF significantly increased after fluid consumption when using ADP. No significant effects were observed for DXA, US, or SF determined %BF after exercise and fluid consumption. CONCLUSION: Acute exercise and fluid consumption impacted ADP determined %BF, but did not have a significant effect on %BF determined by DXA, US, and SF.

**Board #43**
**June 1 8:00 AM - 9:30 AM**
**Decline In Aerobic Capacity Or Increase In BMI?**

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(No relevant relationships reported)

PURPOSE: Aerobic capacities, specifically VO2_max, of children and youth, have been found declining over the second half of 20th century according to the secular trend analyses (see e.g., Tomkinson et al., 2007). Since body mass index (BMI) is often a part of VO2_max prediction, this study was to examine the impact of changed BMI on the declined VO2_max. METHODS: First, 50th percentiles of 8-11 yr. boys and girls’ BMI and 1-mile Run-Walk (1MRW) performance in 1987 National Children and Youth Fitness Study (NCYFS II) were used to estimate their VO2_max using the equation of Cureton et al. (1995): VO2_max (ml/kg/min) = (-8.41*Time)+(0.34*Time²)+(0.21*Age*Sex)-(0.84*BMI)+108.94. Second, BMI in the prediction were replaced by the BMI 50th percentiles of 8-11yr. boys and girls in 2015-2016 NHANES. Finally, the difference between 1987 and 2015-16 estimated VO2_max were computed and compared. RESULTS: Impact of BMI changes on the estimated VO2_max by age and sex was summarized below:

Conclusions: Even when running performances stay the same, the changes in BMI between 1987 and 2015-16 could lead 1-7% decline in estimated VO2_max of 8-11 children and youth, indicating that weight management should be a part of fitness and health promotion in children and youth.

**Board #44**
**June 1 8:00 AM - 9:30 AM**
**Regional Differences In Bone Mineral Density Vary With Whole Body Z-scores In College Track Athletes**

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(No relevant relationships reported)

Track and field athletes are susceptible to musculoskeletal injuries due to a combination of insufficient recovery and excessive training. Stress fractures in these athletes are common, especially in distance runners, and are associated with decreased regional and whole body bone mineral density (BMD). PURPOSE: To determine if college track and field athletes with low BMD experience loss of BMD in the ribs (RIB) to compensate for musculoskeletal loading of the lower extremity. METHODS: 110 NCCA Division I track and field athletes (57 males, 53 females) underwent whole body and bilateral hip dual energy x-ray absorptiometry (DXA) scans. Whole body Z-scores and BMD for standard sub-regions, including RIB, were compared to predicted (PRED) BMD and percent change. RESULTS: Females and males experienced a significant decrease in whole body and bilateral hip BMD following season. Females: -2.8% for whole body and -2.1% for bilateral hip PRED vs. -3.1% for whole body and -2.4% for bilateral hip Z-score. Males: -1.3% for whole body and -1.0% for bilateral hip PRED vs. -1.5% for whole body and -1.2% for bilateral hip Z-score.
RESULTS: Significant correlations between DXA %fat and all 8 US sites (r = -0.52 to -0.87, p ≤ 0.01) were found. Using step down multiple regression analyses all 8 sites were entered into the analyses to predict DXA %fat. Three sites for females (lower abdomen (LA), medial calf (MC), distal triceps (DT); p ≤ 0.001, SEE = 2.4-2.6%); and two sets of three sites for males: LA, MC, and erector spinae (ES) (p ≤ 0.01; SEE = 1.8-2.2%); and upper abdomen (UA), MC, ES (p ≤ 0.01; SEE = 1.9%); were found to be the best predictors.

CONCLUSIONS: These findings show that US can predict DXA %fat with low SEE’s in both male and female athletes.

Electrical impedance myography (EIM) has been compared with DXA in physically active subjects, but its accuracy in professional athletes has not been explored.

METHODS: We evaluated the body fat percentage (BF%) of 28 professional male soccer players (19 - 34 years old; BF% = 14.5 ± 2.4%) with a whole body DXA scan (Hologic®) and a mobile EIM device (Skulpt® Chisel). The EIM was assessed at ten anatomical sites (abdomen, biceps, calves, chest, forearms, hamstrings, lower back, quadriceps, shoulders, and triceps). The BF% was estimated for each anatomical point and for the sum of all according to the manufacturer’s instructions. We calculated mean differences in BF% (DXA - EIM) and their 95% limits of agreement. DXA and EIM BF% were analyzed for correlation with intra-class correlation coefficient and compared with ANOVA and Dunnett post hoc test.

RESULTS: There were strong correlations between DXA BF% and EIM BF% assessed at abdomen, chest, lower back, quadriceps, hamstrings, and all sites. Moderate to low correlations were observed for shoulders and triceps, biceps, calves, and forearms showed no significant correlation. Similarly, DXA BF% was different to EIM BF% at calves and forearms only (p < 0.05). From the other anatomical sites, the lowest mean difference was observed at hamstrings and the biggest at biceps. However, the narrowest limits of agreement were observed at quadriceps and the widest at chest. BF% estimated using all sites showed similar results as obtained evaluating BF% at quadriceps (Table).
Board #48  
June 1 8:00 AM - 9:30 AM  
Influence of Circumference Measurements and Body Composition on Estimating Resting Metabolic Rate in Healthy Adults  
Kristi Chase, Kyle Patek, John Walker, FACSM, Joni Mettler. Texas State University, San Marcos, TX.  
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(No relevant relationships reported)  

Measurement of resting metabolic rate (RMR) is an important factor for weight management. Previous research has reported several variables to estimate RMR such as body size, percent fat (%BF), age, and sex; however, little is known regarding the effect of circumference measures in estimating RMR. PURPOSE: The purpose of this study was to develop a model to estimate RMR using waist circumference (WC), an easily obtainable measure, and cross-validate it to previously published models. METHODS: Subjects were 140 adult men and women, ages 18-65 years. RMR was measured through indirect calorimetry, %BF was measured through air displacement plethysmography, and fat mass and fat-free mass were determined from %BF and weight. Other variables collected were: weight, height, age, sex, ethnicity, body mass index, WC, hip circumference, waist-to-hip ratio, waist-to-height ratio, and %BF estimated from bioelectrical impedance analysis. Subjects were randomly divided into derivation and cross-validation samples. A multiple regression model was developed to determine the most accurate estimation of RMR in the derivation sample. The cross-validation sample was used to confirm the accuracy of the model and to compare the accuracy to published models. RESULTS: The best predictors for estimating RMR were body weight, r = 0.70, p < 0.001, age, r = 0.30, p = 0.012, and sex, r = 0.51, p = 0.018. Other factors failed to account for significant variation in the model. The derived equation for estimating RMR is: RMR (kcal/day) = 843.11 + 8.77(weight) - 4.23(age) + 228.54(sex, M = 1, F = 0), R2= 0.68, SEE = 173 kcal/day. Cross-validation statistics were: R2= 0.54, p < 0.001, SEE = 199 kcal/day, and total error = 196 kcal/day. In published models, R2 ranged from 0.47 to 0.57, SEE ranged from 192 to 213 kcal/day. CONCLUSIONS: Cross-validation to published models for estimating RMR were similar to those of the derived model; however, the total error in the derived equation was lower than any of the previously published models. Several published models considerably overestimated RMR compared to the current model. The results of this study suggest that RMR can be reasonably estimated with easily obtainable measures which allow for estimation and implementation of RMR for weight management in clinical practice.

G-35 Free Communication/Poster - Fitness Assessment  
Saturday, June 1, 2019, 7:30 AM - 11:00 AM  
Room: CC-Hall WA2  

3361 Board #49  
June 1 9:30 AM - 11:00 AM  
Health and Fitness Differences Between Urban and Rural Costa Rican Older Adults  
Luis Solano-Mora1, Mónica Salazar-Villanueva1, Luis A. Araya-Ortega1, Esmeralda da Valdivieso-Mora1, David K. Johnson2, Yamileth Chacón-Araya1, José Moncada-Jiménez2. 1National University, Heredia, Costa Rica. 2University of Costa Rica, San José, Costa Rica.  
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(No relevant relationships reported)  

Costa Rica has one of the highest life expectancies in America, even higher than the United States. Studies addressing health and fitness in Latin American urban and rural older adults are scarce. PURPOSE: The purpose of the study was to test the hypothesis that older adults from rural areas present fewer negative health conditions and higher fitness than older adults from urban zones. METHODS: 298 participants aged 60 to 85 (Urban n =188, Rural n = 110) completed a 29-item chronic diseases questionnaire and performed the Senior Fitness Test: a) 6-min walking test (6-MWT), b) 30-s Chair to Stand Test, c) 30-s Arm Curl Test, d) timed up- and go test (TUG), balance time, and handgrip strength (HGS). Categorical variables were analyzed with non-parametric Chi² and continuous variables with 2 x 2 ANOVA (residency zone x gender). RESULTS: Urban women reported more chest pain (χ² = 6.05, p = 0.014), more pacemakers (χ² = 4.70, p = 0.030), diabetes (χ² = 3.98, p = 0.046), and osteoarthritis (χ² = 5.08, p = 0.024) than rural women. Urban men reported more chronic low back pain (χ² = 5.65, p = 0.017) and depression (χ² = 3.90, p = 0.048) than rural men. A higher diastolic blood pressure was observed in urban compared to rural older adults (Urban = 76.2 ± 0.9 mmHg vs. Rural = 70.2 ± 1.3 mmHg; p < 0.001). Urban older adults showed better balance time than rural older adults (Urban = 76.2 ± 0.9 mmHg vs. Rural = 70.2 ± 1.3 mmHg; p = 0.001). A higher diastolic blood pressure was observed in urban compared to rural older adults (Urban = 76.2 ± 0.9 mmHg vs. Rural = 70.2 ± 1.3 mmHg; p < 0.001). Performance was similar between urban and rural older adults on the 6-MWT, 30-s Chair to-stand, 30-s Arm Curl, TUG, and SPARSG test (p > 0.05). CONCLUSION: In spite of having a higher negative health profile compared to rural older adults, balance was the only functional variable positively observed in urban older adults.

3362 Board #50  
June 1 9:30 AM - 11:00 AM  
A Comparison of Back Squat & Safety Squat Bar on Measures of Strength, Speed, and Power in NCAA Division I Baseball Players  
Richard Meldrum, Mark DeBeliso, FACSM. Southern Utah University, Cedar City, UT. (Sponsor: Mark DeBeliso, FACSM)  
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(No relevant relationships reported)  

Squat exercise variations are considered a cornerstone of resistance training (RT) programs. Understanding the effectiveness of differing squat exercise variations is important for coaches and athletes in order to optimize the effectiveness of a RT program. PURPOSE: The current investigation examined a comparison of the standard Olympic barbell loaded back squat (BS) with a squat performed with the safety squat bar (SSB). METHODS: Twenty eight Division I male baseball players (19.2±1.1 years, 182.5±5.6 cm, 87.6±5.1 kg) participated in a RT program comprised of two workout sessions a week for nine weeks, performing either a BS or SSB utilizing an autoregulatory progressive resistance periodization protocol, concurrent with their existing, season-specific, RT program. Pitchers (n=14) utilized the SSB with the goal of minimizing stress on the shoulder and elbow joints during the execution of the squat. The non-pitchers (n=14) performed the Olympic barbell BS. Lower body strength (estimated 1RM squat: kgs), sprint speed (54.86 m sprint: secs), and vertical jump (VJ: cms) were assessed prior to and following the RT training period. RESULTS: The VJ had a significant positive improvement from pre to post RT for both the BS (pre: 74.6±8.1, post: 76.5±8.0) and SSB (pre: 72.4±7.6, post: 75.3±8.3) groups (p<0.05). The estimated squat 1RMs had a significant positive improvement from pre to post RT for both the BS (pre: 136.2±11.0, post: 166.1±23.7) and SSB groups (pre: 112.3 ± 14.9, post: 152.6 ± 22.0) (p<0.05). The 54.86 m sprint did not improve significantly from pre to post RT for either the BS (pre: 7.12±0.33, post: 7.05±0.26) or SSB groups (pre: 7.27±0.17, post: 7.19±0.20) (p>0.05). When comparing gain scores between each group there were no significant difference between the BS and SSB groups for either 54.86 m sprint or VJ (p>0.05). However, the estimated squat 1RM gain score for the SSB was significantly greater than the BS group (p<0.05) noting that the effect size of change from pre to post RT was 2.69 and 2.71 standard deviations for the BS and SSB groups respectively. CONCLUSION: Given that both squat modalities yielded approximately equal improvements in VJ and lower body strength, coaches and athletes can consider the SSB variation of the squat as a viable option for developing lower body strength and power.

3363 Board #51  
June 1 9:30 AM - 11:00 AM  
Assessment of Bilateral Glenohumeral Posterior Capsule Tightness in Recreational Golfers  
Andrew Cannon, PT, SCS, MHS, CSCS, Jessica Wagner, Kevin Finn, FACSM, Merrimack College, North Andover, MA.  
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(No relevant relationships reported)  

Andrew Cannon; Jessica Wagner; Kevin Finn FACSM  
Merrimack College, North Andover, MA.  
Comparison of Glenohumeral Posterior Capsule Tightness between Golfers and Non-Golfers  
Abstract  
The primary movement of the golf swing is habitually unidirectional. Consistently the leading side, (left side of a right handed golfer) and the trail side, (right side of a right handed golfer) are asked to perform remarkably different tasks with an overall shoulder injury prevalence of between 8-16%. PURPOSE: The current study examined glenohumeral posterior capsule mobility of the leading shoulder compared to the trail shoulder in recreational golfers and non-golfers. METHODS: Participants were twenty-two recreational golfers (15 males, 7 females) mean age 38.8 years(SD=18.85) with at least two years of prior experience and thirteen non-golfers (7 males, 6 females) with a mean age of 33.1 years (SD=12.35). All participants had bilateral glenohumeral posterior capsule mobility measured as medial epicondylic distance from exam table in inches via side lying horizontal adduction of the non weight bearing upper extremity with scapula manually stabilized. RESULTS: Golfers exhibited a statistically significant (P<.001) asymmetry of glenohumeral posterior capsule mobility in their leading shoulder compared to the trail shoulder. The non-golfing participants demonstrated no statistically significant difference in right to left glenohumeral posterior capsule mobility exhibiting relatively equal measurements bilaterally. Conclusions. The sample of golfers demonstrated an asymmetry in glenohumeral posterior capsule mobility in leading to trail shoulders.
that was not seen in the non-golfing population. Clinical consideration should be given to this asymmetry in training and care of the golfing athlete especially as it relates to limitations in shoulder mobility and motion.

3364 Board #52 June 1 9:30 AM - 11:00 AM

**Adjusted Muscle Strength Evaluation Using Directional and Continuous Jump Motion Test by 3D Motion Analysis**

Tamotsu Kitabayashi1, Kosho Kasuga2. 1Tokyo University of Science, Tokyo, Japan. 2Gifu university, Gifu, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

(No relevant relationships reported)

**PURPOSE:** To study adjusted muscle strength evaluation methods using directional and continuous jump motion tests (vertical, forward, backward), this study compares basketball players with general students and examines differences between the groups and directional differences.

**METHODS:** Subjects were two groups; General Students (14 male students) and Basketball Students (10 male students). Vertical, forward and backward jumps were measured for maximum exertion (100%) and adjusted exertion (50%). The first vertical jump with full strength and then immediately after landing, adjusted exertion in each direction (50% exertion) (vertical, forward, backward) were measured using 3D motion analysis (Kinect2 (Microsoft)). Difference in average value in single jump measurement (50%) and continuous measurement (50%) using absolute values (cm) was verified and two factor ANOVA was conducted for differences between the groups (basketball vs. general) using relative values (%) and for differences among each direction (vertical, forward, backward). For the multiple comparison test, the Bonferroni method was used. The level of significance was set at 5%.

**RESULTS:** In single jump and continuous measurements, the general student group showed close to 50% exertion in the order of forward, vertical, and backward jumps. The basketball group showed 50% exertion in the order of forward, backward, and vertical jumps. The order of superiority tended to be different between the two groups. Additionally, compared to the single jump measurement, continuous measurement showed that both the general student and basketball groups demonstrated close to 50% exertion and particularly in the continuous measurement, differences between the two groups tended to become more noticeable in the backward jump.

**CONCLUSIONS:** For two groups, there are different directions in which adjusted exertion are likely to occur. By continuous jump measurement with initial movement maximum exertion, it is possible to evaluate accurate adjustment abilities and competitive qualities.

3365 Board #53 June 1 9:30 AM - 11:00 AM

**Comparison Of RPE Rating Scales For Session RPE**

Blaine E. Arney, Reese Glover, Andrea Fusco, Cristina Cortis, Jos J. de Koning, FACSM, Teun van Erp, Salvador Jaime, Richard P. Mikat, FACSM, John P. Porcari, FACSM, Carl Foster, FACSM, University of Wisconsin-La Crosse, La Crosse, WI.

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(No relevant relationships reported)

**Purpose:** The Session RPE (sRPE) is an accepted method of monitoring training in athletes in many different sports. It is based on the Category-Ratio (0-10) RPE scale (BORG-CR10) developed by Borg. There is no evidence how substitution of the Borg 6-20 RPE scale (BORG-RPE) might influence the sRPE. Methods: Systematically training, recreational level athletes from different sport disciplines performed six, randomly ordered, 30-minute interval training sessions, at intensities based on peak power output (PPO), designed to be easy (50%PPO), moderate (75%PPO) or hard (85%PPO). sRPE was obtained 30 min post-exercise using the BORG-CR10 or BORG-RPE and compared for matched conditions. Results: The average percent of heart rate reserve (%HRR) was well-correlated with sRPE from both BORG-CR10 (r = 0.76) and BORG-RPE (r = 0.69). The sRPE from BORG-CR10 and BORG-RPE were very strongly correlated (r = 0.90) at matched times. Conclusions: Although producing different absolute numbers, sRPE derived from either BORG-CR10 or BORG-RPE provide substitutable estimates of perceived exercise training intensity.
Rock climbing has been increasing in popularity both recreationally and competitively. Indoor sport rock climbing is a type of climbing where the climber ascends a wall using artificial rocks (hand and foot holds) and is attached to a safety rope. Despite this increase in popularity of the sport, the physiological responses to sport climbing as an exercise to specific muscle groups are not well defined in literature. PURPOSE: The purpose of this study was to quantify the change in handgrip strength over a 30-minute bout of continuous climbing, specifically in intermediate sport climbers. An additional aim of this study was to compare any change in forearm girth over a 30-minute bout of climbing and compare it to the change in strength and to identify if there is a relationship between the two.

METHODS: Ten intermediate rock climbers [Age: 26.7±6.7 years; Height: 174.5±6.12 cm; Mass: 68.1±8.21 kg; Body Fat %: 15.75±.63 %; Years Climbing: 7.3±4.9 years;] consented to participate and completed baseline handgrip strength (via handgrip dynamometer) and forearm girth (via tape measure). A climbing questionnaire indicated each participant’s rock climbing ability and to define them as intermediate climbers. Each participant ascended one of two 5.9 YDS (Yosemite Decimal System) routes as many times as possible within 30 minutes. After each ascent, heart rate, handgrip strength and forearm girth was measured. Data were analyzed using repeated measures ANOVA and correlation with significance accepted at P <0.05 level. Results: Dominant handgrip strength decreased by 22% (p=0.002) compared to pre-climb. Dominant and non-dominant forearm girth increased by 4.4% (p=0.001) and non-dominant handgrip strength decreased by 23% (p=0.009) and non-dominant handgrip strength decreased by 22% (p=0.009) compared to pre-climb. Dominant and non-dominant forearm girth increased by 4.4% (p=0.001, p=0.009) and non-dominant handgrip strength decreased by 23% (p=0.002) compared to pre-climb. These results contribute to the existing literature and increase understanding of the physiological demands of indoor sport rock climbing.

PurpOse: To compare biomechanical factors between court shoes for indoor sports performance. METHODS: The Mizuno Wave Lightning Z (MLZ), ASICS Blast 5 (AB5), and ASICS Blast 6 (AB6) court shoes were compared. 12 male Singapore handball players (age: 23.7±5.8 years; height: 1.78±0.056 m; weight: 69.6±9.5 kg; shoe size 10.1±1.0) participated in the randomized, counter-balanced study. Participants performed the vertical jump and Illinois Agility Run Test during each session, for four test sessions. Rate of perceived exertion (RPE), comfort, and fit variables were measured before and after each physical test. RESULTS: No significant differences were found in maximum jump height (MLZ: 46.083±0.059 cm; AB5: 46.333 ± 0.277 cm, AB6: 45.083 ± 0.377 cm, MWL: 46.083 ± 3.965 cm; p = 0.341), maximum jump force (MLZ: 1.304 ± 0.116 N, AB5: 1.283 ± 0.074 N, MWL: 1.300 ± 0.068 N, AB6: 1.304 ± 0.066 N; p = 0.831), and maximum landing jump force (MLZ: 3.212 ± 1.312 N, AB5: 3.155 ± 2.836 N, MWL: 3.296 ± 0.979 N, AB6: 3.164 ± 1.628 N; p = 0.730) during the vertical jump. Significant differences were found between all shoes in the total time taken during the agility run (p = 0.020). AB6 resulted in better total time (MLZ: 11.867 ± 0.058 s; MWL: 11.859 ± 0.057 s; AB5: 11.850 ± 0.059 s; p = 0.020) and most consistent fit variables (Shoe length: 4.08 ± 0.5, Forefoot width: 3.75 ± 0.75, Heel region: 4.08 ± 0.5, Forefoot width: 3.75 ± 0.75, Collar: 4.08 ± 0.69; p = 0.341). CONCLUSION: Participants performed fastest during the agility run when wearing ASICS Blade 5, although participants found that the ASICS Blast 6 was more comfortable and had the most consistent fit. Future research should focus on improving both shoes to enhance comfort and at the same time improve capacity in sports performance.

Military personnel must assume demanding physical activities during both tactical and physical training in military installations or theaters of operations. In military operations, high levels of aerobic capacity and muscular strength are required, that is why adequate fitness (aerobic endurance, muscular endurance, strength, flexibility, body composition) is an important factor in the performance and survival. PURPOSE: To determine the fitness of the military personnel in training of the different schools of the Colombian Army. METHODOLOGY: Cross-sectional study with an analytical component, where morphological and physiological variables were measured in 120 senior Military students in the three military training schools (ESMIC-Officers, EMSUB-NCOs and ESPRO-soldiers). The body composition was evaluated by electrical bioimpedance after checking the pre-test protocol conditions. The explosive strength of the upper and lower limbs was assessed in a jump platform, with the Push-Up and Squat Jump tests without load. The flexibility was assessed by the “Sit and Reach” test, the maximum consumption of VO2 with the “Leger” test and the prehensile force was evaluated by dynamometry. The comparisons were made using one-way analysis of variances (ANOVA) and post hoc tests. RESULTS: The comparison between the fitness of the students of the schools, showed differences in the consumption of VO2 (49.8 vs 48.3 vs 53.5 ml / min / kg, p = 0.001), flexibility (4.5 vs 3.2 vs 10 cm, p = 0.001), prehensile strength (44.4 vs 37.1 vs 48.3 kilograms, p = 0.001), flight time in the Squat Jump test (48.1 vs 451 vs 482.4 milliseconds, p = 0.001), flight time in the Push Up test (404.6 vs 316.7 vs 375.5 milliseconds, p = 0.001), body mass index (23.5 vs 22.7 vs 22.4 weight / height2, p = 0.027) and an absolute value of fat-free mass (56.4 vs 52 vs 56 kg, p = 0.009). CONCLUSIONS: Although the training plan of the Colombian Army is standardized, it was found that there are differences in the fitness of personnel in military training, which could be due to the differences in intensity, volume, duration, density and frequency of training. Supported by internal Grant 001-2017 / Technological Support Command, Ejército de Colombia.

Aging is a multi-factorial process. The relative contributions of decreases in maximal heart rate, stroke volume, and oxygen extraction rates as well as changes in body weight and composition to the age-related decline in maximal oxygen uptake (VO2max) are unclear. PURPOSE: The purpose of this study is to compare the differences in body size and cardiorespiratory fitness among young and senior elite endurance athletes. METHODS: This study measured anthropometric and physiological data on 29 elite endurance athletes (mountain and road bikers, cross-country runners) made up of 12 young athletes (YA), ages 24±5.9 yrs. and 17 senior athletes (SA) ages 52±3.6 yrs. The Research Ethics Committee of ELTE University approved the study. Laboratory measurement of metabolic parameters was performed using a 2-min progressive treadmill protocol of 8 km/h-at 1% grade, 8 km/h-at 6%, grade 9 km/h-at 6% grade, 10 km/h-at 8% grade, 10 km/h-at 10% grade, 11 km/h-at 12 % grade with additional 3% increase in grade per 2-min stage until volitional exhaustion. Anaerobic threshold (AT) was determined using ventilatory equivalents from the Vnxs 6729 machine (Vorita Linds, CA, USA) software.

RESULTS: No significant differences were found between the groups’ mean height (YA 178.7 ± 7.3 vs SA 174.5 ± 6.2 cm) and body mass (YA 72.8 ± 7.5 vs SA 75.8 ± 7.7 kg). Young athletes (YA) spent nearly twice as much time on the treadmill (YATST: 895 ± 114 sec.) as their senior counterparts (SATST: 529 ± 170 sec.) and their mean VO2max was significantly higher (17.60 ± 7.55 vs 40.46 ± 8.59 ml kg-1 x min-1). However, only 11% of the YA total power was spent under anaerobic conditions, as compared to 43% for the SA group. The ratio of time spent in the aerobic zone during complete load calculated from the values of ventilation (VE), breathing
rate (BF) and absolute aerobic capacity (VO2max) at the AT and peak load (PE) was 80% for senior athletes (SA) and reached a value of 90% (p < 0.05) in the young athletes (YA). The difference between the performances of the two groups is not surprising. However, remarkable is the asymmetry of the metabolic performance of the senior athletes (SA), which may carry other pathological hazards. It is therefore important to pay great attention to the physiological characteristics of the age related performance sport.

3372 Board #60 June 1 9:30 AM - 11:00 AM A Longitudinal Study of Muscular Fitness in Korean Firefighters
Hyunjoo Kang1, Kyounghmin Noh1, Woek Song2, Chungkun Lee2, Seoyung Park2, Jungjun Park1, Hanjung Long1, Dongil Seo1, Yeonsoon Ahn3, Soochunhyang University, Asan, Korea, Republic of. 2Seoul National University, Seoul, Korea, Republic of. 3Pusan National University, Pusan, Korea, Republic of. PURPOSE: To investigate the changes in the muscular fitness of firefighters. METHODS: Muscle fitness test data was received from the National Fire Service Academy and represented firefighters working in Seoul from 2011 to 2016. We analyzed the muscular fitness from a total of 30,933 people over a 6-year period. The data was made using ANOVA and multiple regression analysis.

RESULTS: Grip strength shows statistically significant differences between genders (Fmale = 256.808, Female = 160.856, both p < 0.01) every year. Records show that grip strength decreased as age increased (B = -1.345); records also show that grip strength improved in later years (B = .717). The results show that males’ grip strength was higher than that of females (B = 22.295). Back strength increased each year showing statistically significant improvement for each gender (Fmale = 1061.565, Female = 23.336, both p < .001). Records show that back strength decreased as age increased (B = -0.345); records also show that back strength improved each year to year (B = 6.114) As the years went on, male firefighters saw a bigger improvement than female firefighters (B = 80.276). Sit-up records each year show statistically significant differences between genders (Fmale = 515.381, Female = 23.336, both p < .001). Sit-up results decreased as firefighters aged (B = -3.95); sit-ups increased each year (B = 1.522). Results among males were higher than among females (B = 10.948).

CONCLUSIONS: This study provided basic data on firefighter muscular fitness tests and practical information that can be used to training programs. The characteristics of firefighters’ tasks show that female firefighters need to perform their duties under the same conditions as male firefighters. However, results show that female firefighters are not testing as well in those three categories. Female firefighters should be required to carry out some tasks in emergency situations. Supported by the Field-oriented Support System for Fire Fighting Technology Research and Development Program funded by NFA (MPSS Safety-2017-87)

3373 Board #61 June 1 9:30 AM - 11:00 AM Convergent Validity and Relative Reliability of Hexoskin during a Maximal Field Test
Mounem Haddad, Feryel Dalansi, Mariam Kharbach, Azam Mohamed, Zhien Aganovic. Qatar University, Doha, Qatar. Email: mhaddad@qu.edu.qa

(Purpose relationships reported)

PURPOSE: The aim of the study was to determine the convergent validity and relative reliability of a wearable metric Hexoskin “the smart suit” during a maximal field test in measuring Heart Rate (HR) variables: resting HR and peak HR. METHODS: Variables were recorded simultaneously by the Hexoskin and Polar Team Pro 3. Fourteen professional male Handball players (age 21.8 ± 2.4 years) participated in the study voluntarily completed two trials of 400 m shuttle run test (10 s) separated by a minimum of 72 h. RESULTS: Nearly perfect (r = 0.93) and trivial (r = 0.090) correlations have been shown in the resting HR and peak HR, respectively, between Hexoskin and Polar Team Pro 3 results. Good (ICC = 0.715) and low (ICC = 0.081) intraclass correlation coefficient measured by Hexoskin. CONCLUSIONS: The findings indicate that Hexoskin has high validity and relatively good reliability in measuring resting heart rate and it can be used in slow activities/ motions. However, it seems that quick movements affect the cardiac sensor and leads to an abnormal recording using Hexoskin.

3374 Board #62 June 1 9:30 AM - 11:00 AM Cardiovascular Fitness In Recreational Athletes Prior To And After Anterior Cruciate Ligament Reconstruction
Dean M. Cordingley1, Sheila McRae1, Jeff Leiter1, Greg Stranges2, Peter MacDonald3. 1Pan Am Clinic Foundation, Winnipeg, MB, Canada. 2Pan Am Clinic, Winnipeg, MB, Canada.

(No relevant relationships reported)

Emphasis of most rehabilitation programs following anterior cruciate ligament reconstruction surgery (ACLR) is on range of motion and strength, with little, if any, focus on the recovery of cardiovascular fitness. PURPOSE: To evaluate cardiovascular fitness of recreational athletes from injury to 12-months post ACLR. METHODS: This was a prospective case series. Patients were recruited from a sports medicine clinic with an ACL rupture confirmed on MRI. Participants must have been involved in aerobic sport at least twice a week based on self-report. Study time points were baseline (as soon after injury as possible); T1, 6 (T2) and 12-months (T3) post-ACLR. The primary outcome measure was relative VO2peak as measured during a graded aerobic exercise test (GXT) on a bike ergometer (Monark, Ergomedic 944E) using a metabolic measurement system (Oxycon Mobile, Carefusion). Secondary outcomes were absolute VO2peak, Tegner activity score, and ACL-Quality of Life. Repeated measures ANOVA was performed to compare within groups between time points. RESULTS: Nineteen patients (13 male /6 female) consented at mean age of 29.2 ± 4.8 years. Baseline testing and surgery were performed 78 ± 48 and 152 ± 81 days post injury, respectively. Preoperative relative VO2peak was 37.7 ± 6.3 mL·kg⁻1·min⁻¹ at T2 was 32.7 ± 8.9 mL·kg⁻1·min⁻¹ and at T3 was 32.7 ± 9.3 mL·kg⁻1·min⁻¹ (p > 0.05). Based on ACSM cardiorespiratory fitness classifications by age and gender, there was no change in distribution from T1 to T3 (p = 0.88). Tegner scores decreased from pre-injury to T1 (7.6 ± 1.9; p = 0.001), and improved by T3 (7.1 ± 2.1; p = 0.003), but did not recover to pre-injury levels (p = 0.001). ACL-QOL increased from T1 (32.9 ± 15.5) to T2 (53.5 ± 13.4; p = 0.001) and to T3 (70.3 ± 18.7; p = 0.008). Relative VO2peak and Tegner score were not correlated at T1 but were at T3 (r = 0.755; p = 0.001). Conclusion: Recreational athletes were aerobically deconditioned at two months post-ACL rupture and did not improve with 12-months of rehabilitation following ACLR. Pre-injury aerobic fitness level could not be determined, but participants may have become deconditioned waiting for surgery. Without a conscious effort to promote aerobic fitness, recreational athletes may return to play at a suboptimal performance level with increased risk of injury.

3375 Board #63 June 1 9:30 AM - 11:00 AM Effects of a Psyching Up Technique on Maximum Deadlift Ability: A Pilot Study
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(No relevant relationships reported)

PURPOSE: Psyching-up techniques for maximal lifting efforts are common practice among recreational and professional athletes. The use of psyching-up techniques have shown positive effects on bench press and handgrip performance, and on more complex actions such as the standing broad jump and sprinting. This has not been examined on the deadlift. The purpose of this study was to investigate the influence of a self-selected psyching up technique on maximum performance deadlift. METHODS: Five resistance trained men (mean +/- SD: 22.60 +/- 1.67 year, 98.76 +/- 6.94 kg, 4.7 +/- 1.64 years training experience, 2.15 +/- 0.42 deadlift strength to weight ratio) consented to participate in the study. The men had a self-reported one repetition maximum deadlift of at least one and a half times their body weight and had training experience using power lifts (power clean, deadlift, squats, or other main power lifts). Subjects were familiarized with the deadlift test protocol and observed for proper form. A cross-over study design was used in which each participant was randomly assigned to either a distraction technique or a self-selected psyching up technique prior to a maximum deadlift effort. The two trials were separated by a minimum of 72 hours. The distraction technique involved the participant having to count backwards from 100 for 100 seconds prior to executing a maximal deadlift effort. The psyching up technique involved the participant using the self-selected psyching-up technique that they routinely used during their training for 100 seconds prior to exerting a maximal deadlift effort. A dependent t-test was used to analyze the psyching up technique on maximal weight deadlifted.

RESULTS: There was no significant difference (t (4) = -5.12, p > 0.05) between the self-selected psych-up technique (204.93 +/- 48.72 kg) and the distraction technique (205.75 +/- 48.92 kg) on maximal deadlift performance.
CONCLUSION: Within the limitations of this study, a self-selected psyching up technique provided no significant advantage on maximal weight lifted in the deadlift exercise compared to a distraction technique in experienced male lifters. Further investigation is recommended using a larger sample size.

METHODS: Twenty-nine National Collegiate Athletic Association Division I women athletes (basketball: WBB; n=11; lacrosse (WLAX): n=18) completed a continuous GXT to volitional fatigue. Speed increased following each 1-minute stage with a 1% constant grade. VO\textsubscript{2peak} indicated the highest VO\textsubscript{2} value reached during a single domain” (6.82±1.55 vs 0.95±0.34, p<0.001) of MDP, global POMS score (11.73±3.58 “breathing discomfort” (2.50±0.18 vs 1.86±0.11, p=0.02) and “emotional response to attain VO\textsubscript{2max} were: VO\textsubscript{2} plateau of <0.15 L/min with an increase in the last two workloads; maximum heart rate (HR\textsubscript{max}) within 10 bpm of age-predicted heart rate max; respiratory exchange ratio (RER)>1:10; rating of perceived exertion (RPE, 1-10 scale); 8; blood lactate (LAC) collected 5-min post-test ≥8mmol/L. The attainment ≥3 of 5 criteria was required for VO\textsubscript{2max}. Independent t-tests were used for comparison from each team who met each individual criterion. Significant differences between 1% constant grade. VO\textsubscript{2peak} indicated the highest VO\textsubscript{2} value reached during a single submaximal exercise with APC showed a higher increase than NC in the subscales (1.68±0.15 vs 1.32±0.12 RPE, p<0.01 and 138±2 vs 119±1 bpm, p<0.001). In addition, the optimistic affective mind-set. Aerobic exercise such as moderate-intensity interval training (MIT) and moderate continuous training (MCT) activates the frontal areas of the left hemisphere, which gives euphoric feelings. However, whether interval training is appropriate for stimulating an optimistic affective mind-set is unknown. We hypothesized that interval, rather than continuous, training activates the left anterior brain region is linked with activation of the left brain. Previous reports proved that activation of the left anterior brain region is linked with Previous studies have shown that emotions including anxiety and stress influence the perceived unpleasantness of dyspnea. PURPOSE: The aim of this study was to investigate the effects of relaxing and anxiety-provoking situations on exercise-related dyspnea, heart and respiratory rates, blood pressure, mood state, anxiety and depression in healthy subjects. METHODS: Twenty-two healthy adults were included in this randomized cross-over study. Each participant performed three submaximal cycling exercise for 30 minutes on three separate days in a randomized order: a neutral condition (NC) with no particular effect, a relaxing condition (RC) where each subject was observed to relax and an exercise condition (EC) where a horror movie was broadcast. Heart and respiratory rates, blood pressure, dyspnea using the Multidimensional Dyspnea Profile (MDP) and modified Borg scales, mood state using the Profile of Mood States (POMS), anxiety and depression using the Hospital Anxiety and Depression scale (HADS) were evaluated before and 5 minutes after each intervention. In addition, heart and dyspnea rates were measured throughout the intervention. RESULT: Dyspnea and heart rates increased more with APC than NC (1.68±0.15 vs 1.32±0.12, p<0.01 and 119±1 bpm, p<0.001). In addition, submaximal exercise with APC showed a higher increase than NC in the subscales “breathing discomfort” (2.50±0.18 vs 1.86±0.11, p=0.02) and “emotional response domain” (6.82±1.55 vs 0.95±0.34, p<0.001) of MDP, global POMS score (11.73±3.58 vs -4.64±2.3, p<0.001) and HADS-Anxiety subscale (8.59±1.27 vs 3.27±0.61, p<0.001) and the dyspnea rates (0.64±0.12 vs 0.14±0.07 RPE, p<0.001). No significant differences were observed between NC and RC. CONCLUSION: Exercise-related dyspnea and anxiety increased with APC in healthy subjects. In contrast, results did not show difference in any parameters with RC. Many activities and daily life situations can lead the patient with a chronic disease to experience dyspnea. Future studies should investigate strategies to reduce dyspnea in chronic diseases and in fine, improve quality of life of these patients.
By performing muscular testing, such as an isokinetic fatigue test, it is possible to assess anaerobic capacity and measure how strong a limb is. This might also identify weak points and which movements might be related to compensation. However, test-retest reliability is key to obtaining consistent results of muscular function. **PURPOSE:** To establish isokinetic fatigue test-retest reliability when testing without familiarization. **METHODS:** 22 masters (53±5 years), competitive female cyclists completed 2 separate 5-min isokinetic extension tests (T1 and T2) on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. **RESULTS:** Test-retest reliability (intra-class correlation coefficients; ICC), were calculated between T1&T2 scores for fatigue index (T1 38.9±9.5%, T2 43.7±6.9%), time to peak torque (T1 280.5±59.5 hrs; T2 284.1±69hrs) average power (T1 99.0±19.4W; T2 100.5±20.8W), and average peak torque (T1 36.6±6.3N·m; T2 37.5±7.1N·m). ICCs between trials exhibited excellent reliability (.93-.97) for all variables except time to peak torque (ICC=.35) and fatigue index (ICC=.65). **CONCLUSION:** There was strong test-retest reliability for strength and power measurements in masters female cyclists during an isokinetic knee extension fatigue test. However, the test was unreliable for its purpose in determining rate of fatigue. Practitioners should seek other forms of knee extension fatigue measurement.

The 10.5% of the total Mexican population is 60 years and older, and it is expected that by the year 2050, the older adult population reaches 28.7 million inhabitants. The “fragility phenotype in the older adult”, characterized by sarcopenia or loss of skeletal muscle mass and dynapenia or loss of muscle strength, affect functional capacity by impairing neuromuscular functions. **PURPOSE:** To determine the association between handgrip muscle strength and anthropometric variables associated with muscle mass in a sample of female Mexican older adults. **METHODS:** Volunteers were 40 healthy women (Age = 61.15 ± 6.1 yr.; Body Mass Index [BMI] = 27.9 ± 4.2 kg/m²) residing in Ensenada, Baja California, Mexico. A hand dynamometer (BioRadio, Great Lakes NeuroTechnologies, Cleveland, OH), was used to measure handgrip strength on the dominant hand. The maximal circumference of the dominant forearm was measured following the protocol by the International Society for the Advancement of Kinesitherapy. Bioelectrical impedance analysis (InBody 770; Cerritos, CA) was used to measure body composition. Appendicular skeletal muscle (ASM) relative to BMI and skeletal muscle index (SMI) relative to height (m²) were analyzed as anthropometric sarcopenic indicators. **RESULTS:** The older adult’s mean handgrip strength and forearm circumference were 17.0 ± 3.3 kg and 25.5 ± 2 cm, respectively. The ASM relative to BMI was 0.6 ± 0.1 and the SMI relative to height was 6.7 ± 0.8. Handgrip strength was related to arm circumference (r = 0.56, p < 0.0001, 95% CI = 0.31, 0.75, r² = 0.32), and SMI relative to height (r = 0.37, p < 0.01, 95% CI = 0.08, 0.62, r² = 0.14). The ASM relative to height was unrelated to handgrip strength (r = 0.12, p = 0.45, 95% CI = -0.20, -0.42, r² = 0.01). **CONCLUSIONS:** Reduced handgrip strength and SMI were observed in the female participants compared to international norms. Forearm circumference and SMI relative to height might be considered appropriate assessment measures to explore sarcopenic condition in female Mexican older adults.

Anterior cruciate ligament reconstruction (ACLR) requires 6 to 9 months of rehabilitation, often resulting in long periods of sedentary behavior. Following rehabilitation, only 45% of patients fully return to pre-injury level of sport participation, placing them at elevated risk of developing a physically inactive lifestyle. It is unknown whether ACLR negatively impacts aerobic fitness and body composition in the months following surgery. **PURPOSE:** To compare body composition and aerobic fitness between women with ACLR and healthy controls. **METHODS:** Nine women with ACLR (<5 yrs post-ACLR, age=21.2±3.9 yrs) and seven healthy women (age=22.4±3.7 yrs) with no injury history completed the Tegner Activity Scale to assess current physical activity level. Body fat percentage (%BF) was estimated using air displacement plethysmography. A graded exercise test using a cycle ergometer was performed by all participants to evaluate aerobic fitness (VO₂peak), defined as the highest 20 sec VO₂ attained during the test. Maximal heart rate (HRmax) and time to exhaustion (mins) were measured. Variables were compared between groups using Mann-Whitney U tests due to limited sample size. **RESULTS:** Individuals with a history of ACLR had significantly higher %BF than controls (ACLR=33.5±6.7%, healthy=24.4±5.2%) (p<0.008) and significantly lower relative VO₂peak (ACLR=32.1±5.0 ml/kg/min, healthy=48.6±4.9 ml/kg/min) (p<0.008). No differences were observed in absolute VO₂peak (ACLR=2.4±0.3 L/min, healthy=2.5±0.3 L/min) (p=0.61) or time to exhaustion (ACLR=13.0±1.8 mins, healthy=14.2±2.3 mins) (p=0.25) on the cycle. **CONCLUSION:** Women with a history of ACLR may have greater %BF than women who have not experienced a significant lower extremity injury. No significant difference was found in aerobic fitness between the groups as absolute VO₂peak is typically evaluated in cycle protocols. Although individuals with ACLR displayed lower relative VO₂peak, this was most likely due to differences in body weight between groups rather than fitness. Excessive %BF and low aerobic fitness are risk factors for chronic disease and premature mortality; therefore, it is concerning that these young women returning to activity post-ACLR have poorer body composition profiles than healthy women in this pilot study.
Traditionally, evaluation and training of respiratory muscle strength (RMS) have been planned and performed independently of gender. RMSI, measured as maximal inspiratory and expiratory pressures (MIP and MEP, respectively), has been related to musculoskeletal characteristics, such as muscle mass and strength, which might be aspects that influence RMSI development. These musculoskeletal features usually differ among genders, and therefore, it seems plausible that their relationships with RMSI would be different as well, for women and men. This might be an important issue, as assessment and training of RMSI might be planned in accordance of the patient’s gender.

PURPOSE: to determine the correlations between RMSI and musculoskeletal characteristics, for women and men.

METHODS: After obtaining informed consent from each participant, 71 young adults (41 men, 30 women, age 21.6±3.5 and 21.7±1.4 years, respectively) with normal BMI, were assessed in RMSI with MIP and MEP, general muscle strength (GMS) with a back, chest, and leg dynamometer, and chest, arm, thigh and leg corrected perimeters (CP), according to the ISAK protocol. Normal distribution of data was confirmed with D’Agostino and Pearson test and Pearson’s r coefficient was used to determine correlations between RMSI and GMSI and anthropometric variables. A p value <0.05 was considered of statistical significance.

RESULTS: In women, the only correlation found was a direct and moderate correlation between PEM and GMSI (r=0.46; p<0.01). For men, PIM had direct and moderate correlations with GMSI (r=0.53; p<0.01), arm CP (r=0.44; p<0.01), thigh CP (r=0.40; p<0.01) and chest CP (r=0.47; p<0.01), and a direct and weak correlation with leg CP (r=0.36; p<0.05); PIM had a direct and moderate correlation with GMSI (r=0.40; p<0.01).

CONCLUSIONS: According to these findings, gender would be an important aspect to be considered when planning RMSI assessment and training, as musculoskeletal mass and strength in women and men would be related to RMSI in a different manner, and therefore, having different implications in RMSI development.

First-year college is a critical transition period when young adults begin to make lifestyle choices influencing long-term behaviors and health. Cardiorespiratory fitness (CRF) and body fat (BF) are two health-related fitness (HRF) components known to increase disease risk and premature mortality. These components are also known to negatively change during 1st year in college; however, little is known about changes in all health-related fitness components through college years. PURPOSE: to evaluate and compare HRF between 1st year and 4th-6th year college students in Puerto Rico.

METHODS: College students taking elective courses at the Physical Education Department of the University of Puerto Rico, were divided in two groups based on academic year: 1st year (28 females, 48 males; 18.5±1.1 years of age) and 4th-6th year (184 females, 114 males; 21.8±1.0 years of age). HRF was assessed using the Fitnessgram® protocol including measures of height, weight, skinfolds (triceps, calf, and abdomen), push-ups, curl-ups, trunk lift, back sizer sit and reach, shoulder stretch, and PACER. Non-parametric Wilcoxon-Rank tests were used to detect differences between groups and between sex, and Chi-square analysis to detect differences by healthy fitness zone (HFZ) classification. RESULTS: Compared with 1st year, 4th-6th year students had higher BF (19.6±6.6 vs. 23.5±6.8, P<0.001), and lower number of curl-ups (45.3±22.8 vs. 32.4±20.9, P<0.001), push-ups (21.8±11.8 vs. 15.8±12.3, P<0.001), and VO2max estimated from PACER (42±8.6 vs. 32.3±7.5 mL·kg⁻¹·min⁻¹, P<0.001). No group differences were observed for BMI, trunk lift, and flexibility. A higher proportion of 1st year students classified in the HFZ compared to 4th-6th year in curl-ups (90 vs. 71%, P=0.002) and PACER (49 vs. 16%, P<0.001). A higher proportion of males classified in the HFZ compared with females in push-ups (79 vs. 64%, P<0.003), sit and reach (91 vs. 71%, P<0.001), and PACER (40 vs. 10%, P<0.001); while more females classified in the HFZ in shoulder stretch (84 vs. 65%, P<0.001) and BMI (69 vs. 57%, P=0.03). CONCLUSION: Important declines in HRF
Ischemic preconditioning improves the physical fitness of athletes of different sports modalities. However, until now, there is no evidence of the effect of ischemic preconditioning (IPC) on the performance of judo athletes. 

**PURPOSE:** To examine the effect of ischemic preconditioning (IPC) on the performance of judo athletes. 

**METHODS:** We sought to examine maximal exercise responses during short-term anaerobic tests (10SPV and GXT) of judo athletes. 

**RESULTS:** The IPC improved the physical fitness of judo athletes. 

**CONCLUSION:** IPC improves the physical fitness of judo athletes.

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**CONCLUSION:** IPC improves the physical fitness of judo athletes.
Pickleball is the fastest growing racquet sport in the United States and is particularly popular among older adults. Because the typical frequency, intensity, and duration of play is undefined, the extent to which Pickleball participation can contribute to meeting physical activity guidelines is unknown. PURPOSE: To estimate the typical frequency, intensity, and duration of physical activity during recreational pickleball play.

METHODS: A convenience sample of 25 players (59.0 ± 15.8 yrs) wore an Actigraph GT3X+ on their waist and rated their perceived exertion (RPE) for 2 to 5 games of recreational doubles play. Data were collected in 5 sec epochs and the Sasaki (2011) cutpoints were used to calculate the percent of game play spent in light, moderate and vigorous intensity activity. Players also reported their typical pickleball participation frequency, duration, and subjective exertion level during the past 3 months via an online survey. RESULTS: Players reported playing pickleball 96-240 minutes per session for 2-6 days per week (53.7 ± 38.1 min/week). On average, 63.5% ± 14.3% of game play was at moderate or higher intensities (47 ± 10.3% at moderate) based on Actigraphy estimates. This was in general agreement with self-reported intensity levels (11.8 ± 1.3 on RPE scale). Assuming only 50% of reported weekly pickleball participation is spent in actual game play, it is estimated that players typically engage in an average of 162.5 ± 140.8 min/week (range: 53.8-526.2 min/week) moderate and vigorous intensity activity during play. CONCLUSIONS: For most recreational pickleball players, over half of the duration of doubles play is spent at a moderate or higher intensity. This suggests that participation in recreational pickleball may be a viable strategy for increasing health enhancing physical activity in adults. However, the physical activity characteristics of pickleball play should be examined using alternative measures of intensity and in larger, more diverse, samples of players.

ESTIMATING ENERGY EXPENDITURE DURING PICKLEBALL PLAY

PURPOSE: To determine the accuracy of user indicated activity HR chest strap monitors for estimating EE during recreational pickleball play.

METHODS: Fourteen males (n=14) ages 20-36 yrs completed two circuit weight training protocols with integrated high-intensity interval training. Both trials were equated for total volume-load and lasted exactly 43.25 min. Following the exercise portion, each participant completed a 20-min excess post-exercise oxygen consumption measurement. Prior to each exercise protocol the HR monitor watch was set using individual subject anthropometric and data. Heart rate was continuously monitored during the trials by watch device and portable metabolic analyzer. Comparisons of EE (kcal) were performed between estimations by HR monitor and via indirect calorimetry. Device comparisons for EE were made using paired t-tests, Pearson correlation and Bland-Altman analysis (SPSS v22; p<.05). RESULTS: Estimated EE was significantly higher with the user indicated activity HR monitor chest strap compared to indirect calorimetry (596.9 ± 1212 kcal vs. 484.2 ± 449.9 kcal, p<.001). Correlational analysis determined there was a significant moderate-strong positive relationship between HR monitor and indirect calorimetry (r=.56, p=.002) Average HR during the protocol was 149.7 ± 14.3 bpm and percent-maximum HR was 78.5 ± 5.9%. CONCLUSION: Despite accounting for activity type in the EE estimation software, HR derived estimations of EE appear to be far higher than those estimated by indirect calorimetry during high-intensity activity. Specifically, this is true for vigorous intensity exercise as indicated by %HRmax.
Physiological Responses of Arena Polo Players during Simulated Game Play

Abby Pritchard, Samuel Barthel, David Ferguson. Michigan State University, East Lansing, MI.

(No relevant relationships reported)

Arena polo is surging in popularity as compared to outdoor polo due to the reduced space and horse requirement. Limited information exists on the physiological demands of polo with no information for arena players. PURPOSE: To document the oxygen consumption (VO₂), ventilation (VE), and respiratory exchange ratio (RER) in conjunction with heart rate (HR) involved in arena polo to better inform players of the physical requirements of participation. METHODS: VO₂, VE, RER, and HR were measured in triplicate with random assignment of horses using a portable telemetric oxygen analyzer coupled with a heart rate monitor on a convenient sample of five female arena polo players (Age: 27 ± 6 yr; Weight: 73 ± 13 kg; Height: 177 ± 3 cm). Data were recorded on each player during designated riding sessions which included a prescribed and free choice warmup, mock gameplay (chukker), and five-minute recovery. Descriptive statistics for each variable (Mean ± SD) were calculated for each time period. A one-way ANOVA was performed to determine differences between time periods within a session, and a linear regression was used to determine if horses affected the physiological responses. RESULTS: Descriptive statistics are presented in Table 1 showing an increase in VO₂, VE, and HR for free choice and chukker. Horse heart rate increased to 176 ± 5 bpm (P < 0.05) on HR (r² = 0.04), VE (r² = 0.03), VO₂ (r² = 0.06), or RER (r² = 0.13). CONCLUSION: Arena polo constitutes intense exercise with gameplay that mimics increased physiological demands comparable to traditional sports above warmup and recovery. Horse does not influence physiological responses, indicating that competition intensity is the primary driver of metabolic demand.

Table 1. Mean ± SD of heart rate (HR), ventilation (VE), oxygen consumption (VO₂), and respiratory exchange ratio (RER) of arena polo players during each time period. Values within a column lacking a superscript differ (P < 0.001).

| Warmup | 136 ± 1b | 37 ± 1b | 17.4 ± 0.3b | 0.97 ± 0.01 |
| Free Choice | 164 ± 2a | 61 ± 2a | 23.3 ± 0.6a | 0.97 ± 0.02 |
| Chukker | 169 ± 1a | 57 ± 1a | 24.9 ± 0.4a | 0.96 ± 0.01 |
| Recovery | 136 ± 2a | 26 ± 1a | 10.8 ± 0.5a | 0.98 ± 0.01 |

Electroencephalography (EEG) is a non-invasive method of assessing electrical activity of the brain, and can be used during exercise. Previous studies using younger adults have shown a decrease in relative power spectral density (PSD) toward the end of a maximal exercise test, suggesting an inhibitory role of the prefrontal cortex at high intensities. However, this response is not consistent between studies, and unknown in middle-aged adults. PURPOSE: To determine how brain activity changes throughout a self-paced incremental maximal exercise test in middle-aged adults. METHODS: This study included ten middle-aged (49.1 ± 3.2 years) recreationally active individuals (3 men, 7 women). A self-paced VO₂max (SPV) test was performed according to exercise. Repeated-measures ANOVA was used to determine the effect of test stage on EEG activity. RESULTS: The mean VO₂max was 37 ± 7 mL·kg⁻¹·min⁻¹. Relative PSD in both the alpha and beta frequency bands increased with corresponding increases in heart rate. In the PFC, there was a significant main effect of test stage in both the alpha and beta frequency bands (p = 0.013 and 0.034) respectively. In the MC, the main effect of time was significant in the alpha (p = 0.033), but not the beta (p = 0.080) frequency. Large increases in relative PSD were seen in the transition from RPE17 to RPE20 (e.g. 7.6±2.0 µV²·Hz⁻¹ to 16.1±6.4 in the MC beta wave analysis). CONCLUSIONS: This study suggests that for middle-aged individuals, there is no decline in EEG activity either in the prefrontal or motor cortices during a maximal
Bilateral weight distribution asymmetry was present in the FMS DS both with flat and between squat conditions. The EH condition did not significantly change weight starting position and full squat position during both FF and EH. There were no participants experienced >5% asymmetry (0% being perfectly symmetric) for the 2x6 board. Trials were completed on two embedded force plates (120Hz). Vertical ground reaction force (vGRF) data were used to determine asymmetry in bilateral weight distribution. Six reflective markers placed bilaterally on the greater trochanter, lateral femoral epicondyle and lateral malleolus were tracked with a 10-camera motion analysis system (120Hz). A Matlab script processed the data and computed knee flexion angle and vGRF asymmetry at squat initiation and full squat. Paired samples t-tests with a significance level of 0.05 were used. RESULTS: A significant increase (p<0.01) in knee flexion occurred in the EH squat condition (Left 105.9±20.2°; Right 105.8±20.5°) compared to FF (Left 100.8±22.5°, Right 101.0±23.1°). On average, participants experienced 5% asymmetry (0% being perfectly symmetric) for the starting position and full squat position during both FF and EH. There were no significant differences in weight distribution symmetry in the starting position (p>0.31) between squat conditions. The EH condition did not significantly change weight distribution symmetry (p=0.69) in the full squat position. Within squat condition, there was no significant differences between weight distribution symmetry from the starting position to the full squat position (FF: p=0.76, EH: p=0.43). CONCLUSION: Bilateral weight distribution asymmetry was present in the FMS DS both with flat and elevated heels in physically active participants. Coaches and trainers should consider implementing training programs to optimize biomechanical function during the FMS DS.
Through precise training for the athlete we can improve their specific physical condition for each sport discipline, in the same way the tests we perform to see the metabolic changes according to the corresponding pathways to the sport activity must try to be as specific as possible and simulate sports techniques. **PURPOSE:** To analyze with specific judo fitness test, the sports performance according to the training stage in athletes. METHODS: Descriptive study, n = 18, 11 males, 7 females of the Judo Senior Team, age 20.4 ± 3.9 years, with a range of 15 to 29 y. The same test was performed three times, every 4 months. The test is performed to assess the sports training in judo. The first and second tests, 11 athletes were evaluated, and in the 3rd test, 16 athletes participated. The fitness index tests are specific, analyze the performance with Judo technique (“Ippon-sevi-nage”), the Index consists of the measurement of the maximum heart rate load of effort (MHRE) plus the heart rate at the minute of recovery at the end of the test, in beats per minute, divided by the number of techniques, made from the 1st 15 seconds (s), 10 s recovery, 2nd 30 s, 10 s recovery and 3rd 30 s work, and the heart rate at the minute of recovery. It started at 6000 hrs, with an ambient temperature 20°C, monitoring the heart rate, during rest, warm-up, maximum effort and at one minute of recovery using Polar®V800 heart rate monitors. Additional instruments used were writing board, sheets of bond paper, pencil, whistle and a chronometer. The information was tabulated in Microsoft Excel 2016. RESULTS: In the 1st test, 11 athletes, men (7), the results were, 4, 36.4% good, 1, 9% very good, 2, 18.2% excellent; women (4), 1, 9% bad and 3, 27.3% regular, in the 2nd test, 11 men (8), 1, 9% bad, 1, 9% regular, 3, 27.3% good and 3, 27.3% excellent; women (3), 1, 9% regular and 2, 18.2% good and in the 3rd (16), men 10, 2, 12.5% regular, 6, 37.5% good and 2, 12.5% excellent; women 6, very bad 1, 6.3%, 2, 12.5% regular and 3, 18.7% good. **CONCLUSION:** With the special fitness Judo Index test we can track the sports preparation of judo athletes and evaluate their performance specifically with Judo technique (“Ippon-sevi-nage”).

**G-36** Free Communication/Poster - Methodology

**Board #92** June 1 9:30 AM - 11:00 AM Special Fitness Judo Index Test to Evaluate Sports Performance According to the Training Stage in Athletes Luis Del Valle, Calvin Illescas, FACSM. Conferenciador Deportiva Autonoma De Guatemala, Guatemala, Ciudad, Guatemala. (Sponsor: Dr. Calvin Illescas, FACSM) Email: calvinmd@gmail.com (No relevant relationships reported)

**Board #93** June 1 9:30 AM - 11:00 AM Physiological Demands of Hard Shoe and Soft Shoe Irish Dancing: A Pilot Study Madison P. Trebour, Jo P. Morrison, Laura Q. Jimenez, Tim G. Coffey, Madison M. Cutten. Longwood University, Farmville, VA. Email: madison.trebour@live.longwood.edu (No relevant relationships reported)

**Board #94** June 1 9:30 AM - 11:00 AM Elite Orienteering Athletes In Standardized Time-trial And Distance-trial Tests Own Better Physiological And Psychological Indicators On Treadmill Chia-Chih Lin¹, Guan-Yu Lin². ¹National Dong Hwa University, Hualien, Taiwan. ²National Taiwan Normal University, Taipei, Taiwan. Email: cclin@gms.nndu.edu.tw (No relevant relationships reported)

**Board #95** June 1 8:00 AM - 9:30 AM Accuracy Of The Equations For VO2max In Aerobically Trained Women. Sergio A. Garcia Corzo, Moises Arturo Cabrera Hernandez, Luis Javier Tafur Tascón, Yecid Mina Paz, Carmen Ximena Tejada Rojas, Hugo Hurtado Gutierrez. Institution Universitaria Escuela Nacional del Deporte, Cali, Colombia. (No relevant relationships reported)
CONCLUSION: Equations 3, 4 and 7 meet all the statistical criteria used to evaluate the accuracy of the prediction in this study; however, none of the equations was rated as good concordance, when using the CCC method.

### Table 4. Comparison of absolute and relative values of VO2max predicted from the equations.

<table>
<thead>
<tr>
<th>Equation</th>
<th>VO2max (ml.min⁻¹) (mean ± ED)</th>
<th>CE (media ± DE)</th>
<th>p value</th>
<th>r</th>
<th>SEE (ml.min⁻¹)</th>
<th>TE (ml.min⁻¹)</th>
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<tbody>
<tr>
<td>1</td>
<td>3271.3 ± 336.7 (mean ± ED)</td>
<td>-272.9 (202.1)</td>
<td>.001</td>
<td>.87*</td>
<td>161.3</td>
<td>339.7</td>
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<tr>
<td>2</td>
<td>2879.5 ± 282.6 (203.2)</td>
<td>.081</td>
<td>.85*</td>
<td>172.4</td>
<td>224.8</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2840.5 ± 305.1 (191.6)</td>
<td>.019</td>
<td>.87*</td>
<td>161.3</td>
<td>237.9</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2985.1 ± 321.5 (195.1)</td>
<td>.903</td>
<td>.87*</td>
<td>161.3</td>
<td>187.0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2125.9 ± 132.0 (368.3)</td>
<td>.000</td>
<td>.27</td>
<td>315.1</td>
<td>935.3</td>
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<tr>
<td>6</td>
<td>2957.3 ± 301.1 (193.4)</td>
<td>.546</td>
<td>.87*</td>
<td>161.3</td>
<td>188.4</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3131.4 ± 320.8 (197.5)</td>
<td>.033</td>
<td>.87*</td>
<td>161.3</td>
<td>234.8</td>
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</table>

<table>
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<tr>
<th>ml.kg⁻¹.min⁻¹ (mean ± ED)</th>
<th>60.6 ± 6.7</th>
<th>-5.1 (3.6)</th>
<th>.001</th>
<th>.81*</th>
<th>4.3</th>
<th>6.2</th>
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<tbody>
<tr>
<td>2</td>
<td>53.4 ± 5.7</td>
<td>2.2 (3.8)</td>
<td>.078</td>
<td>.78*</td>
<td>4.6</td>
<td>4.3</td>
</tr>
<tr>
<td>3</td>
<td>52.6 ± 6.1</td>
<td>2.9 (3.6)</td>
<td>.019</td>
<td>.81*</td>
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<td>4.5</td>
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<tr>
<td>4</td>
<td>55.3 ± 6.5</td>
<td>0.2 (3.6)</td>
<td>.852</td>
<td>.81*</td>
<td>4.3</td>
<td>3.5</td>
</tr>
<tr>
<td>5</td>
<td>39.4 ± 2.9</td>
<td>16.1 (7.1)</td>
<td>.000</td>
<td>.12</td>
<td>7.3</td>
<td>17.5</td>
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<tr>
<td>6</td>
<td>54.8 ± 5.9</td>
<td>0.7 (3.6)</td>
<td>.500</td>
<td>.81*</td>
<td>4.3</td>
<td>3.6</td>
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<tr>
<td>7</td>
<td>58.0 ± 6.4</td>
<td>-2.5 (3.6)</td>
<td>.036</td>
<td>.81*</td>
<td>4.3</td>
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</tr>
</tbody>
</table>

* = p value < 0.05

### A Novel Assessment of Baseball Throwing Mechanics

**PURPOSE:** To examine the learning effect when fatigue testing without familiarization. METHODS: 22 masters-aged [53.1±5 years], competitive female cyclists completed 3 separate 50-repetition knee flexion/extension tests on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. RESULTS: No significant differences [Wilks’Λ < 0.05] existed between trials, indicating no learning effect was associated with the tests for any variable: a) peak torque (T1 50.7±10.4 N·m; T2 53.0±11.5 N·m; T3 56.6±11.0 N·m), b) relative peak torque (T1 36.2 ± 6.7 N·m/kg; T2 37.9 ± 7.5 N·m/kg; T3 39.2 ± 7.3 N·m/kg), c) torque generated at 30° (T1 27.1 ± 10.0 N·m; T2 26.4 ± 10.2 N·m; T3 26.6 ± 9.4 N·m), d) torque generated at 0.18 s (T1 45.7 ± 9.0 N·m; T2 47.4 ± 10.1 N·m; T3 50.1 ± 9.0 N·m), e) relative work completed (T1 50.2 ± 9.7 kg; T2 50.5 ± 9.0 kg; T3 51.5 ± 10.9 kg), or f) total work completed (T1 2548.4 ± 524.4; T2 2544.8 ± 516.0; T3 2615.3 ± 579.3 J). CONCLUSION: No learning effect was seen with the isokinetic knee extension/ flexion fatigue protocol in masters-aged, female cyclists. Therefore, these findings would suggest that previous experience in isokinetic muscular fatigue testing does not alter subsequent performance.
Board #99  June 1 8:00 AM - 9:30 AM  
Acute Effects of Neuromuscular Electrical Stimulation on Vertical Jump  
Yusuf K. Kaire, Andrew Harveson, Dominick Sturz, Levi Garrett. California Baptist University, Riverside, CA.  
Email: ykaire@gmail.com  
(No relevant relationships reported)

Yusuf K. Kaire, Andrew Harveson, Dominick Sturz, Levi Garrett  
California Baptist University, CA  
Multiple studies have indicated improvements in muscular strength, power, and performance can be made over time using neuromuscular electrical stimulation (NMES). Yet no previous studies have conducted research into the effects of NMES on vertical jump immediately after isometric stimulation to the quadriceps group.  
PURPOSE: To determine the acute effects of NMES on vertical jump. METHODS: A group of 24 participants were randomly divided into an experimental and a control group. All participants were pretested in the countermovement jump (CMJ) to determine maximum jumping height. Participants in the treatment group were treated with NMES to the quadriceps. Participants in the control group received sham treatment in identical testing conditions. All participants then engaged in a post-test CMJ test. The difference between pretest and posttest jump scores was computed to determine the effects of treatment.  
RESULTS: A paired samples t-test showed a statistically significant increase in experimental CMJ scores from pre-test (M = 28.69, SD = 6.87) to posttest (M = 30.14, SD = 7.42), t(11) = 1.796, p < .05. (Figure 1). A statistically significant decrease in control CMJ scores occurred from pre-test (M = 30.72, SD = 6.51) to posttest (M = 29.18, SD = 6.24), t(11) = 1.796, p < .05. The mean increase in experimental CMJ scores was 1.54 with a 95% confidence interval ranging from 26.61 to 33.67. The mean decrease in control CMJ scores was 1.54 with a 95% confidence interval ranging from 26.21 to 32.15. Cohen’s d (24) indicated a small effect size. CONCLUSION: The acute application of NMES to the quadriceps group lead to significant improvements in vertical performance.

The BodPod® (BP) is a standard, reliable tool for measuring body composition. A new body composition measurement tool called the Shulpt© (SK) was created recently. The SK is a form of bioelectrical impedance analysis that measures at three different sites, tricep, abdomen, and thigh, but little to no research exists examining the validity of this form of measurement. For this reason, this study sought to determine the accuracy of the SK to the BP.  
PURPOSE: To determine the accuracy of the SK© to the BP©. METHODS: A sample of ninety-one females had their body composition measured using the SK© and BP©. The BMI and body fat % of the subjects were then calculated to compare the mean body fat % from the SK© to the mean body fat % of the BP©.  
RESULTS: A Spearman’s R correlation coefficient was calculated to determine the relationship between the body fat % measured from the SK and BP. A strong positive correlation was found R = 0.904 (p < 0.001) indicating a strong direct relationship between the variables. This suggests that a subject measuring a high body fat % on the BP also measures high on the SK. A paired-samples t-test was calculated to compare the mean body fat % from the SK to the mean body fat % of the BP. The results conclude there was a statistical significant difference between the BP and SK of p < 0.000. An average of 5.55% difference was found between the results of the two measurement tools. The mean body fat % on the BP was 21.84 (sd = 10.05). The mean body fat % on the SK was 27.371 (sd = 8.67). CONCLUSION: Since there was significant difference found between BP and SK, the SK is not a recommended body fat measurement tool in research settings, but is acceptable to use in general population settings. However, the positive correlation shows the SK can differentiate between individuals with high versus low body fat. These findings suggest an individual could use the SK to track changes in body composition, an important factor in a person’s overall health and wellness.

Board #100  June 1 8:00 AM - 9:30 AM  
Correlation Analysis Of The Skulpt© And Bodpod©  
Alyne L. Williams, Melissa Renee Cook, Ciro Moraes Costa De Castro, Annabell Kennell, Victoria Haller, Alex Seabeck, Alex Springer. Indiana Wesleyan University, Marion, IN.  
Email: aly.williams@indwes.edu  
(No relevant relationships reported)

Linear momentum represents the product of mass and velocity, is the key determinant of the outcome of collisions. In collision-based sports, such as American football, players with the greatest momentum tend to achieve more favorable outcomes during on-field collisions, or tackles. Therefore, today’s players are constantly seeking to increase mass without sacrificing velocity. However, no study has quantified linear momentum in American football players.  
PURPOSE: To examine the positional differences in linear momentum during a vertical jump in Division II college football players. METHODS: 56 male Division II college football players were assessed for height, body mass, and vertical jump. All players were categorized according to playing position into defensive back (DB), defensive line (DL), running/full back (RB), linebacker (LB), offensive line (OL), tight end (TE), and wide receiver (WR) groups; all other positions were excluded due to insufficient sample. Height and body mass were assessed using a stadiometer and digital scale, respectively. A vertical jump test was performed to determine jump height, which was then used to calculate vertical jump velocity. Vertical jump momentum (VJM) was calculated as the product of body mass and vertical jump velocity. Positional comparisons in VJM were made using one-way ANOVA with LSD post hoc comparisons. Alpha level was set a priori to p<0.05. RESULTS: A significant main effect of position was observed for VJM (p<0.001). Post hoc tests revealed that OL (439.6±44.7 Ns) had significantly higher VJM than DB (p<0.001; 317.3±34.4 Ns), RB (p<0.001; 371.7±24.7 Ns), LB (p=0.006; 376.3±12 Ns), TE (p<0.001; 377.4±51.9 Ns), and WR (p<0.001; 338.6±25.0 Ns), while trending to be greater than DL (p=0.089; 406.9±59.6 Ns). Also, DL had significantly greater VJM than DB (p<0.001) and WR (p<0.001), and trending to be greater than RB (p=0.068), LB (p=0.099), TE (p=0.013), and RB (p=0.004) had significantly greater VJM than DB, but only RB trended to be greater than WR (p=0.086). CONCLUSIONS: While positional differences in VJM exist in collegiate American football, positions that regularly engage during gameplay (OL vs DL, WR vs DB, and LB vs RB vs TE) have no statistically significant differences. Therefore, these positions are most likely evenly matched when colliding on the field.
**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**S738 Vol. 51 No. 5 Supplement**

**3415 Board #103 June 1 8:00 AM - 9:30 AM**

**A New Functional Screening Tool For Lower Limb Injury Risk: A Retrospective Cohort Study**

Liping Jiang1, Shimeng Shi1, Xiaojuan Shi2, Zonghan Yang2, Gordon Waddington3, Jeremy Witchalls1, Roger Adams4, Doa El-Ansary5, Jia Han1, Tongqi University, Shanghai, China. 1Shanghai University of Sport, Shanghai, China. 2University of Canberra, Canberra, Australia. 3University of Sydney, Sydney, Australia. 4Swinburne University of Technology, Melbourne, Australia.

(NO relevant relationships reported)

**PURPOSE:** The aim of the current study was to develop a new screening instrument for lower limb functional assessment. **METHODS:** Fifty-three athletes (33M:20F; mean age: 19.4 ± 2.5yrs old) volunteered for the study. Athlete injury history and sport performance level (international, national, regional, recreational) were recorded. A lower limb functional screening tool was developed (the LoLiFST), based on 5 lower limb movements in different modes, planes, directions and at varying intensities. Both legs were assessed in a random order and each athlete was given a technique and a symptom score. Reliability was evaluated. Spearman’s correlation was employed to examine the relationship between the measures and the incidence of injury. Receiver operating characteristic (ROC) analysis was employed to assess the instrument’s capacity to classify injury status. **RESULTS:** (1) The test-retest reliability was 0.74. The inter-rater reliability was 0.95. (2) Twenty-five of the athletes had a history of low back or lower limb injuries in the past 12 months. (3) Both the technique and symptom scores from the LoLiFST were significantly correlated with the injuries (r=0.290, P=0.035; r=0.390, P=0.004), and the two scores were significantly inter-correlated (r=0.354, P=0.009). (4) When technique or symptom scores alone were included to differentiate between athletes with or without injury, the area under the ROC curve (AUC) scores were 0.668 (P=0.036, 95%CI:0.520-0.815) and 0.722 (P=0.006, 95%CI:0.582-0.862), respectively. With technique and symptom scores combined, the AUC discrimination score was 0.762 (P=0.001, 95%CI:0.634-0.890). When sport performance level was added into the variable set, the AUC discrimination score was 0.834 (P=0.00, 95%CI:0.728-0.939), meaning that 83.4% of cases can be correctly classified as low back or lower limb injury/non-injured using the decision point obtained from applying Youden’s index to the ROC curve. **CONCLUSION:** The findings support the use of a functional movement screening tool that includes both technique and reported symptoms, that can be used in combination with sporting performance level to enhance capacity for identifying injuries. Future longitudinal studies are warranted to explore the validity of the LoLiFST in determining low back and lower limb injury risk.

**3416 Board #104 June 1 8:00 AM - 9:30 AM**

**Comparison of Functional Tests of Leg Power in Collegiate Athletes**

Spencer Sullivan, Niles Fleet, Peter Brubaker, FACSM. Wake Forest University, Winston-Salem, NC. (Sponsor: Peter Brubaker, FACSM)

(NO relevant relationships reported)

In the field of sports medicine, functional tests, such as the single leg hop for distance (SLHD) and single leg vertical jump (SLVJ) are often used to determine an athlete’s return to competition. Many sports medicine facilities, including Wake Forest University (WFU), have invested in pneumatic resistance machines, such as the Keiser Air420 Leg Press, that precisely measure single leg power in Watts. However, little is known regarding the agreement of the data obtained from the functional tests and the Keiser Air420. **PURPOSE:** To compare the results of the Keiser leg press to those of the SLHD and SLVJ. **METHODS:** Data were obtained from 79 (40 males and 39 females) healthy student-athletes at WFU. After a warmup, each subject performed the SLHD and SLVJ (cm) and the Keiser leg press (W/kg) in random order with a 5-minute rest period between each test. The relationship between tests was examined with Pearson Correlation Coefficients. **RESULTS:** The means for the Keiser, SLHD, and SLVJ tests (listed right and left, respectively) were 15.4±3.7 W/kg and 14.9±3.6 W/kg, 170.6±27.8 cm and 172.9±28.0 cm, 36.2±7.4 cm and 36.2±7.8 cm, respectively. The correlations of leg power were statistically significant at an alpha level of 0.01. The SLVJ and Keiser scores (right leg r=0.82, left leg r=0.83) had a slightly higher correlation than the SLHD and Keiser scores (right leg r=0.65, left leg r=0.70). **CONCLUSIONS:** As suggested by the observed relationships, both the SLHD and SLVJ data correlate significantly with leg peak power results obtained from the Keiser Air420 in healthy, collegiate athletes. Thus, this study suggests low-tech/low-cost functional tests like the SLHD and SLVJ appear to be appropriate for evaluating leg power and return to competition in this population.

**3417 Board #105 June 1 8:00 AM - 9:30 AM**

**Investigation of Optimal Depth Jump Box Height for Reactive Strength Index**

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Reactive strength index (RSI) is used to assess athleticism through use of the stretch-shortening cycle for power and is determined by jump height over ground contact time. RSI is typically assessed utilizing an increment drop jump test and while it is well-established that plyometric training positively impacts power production, the optimal depth jump box height for RSI remains unknown. **PURPOSE:** To measure RSI between different depth jump starting heights. **METHODS:** 20 college students were recruited for this study (M=13, F=7; age: 22.8±2.7y; height: 175.6±11.8 cm, mass: 78.3±13.5 kg) and were prepped using reflective markers on their ASIS and PSIS, bilaterally, which allowed for vertical jump height measurements. After a specific warmup, subjects were instructed to perform three maximal DJSs onto a force plate from five different heights: 30cm (DJ30), 45cm (DJ45), 60cm (DJ60), 76cm (DJ76), and 91cm (DJ91). **RESULTS:** A repeated measures ANOVA revealed no effect of sex but significant differences in RSI between starting heights (DJ30=1.36±0.11; DJ45=1.42±0.12; DJ60=1.35±0.12; DJ76=1.28±0.12; DJ91=1.16±0.11), with DJ45 and DJ60 being greater than DJ30, DJ76, and DJ91. **CONCLUSION:** A parabolic relationship was observed between depth jump box height and RSI, with the optimal depth jump starting heights being 45 and 60 cm. A potential avenue for future research would be to investigate training effects on RSI from various depth jump box starting heights.

**3418 Board #106 June 1 8:00 AM - 9:30 AM**

**The Effects Of Different Local Muscle Endurance Training Protocols In Muscle Activity And Fatigue**

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(NO relevant relationships reported)

The present study assessed fatigue and neuromuscular changes after fatiguing submaximal horizontal chest press exercise between different strength trainings of concentric contractions intensities. **PURPOSE:** The purpose of this study was to evaluate the effect of strength trainings with higher intensity contractions in EMG activity and fatigue. **METHODS:** Fifteen trained males (24±1.29 years old, 181.8±5.8 cm, 83.6±9.6 kg) performed four different strength trainings protocols in horizontal chest press (HCP) with different intensities of a load % one repetition maximum (RM) with a similar total impulse and similar rest. Strength trainings protocols consisted of : A) 3 blocks x 1 (repetition (reps) of 95% RM · 1 rep of 90% RM · 3 reps of 80% RM · 5 reps of 70% RM · 8 reps of 60% RM · 8 reps of 50% RM · 12 reps of 45% RM · 15 reps of 35% RM · 12 reps of 20% RM) rest 5 sec between sets and 3 min between blocks; B) 2 blocks x (6 x 15 of 50% RM) rest 30 sec between sets and 1 min rest after block; C) 3 sets x (3 reps of 90% RM) rest 30 sec between sets and 1 min rest after block and 4 (X of 50% RM) rest 20 sec between sets and 1 ‘40” rest after block and 3 X (15 of 50%) rest 20 sec between sets; D) 3 blocks x (6 x 10 reps of 50% RM) rest 10 sec between sets and 2’30” after block. The maximal voluntary isometric contraction torque (MVIC) was assessed in the HCP exercise before and after exercise. Electromyography (EMG) of the pectoralis major (P), anterior deltoid (AD), and the long head of the triceps brachii (TB) were assessed during the different exercises. **RESULTS:** Similar reductions of the MVIC (1.227±0.15 vs 0.992±0.196 N; P<0.001) were observed after the four strength training protocols. EMG DA activity was greater in protocol C compared to the other protocols (0.956±0.336 vs 0.878±0.347 mV; P<0.01). EMG TB activity was greater in protocol C compared to the other protocols (0.534±0.194 vs 0.473±0.249 mV; P<0.01). EMG P activity was greater in protocol B and D compared to the A and C (0.343±0.115 vs 0.329±0.170 mV; P<0.01). **CONCLUSIONS:** The effect of strength endurance trainings with higher load % RM contractions compared to the others with a lower, affect similarly the loss of performance in the HCP exercise but with greater activity of DA and T muscles.
Cyclists' Brain Cycling: An fMRI Study

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(No relevant relationships reported)

Functional and structural changes in the brain have been associated with regular aerobic exercise and expertise in several sports. A variety of neuroimaging techniques have revealed changes in brain activation with increased exercise intensity; however, how expertise modulates neural activation is still unclear for some sports, like cycling. PURPOSE: Using an adapted cycling MRI ergometer, we compared the neural patterns of cycling experts and non-cyclists during cycling periods of different intensities. METHODS: 22 participants were divided into two groups: 12 healthy adults who performed physical activity 4-6 h/week and 10 trained cyclists (≥2 yrs of training and competitive experience, cycling 4-6 days/week for ~60 min). The participants performed an incremental test on an adapted cycling MRI ergometer while whole-brain activity was recorded with functional MRI. Using a one-sample t-test (p<0.05 family-wise error corrected for multiple comparisons), we identified the positive (activation) and negative (inhibition) blood-oxygenation-level-dependent responses associated with all cycling intensities in each group. RESULTS: The analysis revealed that both cycling experts and novices activated the precentral gyrus, postcentral gyrus, paracentral lobule and medial frontal gyrus (t>11.1), while the cerebellum and insular cortex were activated only in cyclists (t>6.83). In addition, both groups had inhibition of prefrontal cortical areas (t>7.44) during cycling, but the non-cyclists had larger areas of the prefrontal cortex inhibited (t>7.52). CONCLUSION: Cycling expertise impacts the modulation of subcortical and prefrontal brain areas during cycling. We believe that these findings suggest that regular practice of cycling may enhance the neural regulation of cognitive, motor and homeostatic resources during exercise at different intensities, which may explain the higher performance of cycling athletes.

Comparison of Maximal Aerobic Capacity Between the Treadmill and a Skiling Ergometer

Hannah Nelson, Andy Bosak, Madeline Phillips, Russell Lowell, Branden Ziebell, Moroní de Moors, Anna Blackley, Adriel Lau, Abraham Frech, Abby McCarty. Liberty University, Lynchburg, VA. (Sponsor: Dr. James Schofield, FACSM) (No relevant relationships reported)

Cross-country skiing is known to be an extremely aerobically demanding sport. Therefore, the use of a skiing ergometer (ie. SkiErg) to replicate similar aerobic training is increasing in use in lab and fitness settings. The SkiErg is widely used in gyms, research laboratories, and rehabilitation centers, and provides a low impact and total body cardiovascular and muscular endurance workout. Technique for training on the SkiErg can be quickly learned and adapted for immediate use by most individuals. Because of its lower cost and minimal required floor space, this piece of fitness equipment can be used at almost any location for exercise and training. Due to the benefits, convenience, and accessibility, the SkiErg may be a viable alternative max or peak graded exercise test (GXT) mode. To the best of the researchers’ knowledge, a comparison of aerobic capacity between a SkiErg and treadmill has not been assessed. PURPOSE: To compare treadmill (TM) VO2max values vs. those elicited from a SkiErg (SE) GXT. METHODS: Descriptive data (HT. = 176.1 ± 8.2 cm, WT. = 80.5 ± 10.1 kg, BF% = 15.1 ± 5.8%, age = 22.7 ± 2.4 yrs) was measured for 21 averagely fit college-age males. In a counterbalanced order and separated by 72 hours of rest, each subject completed 2 GXT protocols to the point of volitional exhaustion on a TM and SE. Max or peak values for VO2, HR, VE, and RER were compared between SE and TM using a paired-Sample t-Test with an alpha level set at p<0.05. Peak RPE was compared using a Wilcoxon Signed Rank Test. RESULTS: TM was significantly greater than SE in regard to mean VO2(max) (51.1 ± 5.0 vs 44.5 ± 3.8 ml/kg/min, p < 0.01), HR (191 ± 11 vs 186 ± 10 bpm, p < 0.01), and RPE (196.2 ± 2.2 vs 183.1 ± 2.6, p = 0.039). TM was not significantly greater than SE regarding RER (1.2 ± 0.6 vs 1.2 ± 0.1, p = 0.862) or VE (146.2 ± 16.5 vs 144.3 ± 21.5 L/min, p = 0.614). CONCLUSIONS: The TM appears to yield higher max values for VO2, HR, RER, and RPE values compared to SE in college-age males. Although TM elicited higher values than SE, VO2peak was only 15% lower than values measured from TM. This percent difference is comparable to other currently accepted alternative forms of aerobic capacity testing such as leg and arm cycle ergometers. Future studies should assess how gender, fitness variations, SE technique, or various athletic populations may impact VO2 values during a peak SE GXT.

Proximity To Failure And Repetitions Per Set Effect Rpe Accuracy In The Squat, Bench Press, And Deadlift

Nicholas M. Sautter1, Colby A. Sousa1, Daniel J. Belcher1, Joseph P. Carzoli2, Trevor K. Johnson3, Rebecca M. Cernimaro4, Eric R. Helms5, Chun-Jung Huang, FACSM, Michael1. 1TM Whitehurst, FACSM, Michael C. Zourdos5. 2Florida Atlantic University, Boca Raton, FL. 3Auckland University of Technology, Auckland, New Zealand. Email: mzourdos@fau.edu (No relevant relationships reported)

The repetitions in reserve (RIR)-based rating of perceived exertion (RPE) scale has gained significant popularity. Previous research has shown that intra-set RIR predictions become more accurate closer to failure. However, research has yet to examine this concept in the deadlift. PURPOSE: This investigation examined proximity to failure and total repetitions per set on intra-set RPE accuracy. METHODS: Ten males (age: 25.0 ± 4.0 yrs, body mass: 84.1 ± 14.3 kg, training age: 6.9 ± 4.0 yrs) performed 4 sets to failure at 80% of one-repetition maximum (1RM) on the squat, bench press, and deadlift in successive weeks; in a counterbalanced order. During all sets, subjects indicated when they believed to be at a 6 and 9RPE (ie. 4 and 1RIR). The RIR difference (RIRDiff) was calculated by subtracting the predicted number of repetitions.
repetitions from the actual number of repetitions performed. Thus, if 10 repetitions were performed, but a 9RPE was called after 7 repetitions (predicting 8 repetitions), then the RIRDIFF at the end of the set would have equaled 2 (i.e. RIRDIFF=10-8). The RIRDIFF at the called 6 and 9RPE was analyzed with a paired t-test and Pearson’s correlations were used to assess the relationship between repetitions per set and RIRDIFF; significance was set at p≤0.05. RESULTS: The RIRDIFF across all sets of all exercises and within each individual exercise was significantly lower (p<0.01) at the called 9 vs. 6RPE. Across all sets the RIRDIFF at 6RPE vs. an RIRDIFF of 0.50±0.70 at the called 9RPE (p<0.01, ES=0.62). Total repetitions performed per set were significantly related to a higher RIRDIFF (i.e. more inaccurate RPE ratings) on squat (r=0.47, p<0.01), and bench at 6RPE (r=0.50, p<0.01) and bench at 9RPE (r=0.60, p<0.01). There was no relationship between repetitions performed and RIRDIFF at the squat called 9RPE or either called RPE on the deadlift (p>0.05). CONCLUSIONS: These results suggest that intra-set RPE ratings are more accurate closer to failure on all three exercises and that more repetitions per set may lead to more inaccurate RIR predictions on the squat and bench press.

### Board #111
June 1 8:00 AM - 9:30 AM

**Standardization of the Technique for a Medicine Ball Throw Test**

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(No relevant relationships reported)

Muscular power is an essential component of numerous activities. Maximal throws and throws achieved at a given relative intensity can be used to assess and manipulate upper body power, which could make an impact on the distance achieved, is typically either controlled with complicated methods or not controlled at all in the existing literature.

**PURPOSE:** Establish consistent and simple procedures to control the effort of a medicine ball throw protocol and establish the reliability and norms for the test.

**METHODS:** 124 males and 96 females sat on the floor with their back against a wall, knees bent, and feet flat on the ground. On the adjoining wall a sheet of paper displayed lines at a 45 degree angle. After a technician aligned the subject’s outstretched arms with the lines on the sheet, subjects were told to find a point of reference that they were pointing at with their hands. They then held a 6-pound medicine ball at chest level and were instructed to launch the ball directly at the spot selected. Hand chalk was applied to the ball to indicate the landing spot. After three light practice throws subjects performed a maximal effort three times, with the distance from the wall to the nearest point of the landing spot determined. On a separate occasion 38 subjects completed the protocol a second time to establish test-retest reliability.

**RESULTS:** Subjects found the process for launching the ball at the proper angle simple to follow. Paired T-test revealed no significant difference between the best throw and the average of the two best throws (p>0.01). Interclass correlation revealed a high test-retest reliability for the procedure (r=0.98). Maximal throw distance showed moderate to good correlation with both height (r=0.72) and weight (r=0.63). The median distance for males was 223.4 inches, with 25th and 75th percentile values of 199.6 and 245.4 inches, respectively. The median distance for females was 143.1 inches, with 25th and 75th percentile values of 128.4 and 154.6 inches, respectively. Relative to height and weight, males and females had median values of 3.22 and 2.21 inches per inch of height, respectively, and median values of 1.27 and 0.99 inches per pound, respectively.

**CONCLUSIONS:** The protocol demonstrates high reliability and provides a simple mechanism to assist subjects in achieving the desired angle of launch.

### Board #112
June 1 8:00 AM - 9:30 AM

**Effects of an Acute Strength and Conditioning Training Session on Dual Energy X-ray Absorptiometry Results**

Sean T. Stanelle, Jason R. Lytle, Steven E. Martin, John S. Green, FACSM, Stephen F. Crouse, FACSM. Texas A&M University, College Station, TX. (Sponsor: Stephen F. Crouse, FACSM)

(No relevant relationships reported)

In the use of dual x-ray absorptiometry (DXA) scans to obtain reliable measures of body composition, athletic staff must be aware of acute factors that may alter scan estimates, such as hydration status. **PURPOSE:** The purpose of this study was to determine if a strength and conditioning (S&C) training session, based upon what athletes regularly engage in (i.e. upper body conditioning), can alter scan estimates (lean mass, fat mass, and bone mineral content) of a DXA scan. **METHODS:** The S&C session lasted ~ 90 minutes and consisted of upper and lower body resistance exercises and interval running. Twenty-two strength-trained subjects (15 men, 7 women, age 24.2 ± 2.3 years, height 174.2 ± 8.5 cm, weight 83.5 ± 15.0 kg) volunteered to participate in the study.

Each subject completed two standard DXA scans on the same day, before and after the S&C session. Following the consumption of a free-living meal prior to the first scan, subjects were instructed to avoid all food intake until completing the second scan. Throughout the S&C session, subjects were encouraged to drink water ad libitum. **RESULTS:** The results of this study were analyzed via correlated t-test (p < 0.05 considered significant) and significant values are listed in Table 1 below. **CONCLUSION:** The acute physiological effects of a S&C session alter body composition measures obtained by DXA scan. Thus, athletic staff should consider the timing of DXA scans in relation to S&C sessions.

![Table 1](image)

<table>
<thead>
<tr>
<th>Exercise</th>
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<th>Post</th>
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<th>P-value</th>
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<td>35.6%</td>
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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Board #113**
June 1 8:00 AM - 9:30 AM

**Effects Of A Short-term Core Stability Exercise On Functional Movement And Balance**

Jiyeon Kim, Joungbo Ko, Jongil Lim, Hyejung Choi, Kyoungbo Seo, Sukho Lee. TExAS A&M- San Antonio, San Antonio, TX. (No relevant relationships reported)

Recently, the importance of maintaining the alignment of the human muscles and managing the left and right symmetry has been widely recognized in fields that study pain in medicine, physical therapy and exercise rehabilitation. As a result, core stability exercise has been spotlighting. **PURPOSE:** To investigate the effects of a short-term core stability exercise on functional movement and balance in subjects with mild lower-limb discomfort. **METHODS:** Twenty people with mild lower-limb discomfort were randomly assigned to a non-training control (CG, n=10) and core stability exercise training group (EG, n=10). While CG maintained their daily routine, EG completed twenty 30-min training sessions consisting of 10 modified mat pilates program exercises aimed at increasing core stability. Functional movement, dynamic balance, and discomfort level were assessed before and after twenty sessions of core stability training using functional movement test, balance test and visual analog scale (VAS), respectively. Two-way (group by time) repeated measures ANOVA’s were performed for all dependent variables, and the significance for all statistical tests was set at p<0.05. **RESULTS:** EG demonstrated a significant increase in functional movement indicated by increased hurdle step (CG: -4.7 vs. EG; 25%, p = 0.024, group × time effect) and shoulder mobility (CG: -13.04 vs. EG: 5%, p = 0.037, group × time effect). The dynamic balance score was significantly improved only in EG for both limbs (right: EG = 7.7%, p = 0.007, left: EG = 8.10%, p = 0.011, time effect). A significant reduction of VAS score in ankle was exhibited in EG (EG: -74.76%, p = 0.024, time effect). **CONCLUSION:** This study highlights that twenty sessions of short-term core stability exercise can positively affect the lower limb’s functional movement and balance ability in people with mild lower-limb discomfort.

### Board #114
June 1 8:00 AM - 9:30 AM

**Validity And Reliability Of The Computrainer® During 40 km And 100 km Time-trials**


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(No relevant relationships reported)

The ecological validity of findings can substantially be improved when laboratory-based research studies use experimental designs attempting to emulate real-world exercise conditions. The exercise science literature contains ample of research that looked at the impact of various interventions using running and cycling time-trial (TT) protocols. Regarding cycling TT performances, the Computrainer® (CT), an electromagnetically brake bike trainer applying resistance to the rear wheel of a standard bike, has been extensively used for over a decade. Yet, it is unknown whether the CT provides valid and reliable power output data under TT conditions. **PURPOSE:** Determine the validity and reliability of two CTs during 40 km and 100 km TTs.

**METHODS:** Power output data of two CT Lab® were compared against those of a calibration rig (Drouet, J.M. et al. Sports Eng. 2008. 15-22.) connected to left side of the crank axle of a road bike with a driving shaft, allowing direct measurement of the true workloads generated by both CTs. The measurement process consisted of comparing the power delivered by the calibration rig to the power displayed by the CTs. Power uncertainty delivered by the calibration rig is ± 0.9%. Each TT was performed under standardized conditions on two occasions with both CTs®. TTs were completed on a flat course and designed upon previously published results in elite highly-trained cyclists. **RESULTS:** Mean power outputs generated by the two CTs for the 40 km and 100 km TTs were respectively of 359 ± 38 and 282 ± 56 watts. Mean biases between the CT 1 and the rig for the 40 km TTs varied from -0.8 to -0.7%, and between the CT 2 and the rig for the same distance from -2.7 to 3.6%. For the 100 km TTs, biases between the CT 1 and the rig ranged from -1.4 to -0.4%, whereas for the
Cardiorespiratory fitness (CRF) is a criterion measure expressed as maximal volume of oxygen consumption per unit of time (VO2max). The criterion measure is closely related to functional capacity of the heart. Functional capacity of the heart has direct ties to cardiovascular disease and cardiac mortality. CRF is traditionally measured using exercise protocols. Exercise protocols can be contraindicated for clinical high-risk populations. Instances where exercise tests are contraindicated, prediction equations have been useful to estimate CRF. PURPOSE: The purpose of this study was to determine the validity between a treadmill exercise test and a prediction equation used to estimate VO2max uses age, body mass index (BMI), resting heart rate (RHR), physical activity index (PA-1) and is specific to gender. Women: 70.77 - (0.244*age) - (0.749*BMID) - (0.107*RHR) + (0.213*PAI) Men: 92.05 - (0.327*age) - (0.933*BMID) - (0.167*RHR) + (0.257*PAI). Participants completed the BTT on a separate day as the WFL questionnaire. Participants were asked to complete the BTT to volitional fatigue. Heart rate, blood pressure, and VO2 were recorded. Pearson product-moment correlations, mean average percentage error (MAPE) values were large (18%). The correlation between the treadmill test and questionnaire was poor (-18.94 mL ∙ kg−1 ∙ min−1 to 10.99 mL ∙ kg−1 ∙ min−1). RESULTS: The results would suggest the WFL prediction equation is not a valid prediction for CRF. It is important to consider that the PA-1 is subjective and may not accurately represent the true physical activity levels of the participants in this study.
to attempt at least one of the 7 FMS tests, whereas all participants completed the MAPS assessment. A higher score on the FMS Deep Squat was related to a higher score on MAPS; however, given the 21% common variance, FMS and MAPS are not interchangeable. From a practical perspective, one cannot replace the other when assessing movement in older adults.

3431 Board #119 June 1 8:00 AM - 9:30 AM Impact of Short Cranks on 3-Min All-Out Cycling Test and Critical Power Metrics

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(No relevant relationships reported)

The 3-minute all-out cycling test (3MT) is a valid, practical, and time-effective method for determining Critical Power (CP) and intensities used in training and competition for cyclists. Changing the crank length (CL) on a bicycle may affect an individual’s ability to produce and/or maintain power output while cycling. A change in CP due to CL differences would lead to a change in the ability of the cyclist to maintain power output.

PURPOSE: To determine the impact of short crank arms on the metrics of the 3MT.

METHODS: A total of 9 recreationally trained male cyclists (27.6 ± 7.5 yrs.) participated in the study. Subjects completed an incremental cycle test on the metrics to determine VO₂max (37.4 ± 6.4 ml/kg/min; 366 ± 47 W) and gas exchange threshold (276 ± 59 W) to calculate the resistance for the 3MT. Session two consisted of a familiarization trial of the 3MT. For sessions three and four, subjects completed the 3MT using CLs of 145 (short crank, SC) and 175mm (normal crank, NC). CL was determined in a randomized counterbalanced format. T-tests were utilized to determine differences between outcome variables of the 3MT.

RESULTS: Peak power and peak cadence were significantly higher in the SC trial compared to the NC trial (SC 531 ± 116 vs NC 496 ± 113 W, p = 0.00; SC 168.9 ± 9.2 vs NC 157.6 ± 8.9 RPM, p = 0.00). The mean cadence over the last 30 sec of the 3MT did not differ between CLs (SC 93.4 ± 13.9 vs NC 93.0 ± 13.0 RPM, p = 0.79), but the average cadence speed over the same 30 sec was significantly slower in the SC trial compared to the NC trial (SC 1.41 ± 0.21 vs NC 1.70 ± 0.23 m/s, p = 0.00). CP (SC 287 ± 41 vs NC 287 ± 46 W, p = 0.97) and work above power (WEP) (SC 12.2 ± 4.0 vs NC 11.4 ± 3.4 kJ, p = 0.08) were not significantly different between CL trials.

CONCLUSION: CP was not different in the current study and demonstrated that changing CL by as much 30mm may not be a major factor in maintaining submaximal power output when position on the bike is maintained between CLs. However, individual differences among the subjects reveal changing CL could affect CP by up to 20 watts; some individuals performed better with 175mm while others performed better with 145mm. Cyclists should begin testing CLs to determine if a CL outside of the typically prescribed norms of within 2.5mm of 172.5mm could possibly benefit their performance and comfort while cycling.

3432 Board #120 June 1 8:00 AM - 9:30 AM Correlation Of Functional Movement Screen (FMS) And Mobility, Activation, Posture, Symmetry (MAPS) Among College Students

Annie G. Shirk, Michel J.H. Heijnen, Ann T. Shields, Minda Harvey, Cody Leviner, Sarah Noland, Jeremy Grissett, Brad Hollingsworth, Cameron Fitch, Brianna Auer, Emma Baer, Cassandra Berger, Victoria Grande, Laurel K. Koontz, Cassidy J. Smith, Morgan Sanderson, Brittni Moskus, Rebecca Edwards, Jeffrey Welch, Kenndiede Pate, Sierra McCoy, Sarah Cox, Michaela Tran, Claire Campbell, Wayland Tseh. University of North Carolina Wilmington, Wilmington, NC. (Sponsor: Dr. Robert Boyce, FACSM)

INTRODUCTION: Despite the growing popularity of functional assessment and corrective exercise prescription, there is limited research evaluating the correlation between two functional movement assessments: the Functional Movement Screen (FMS) and the Movement, Activation, Posture and Symmetry (MAPS). FMS is a commonly-used tool that takes approximately 20-25 minutes for a trained technician to subjectively score participants on 7 movements. MAPS is a novel assessment tool that takes about 45-60 seconds for a computer-based system to objectively score participants completing 1 movement. PURPOSE: To evaluate the relationship between FMS and MAPS among an apparently healthy, young adult population.

METHODS: Two hundred and nineteen participants (140 Females; 79 Males; Age = 19.5 ± 1.7 yrs; Height = 169.4 ± 10.1 cm; Body Mass = 68.5 ± 15.5 kg) completed FMS and MAPS within a single testing session. Pearson’s correlation coefficients were used to determine the relationship between FMS and MAPS, as well as FMS and the four individual MAPS components. RESULTS: A weak correlation was observed between FMS and MAPS (r=0.25, p<0.001). Furthermore, all individual MAPS components demonstrated a negligible to weak relationship with FMS (r=0.29, 0.11, 0.12, and 0.06 for Mobility, Activation, Posture, and Symmetry, respectively).

CONCLUSION: These findings suggest that FMS and MAPS are relatively independent of one another. From an applied perspective, one cannot replace the other in terms of evaluation. Future research will have to examine the value of MAPS as a tool to monitor improvements during exercise interventions.

3433 Board #121 June 1 8:00 AM - 9:30 AM Agreement And Reliability Between PowerTap™ Power Measurement Pedals And Velotron™ Load Generator Ergometer

Frank Plonka, Brandon Bastianelli, Andrea Workman, Stephen McGregor. Eastern Michigan University, Ypsilanti, MI. (Sponsor: Dr. Mark Peterson, FACSM)

(No relevant relationships reported)

Title: Agreement and reliability between PowerTap™ power measurement pedals and Velotron™ load generator ergometer

Author Block: Frank Plonka, Brandon Bastianelli, Andrea Workman, Stephen McGregor. Eastern Michigan University, Ypsilanti, MI.

Abstract: The PowerTap P1 pedal based power meter allows for measurement of power at the pedal/roller interface independent of crank or hub. This allows for the use of the measurement of power at the pedal to examine putative effects of changes in components such as the crank. The Velotron cycle ergometer is an extensively used ergometer for laboratory testing.

Purpose: To test the agreement between a portable pedal power measurement system (PowerTap; PT, Saris, WI) and Velotron (VCE, Racermate, WA) stationary ergometer. Additionally, to determine the test-retest reliability of PT relative to VCE.

Methods: 16 trained cyclists and/or triathletes consented to procedures approved by the EMU-HRSC, which consisted of three visits. For visit 1, subjects completed and incremental trial on VCE and using indirect calorimetry (Parvomedics, CO) to determine power and ventilatory threshold (pVT) and VO₂max. During visits 2 and 3, subjects warmed-up on VCE and then completed twelve, six-minute stages which consisted of pedaling at a given cadence while maintaining a power output equivalent to 70, 80, or 90 percent of pVT. The six min stages were randomized, power was measured at the pedal (PT), and the load applied by VCE. Linear regressions to determine agreement across power and intra-class correlations to determine reliability were performed using SPSS 24.0 (IBM, IL) with an alpha = 0.05.

Results: Across all absolute VCE power (125-305 watts), linear regression showed strong agreement (r2=0.94; p<0.001) between VCE and PT. Intra-class correlations showed strong agreement between tests (r=0.983; p<0.001). Overall, the ratio of PT/VCE was 0.98 and 0.97 and coefficients of variation were 5.6% and 4.1% for visits 2 and 3, respectively.

Conclusion: These results indicate that the PowerTap P1 power measurement pedal agrees strongly with the Velotron cycle ergometer and is reliable from a test-retest perspective. Therefore, a PowerTap pedal system can be used to evaluate the effects of component changes with the use of a Velotron ergometer.

3434 Board #122 June 1 8:00 AM - 9:30 AM Novel Crank with Elastomer Spring Improves Effective Power in Trained Cyclists and Triathletes

Brandon M. Bastianelli, Andrea Workman, Stephen McGregor. Eastern Michigan University, Ypsilanti, MI. (Sponsor: Dr. Mark Peterson, FACSM)

Email: bbastianelli@emich.edu

(No relevant relationships reported)

Purpose: Test claims a novel cycling crank (IMPACT, Huron Cycling, LLC) may increase effective cycling power. The crank incorporates an elastomer spring and is purported to return energy during the “dead spot” of the pedal revolution, thus improving the net transfer of external power.

Methods: 15 trained cyclists/triathletes (38 ± 7 y, 74.5 ± 9.9 kg, 174.7 ± 6.6 cm) consented to procedures approved by the EMU-HRSC. The study consisted of three visits. During V1, subjects performed a graded exercise protocol on a Velotron (Racermate, WA) cycle ergometer (VCE) to determine ventilatory threshold (VT) (Parvomedics, CO) and power at VT (pVT). During V2 and V3, subjects warmed-up on VCE then completed twelve, six-minute stages which consisted of pedaling at a 85 rpm while maintaining a power output equivalent to 70, 80, or 90 % of pVT. Additionally, a cadence effect was tested at 80% pVT at 75, 85 or 95 rpm. The six stages were randomized, and each stage was completed twice; i) with a pin in the crank (CON), ii) without a pin in the crank (IMPACT)
and ii) without the pin (EXP). The pin eliminated the spring effect of the elastomer, thus making a traditional rigid crank. There was a minute rest between each stage, except when changing from EXP to CON (3 minutes) to change the pin and allow subject to drink. The VCE was used as the external load generator and power was also measured at the pedals (PowerTap P1, Wi; PT) to determine if any difference in power between external load and power necessary to turn the cranks against the load was present. MANOVA statistical tests compared %pVT between PT and VCE and VO2 in both EXP and CON (α=0.05).

Results
Across all conditions, there was a Large effect for EXP power being 1.3 % lower than CON (p=0.001). Although not significant, there were small effects for cadence at 80% pVT, where EXP was lower than CON, but to a greater extent at 85 and 95 than 75 rpm (77.5 ± 2.8, 77.1 ± 3.6 and 78.5 ± 4.2 %, respectively, p=0.019). There was no significant difference between VO2 at each workload when expressed as a percentage of VOT between EXP and CON. There were no significant differences by trial for any variables tested.

Conclusion
Lower power, but similar VO2 during EXP compared to CON supports the notion that the IMPACT crank improves effective power during cycling. Although small in magnitude, the effect was large and could be of interest to competitive cyclists or triathletes.

### Vertical Jump Versus Kinematic Sequencing: Advanced Technology Doesn’t Always Enhance Appraisal

**PURPOSE:** To evaluate the effectiveness of Sparta data in predicting basketball performance. **METHODS:** We analyzed 37 basketball players from a D1 collegiate basketball program over a 4-year period (2013-2014 through 2016-2017). Each player’s vertical jump (VJ) was measured and tested on a Sparta force plate, which provides 3 proprietary outputs: Load, Explode, and Drive. On average, each player was tested 24.9 ± 20.3 times; there were 922 total observations evenly distributed over the 4 years and over year in school. The Sparta outputs were used to predict on-court performance of each athlete during each season that the values were collected via multiple linear regression analyses. The dependent variables were in-game statistics per 40 minutes of court time: points, rebounds, assists, blocks, and turnovers. **RESULTS:** Players played 19.3 ± 12.7 games per year. On average, they scored 12.8 ± 4.4 points, had 6.6 ± 2.7 rebounds, and turned the ball over 2.4 ± 1.0 times. Regression analyses found no significance with Load, Explode, or Drive in points per game, field goals per game, or assists per game. In each analysis all 3 Sparta outputs had negative associations that didn’t reach significance while VJ had a positive association that failed to reach significance. Load predicted rebounds per game (β=0.18; p<0.001) and blocked shots per game (β=0.03; p=0.021). Explode and Drive had non-significant negative relationships and VJ had a non-significant positive relationship. Explode (β=0.31; p=0.017) and Drive (β=0.304; p=0.011) predicted more turnovers per game, VJ predicted fewer (β=0.982; p=0.020), and Load had a non-significant positive association. Without controlling for the full Sparta profile, Explode associated with fewer rebounds (p=0.001) and more turnovers (p=0.020); it had no association with improvements in performance. **CONCLUSION:** Athletic programs are often quick to incorporate new technology believing that it equates to improved player assessment. More analyses are required before simple jumping analyses can be displaced by sophisticated equipment.

**Table 1. Physiological characteristics of amateur padel players.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36.4 ± 5.9</td>
</tr>
<tr>
<td>Lean (kg)</td>
<td>61.5 ± 7.5</td>
</tr>
<tr>
<td>SMM (kg)</td>
<td>33.0 ± 3.4</td>
</tr>
<tr>
<td>HRmax (beats/min)</td>
<td>179 ± 9</td>
</tr>
<tr>
<td>VO2max (l/min)</td>
<td>3.822 ± 0.611</td>
</tr>
<tr>
<td>VO2max (ml/kg/min)</td>
<td>48.8 ± 6.4</td>
</tr>
<tr>
<td>VO2max (ml/kg/min)</td>
<td>62.7 ± 6.3</td>
</tr>
<tr>
<td>AT (ml/kg/min)</td>
<td>33.2 ± 6.2</td>
</tr>
<tr>
<td>%AT (%)</td>
<td>68.3 ± 11.0</td>
</tr>
<tr>
<td>HRat (beats/min)</td>
<td>134 ± 21.8</td>
</tr>
</tbody>
</table>

**SD:** standard deviation; **AT:** anaerobic threshold; **%AT** and HRat indicate oxygen uptake, % of VO2max and HR at anaerobic threshold, respectively.

SM and number of stages were the main predictors of absolute VO2max (R² = 0.72, P<0.001); the equation was VO2max (l/min) = -0.0095 + 0.148 x SMM (kg) - Stage (number). The regression analysis utilized to determine an equation to estimate VO2max. The concordance coefficient correlation (ρc) was used to assess the accuracy of the equation. **Results:** Body composition and metabolic exercise variables are shown in table 1.
3438 Board #126 June 1 8:00 AM - 9:30 AM

Differences In Performance Traits In Intermittent Versus Continuous Exercise Testing Of Handball Players and Triathletes

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Moderate validity of endurance performance diagnostics may depend on type of sports. In order to reflect different load quality for the muscle specific endurance testing regimes have been developed for intermittent sports. Here we examined the influence of an intermittent versus a typical continuous step-wise progressive treadmill protocol on metabolic and cardiorespiratory parameters. **PURPOSE:** To determine if handball players (HB) in comparison to triathletes (T) show differences in typical submaximal lactate thresholds (LT and LT + 1.5 mmol), or in VO2max depending on either continuous or intermittent type of a step-wise progressive exercise testing.

**METHODS:** 13 HB and 13 T; mean (SD) age 24.7 ± 3.1 yrs height 184.2 ± 7.2 cm, weight 82.7 (10.8 kg) with a training load of 6.8 (3.1) h/wk in HB versus 8.8 (3.3) h/wk in T. Each subject performed two treadmill protocols within one week. First a typical step-wise incremental treadmill test (CTT) starting at 6 km/h increasing every 3 min by 2 km/h until exhaustion. Second a step-wise incremental intermittent test (IMT) with steps split into 6x15s load phase interlaced with 6x15s active recovery. Load phase started at 8km/h and was increased every 3 min by 2 km/h, while active recovery remained at 6 km/h throughout all steps until exhaustion. VO2max until exhaustion at LT, velocity at LT + 1.5 mmol/lactate (IAT). **RESULTS:** VO2max in ml/min/kg was not significantly different between sports and testing protocols (all 4 groups) with HB and T showing 11.9 (0.8) and 12.4 (1.3) for LT + 1.5 mmol/l for IAT. **CONCLUSIONS:** This project sought to determine if estimated mid-thigh whole muscle CSA and muscle fiber CSA increases following hypertrophy are puzzling and warrant further study.

3439 Board #127 June 1 8:00 AM - 9:30 AM

A Comparison of Techniques for Estimating and Detecting Changes in Skeletal Muscle Cross-Sectional Area

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Muscle biopsy and subsequent histological analysis of muscle fibers is a criterion technique for determining hypertrophy of skeletal muscle in resistance- and endurance-trained individuals. However, due to the training necessary to complete the biopsy, and the invasive nature of the biopsy itself, alternative methods for estimating muscle fiber hypertrophy offer increased ability to gather data discerning skeletal muscle hypertrophy. Furthermore, such procedures require less training and are noninvasive. **PURPOSE:** This project sought to determine if estimated mid-thigh whole muscle cross-sectional area (CSA) is related to muscle fiber CSA from muscle biopsies. **METHODS:** Twenty-nine resistance-trained men (age: 21 ± 2 yrs, weight: 83.6 ± 11.0 kg, height: 178.7 ± 8.1 cm) underwent six weeks of total-body resistance training. Muscle biopsies were taken from the Vastus lateralis prior to and following training. Mid-thigh circumference and skinfold measurements (anterior, posterior, medial, and lateral) were used to estimate whole muscle mid-thigh cross-sectional area using the methods of Moritani and DeVries. **RESULTS:** Whole-muscle CSA did not significantly differ from pre- (372.737 ± 37.401 cm²) to post-training (377.206 ± 29.474 cm², p = .0201). Muscle fiber CSA did not significantly increase from pre- (4068 ± 865 μm²) to post-training (4221 ± 704 μm², p = .368). Additionally, pre muscle fiber CSA did not correlate to pre-whole-muscle CSA (r = 0.029, p = 0.882). Also, muscle fiber CSA percent change did not correlate with whole-muscle CSA percent change (r = –0.064, p = 0.741). **CONCLUSIONS:** Estimated whole-muscle CSA and muscle fiber CSA do not appear to correlate well. A lack of a relationship between the changes in these measurements following hypertrophy are puzzling and warrant further study.

3440 Board #128 June 1 8:00 AM - 9:30 AM

Is Core Temperature Influenced by Triathlon Wetsuit Models When Swimming in Warm Water?

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Email: aurem1@unlv.nevada.edu

(No relevant relationships reported)

Swim-related fatalities have raised safety concerns in the sport of triathlon. As a majority of deaths occur during the swim, there are strict guidelines related to water temperatures and the use of wetsuits in triathlon events governed by USA Triathlon (USAT). Due to the varying water temperatures, athletes can select from a wide variety of wetsuit models. Two main categories of wetsuit models are sleevesless and full sleeve. The use of a wetsuit in warm water may increase body heat storage and may result in an increase in core temperature. However, there are no data investigating the influence of triathlon wetsuit design on core temperature when swimming in warm water. **PURPOSE:** The purpose of this study was to examine the influence of wetsuit design on core temperature responses during swimming in warm water (25 ± 0.5 °C).

**METHODS:** Three experienced triathletes (mean ± standard deviation (SD), age 48 ± 4.93 years, height 1.73 ± 0.09 m, weight 71.62 ± 8.54 kg) participated in the study. At least 8 hours prior to attending the test session, participants swallowed an ingestible core temperature pill. Before beginning the test session, core temperature (pre-determined) was transferred to the participant and sample rate was set to 0.1 Hz (1 sample every 10 s). Testing consisted of a self-directed warm-up followed by a 500-m swim in an indoor pool (set to either 25 or 50 m in length) for each condition: no wetsuit (NW), sleevesless wetsuit (SL), and full sleeve wetsuit (FS). Participants swam at a self-selected pace at a somewhat hard intensity (Borg Rating of Perceived Exertion = 13). Participants were required to rest until core temperature was within 0.5 °C of baseline before beginning the swim. Core temperature data were transferred to the monitor after each swim. Average Tc during the first and last minute of each swim was computed for analysis. A 2 (time) x 3 (wetsuit condition) repeated measures ANOVA was used (α=0.05). **RESULTS:** There was no effect on the YMCA bench performance. Because the test requires maximal effort, research, however, has debated the actual effects of music on performance, as well as the ergogenic effects vary with different music types, modes of exercise, intensities, and training status. One of the variations observed both in and outside the laboratory is exercise which is synchronized with the rhythm of the music. It is unclear how synchronous music affects maximal exercise testing when a cadence is required as part of the protocol, such as during the YMCA bench press test. **PURPOSE:** The purpose of this study was to investigate the effect of synchronous music on the YMCA bench press test. **METHODS:** Sixteen subjects (6 males, 10 females, 22 ± 1.4 years self reported being active or non-active according to ACSM physical fitness guidelines. Each performed a YMCA bench press test at a cadence of 60 repetitions per minute under two conditions: (1) using a metronome set at 60 bpm and (2) with pre-determined synchronous music with a beat of 120 bpm. The music condition was manipulated during the test session such that: (1) the music trial required a beat of 120 bpm to be counted by the music condition and (2) the metronome condition required a beat of 60 bpm to be counted by the metronome condition. There was no significant difference in the number of repetitions completed during the metronome condition (39.1 ± 22.3 repetitions) and the synchronous music condition (39.1 ± 23.1 repetitions, p=.99). There was also no significant difference in change in repetitions completed between active (0.5 ± 6.3 repetitions) and non-active subjects (1.0 ± 15.3 repetitions, p = .74). **CONCLUSION:** Synchronous music did not have an effect on the YMCA bench performance. Because the test requires maximal effort, it may be that the beneficial distraction often caused by music was muted by the high intensity required for the exercise.
Validity of a New Portable Metabolic Gas Exchange System

Holly L. McCung, Leila A. Walker, David P. Looney, William J. Tharion, Alexander P. Welleis, Heather M. Hansen, Adam W. Potter, Maxwell N. Rome, Christopher R. Chalmers, Reed W. Hoyt. US Army Research Institute of Environmental Medicine, Natick, MA; Oak Ridge Institute for Science and Education, Oak Ridge, TN. (Sponsor: Scott Montain, FACSM) Email: holly.l.mccung.civ@mail.mil

Valid and reliable methods to measure oxygen consumption (VO\textsubscript{2}) and carbon dioxide production (VCO\textsubscript{2}) are required in the assessment of exercise capacity and energy expenditure. However, research is often restricted by financial and portability issues with existing open circuit spirometry, metabolic cart or portable devices. **Purpose:** Evaluate a new, lightweight and scalable metabolic system (CO\textsubscript{2}/O\textsubscript{2}, Breath & Respiration Analyzer, COBRA) against a criterion metabolic cart system (Parvomedics TrueOne 2400, PARVO). **Methods:** Fourteen volunteers (13 male, 1 female; 24 ± 6 y (mean ± SD); 76 ± 11 kg BW; VO\textsubscript{2}max, 3.8 ± 0.7 L-min\textsuperscript{-1}) performed four identical trials over two laboratory test days. The COBRA and PARVO were used to monitor VO\textsubscript{2}, VCO\textsubscript{2}, and minute ventilation (Ve). Systematic bias was examined to assess the accuracy of the COBRA. **Results:** The COBRA and PARVO produced highly correlated measures of VO\textsubscript{2} (R\textsuperscript{2}=0.98), VCO\textsubscript{2} (R\textsuperscript{2}=0.98) and Ve (R\textsuperscript{2}=0.99). The COBRA had very low bias compared to the PARVO for VO\textsubscript{2} (0.01 ± 0.13 L-min\textsuperscript{-1}), VCO\textsubscript{2} (0.06 ± 0.13 L-min\textsuperscript{-1}), and Ve (2.12 ± 2.75 L-min\textsuperscript{-1}). COBRA was in high agreement (CCC=0.99) with the PARVO across each measure of VO\textsubscript{2}, VCO\textsubscript{2}, and Ve. **Conclusion:** The COBRA device is an accurate mobile metabolic system for measuring respiratory variables across a range of work intensities.

**PURPOSE:** To analyze the relationship between RPE scores from the OMNI scale and HR and RER during incremental exercise. **METHODS:** Twelve active military personnel (11 male, 1 female; 24 ± 5 y; height, 175±9 cm; body mass, 79 ± 14 kg) completed two trials over one test day. Each trial consisted of three exercise intensities (walk, jog, run) based on percentages of their maximal oxygen uptake (%VO\textsubscript{2}max) performed at baseline separated by a 20-30 minute rest between trials. Measures of RER were collected using a metabolic cart (ParvoMedics TrueOne® 2400), HR with a commercial chest belt monitoring system (Polar T31 Heart Rate Sensor), and RPE with the OMNI-walk/run scale (Adult OMNI Scale of Perceived Exertion 2004). **RESULTS:** The calculated Pearson’s correlation of coefficients for RPE was moderately correlated with HR (r=0.83) but weakly correlated with RER (r=0.47). The average RPE for walk (RPE, 2±1), jog (RPE, 4 ±1), and run (RPE, 6±1) increased with each higher work rate. **CONCLUSION:** The OMNI RPE Scale is moderately related to heart rate responses elicited by exercise, but is less correlated to changes in RER and therefore less indicative of the transition to greater reliance on glycolytic energy pathways. **DISCLAIMER:** The views expressed in this paper are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.
The U.S. Navy is transitioning from a culture of fitness testing to a more pervasive culture of functional fitness. The objective is to shift away from the current Physical Fitness Assessment, which evaluates general physical fitness levels and disease risk, toward more operationally relevant metrics of performance fitness and mission readiness. **PURPOSE:** To assess and down-select from 11 fitness tasks to 3-5 modalities for potential inclusion in an alternative Physical Readiness Test (PRT). **METHODS:** Forty-one active duty sailors (30 males; 11 females) completed traditional strength tests and 11 performance fitness modalities; the only modality that measured upper body strength and power—had a strong correlation with the 1 repetition maximum (1RM) bench press (r=0.79). Standing long jump (SLJ) evaluated lower body strength and power and had a moderate correlation with 1RM seated leg press (r=0.50) and 1.5 mile run (r=0.59). The repeated 300-yd shuttle run (300SR) demonstrated a plausible correlation with fatigue: VO2max (r=0.64) and was highly correlated to participants’ 1.5 mile run times on their most recent PRT. Forearm plank (FP) did not show significant correlations to traditional strength tests or previous fitness test scores (PRT), with the exception of a moderate correlation to PRT push-up scores (r=0.51). **CONCLUSION:** SMBT, SLJ, 300SR, and FP were the modalities recommended for inclusion in an alternative PRT. These new modalities evaluate more operationally relevant measures of performance fitness, thereby expanding knowledge of a sailor’s physical capabilities and or limitations. Future considerations should include a follow-on, large scale validation study to develop the appropriate norms and performance standards across gender/age brackets.

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**3446 Board #134 June 1 9:30 AM - 11:00 AM U.S. Navy Physical Readiness Test Modality Pilot Study**
Rebecca S. Weller1, Douglas M. Jones1, Katherine M. Wilson1, Andrew J. Oriol1, Dale A. Hirsch1, John J. Fraser2, Trevor B. Vibo1, Aaron J. Wolf1, Valerie M. Costantini1, Heath Clifford1, Jay H. Heaney1, Melissa D. Laird1. 1Naval Health Research Center, San Diego, CA; 221st Century Sailor, Millington, TN. Email: rweller223@gmail.com

**PURPOSE:** To determine the associations of combat exposure (CE) and traumatic exposure (TE), physical injury history, and bodily pain on functional movement (FM) outcomes. **METHODS:** Eighty-two male, active duty U.S. Navy Explosive Ordnance Disposal personnel (mean age ± SD = 34.0 ± 6.7 years) self-reported CE, FM characteristics (i.e., Functional Movement Screen [FMS]), and was highly correlated to participants’ 1.5 mile run times on their most recent PRT. Forearm plank (FP) did not show significant correlations to traditional strength tests or previous fitness test scores (PRT), with the exception of a moderate correlation to PRT push-up scores (r=0.51). **CONCLUSION:** SMBT, SLJ, 300SR, and FP were the modalities recommended for inclusion in an alternative PRT. These new modalities evaluate more operationally relevant measures of performance fitness, thereby expanding knowledge of a sailor’s physical capabilities and or limitations. Future considerations should include a follow-on, large scale validation study to develop the appropriate norms and performance standards across gender/age brackets.

**3449 Board #137 June 1 9:30 AM - 11:00 AM Ability to Predict Impending Volitional Exhaustion Based on Aerobic Capacity**
Dustin W. Davis, Jenna L. Carducci, Matthew J. Garver, Whitley J. Stone, Meera Penumetcha, Nicolas M. Philipp, Josie H. Hair, Jordan R. Ellended, Haley R. Williams, Matthew T. Oliphant, Zachariah S. Hopkins. University of Central Missouri, Warrensburg, MO. Email: dwdavis@ucmo.edu

**RESULTS**
- VO2max during session 1 (10.00 ± 2.46 min) was 47.0 ± 7.4 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 40.0 ± 18.5 s. No significant correlation was detected between VO2max and time to test termination after participants indicated they were 30 s from volitional exhaustion.

**CONCLUSIONS**
- Aerobic capacity did not affect the ability of healthy, recreationally active young adults to predict impending volitional exhaustion during maximal treadmill running.
- Time to test termination after the tap did not significantly change during a repeated trial.

**S548 Board #136 June 1 9:30 AM - 11:00 AM A New and Simple Prediction Equation For Health-Related Fitness: Use of Honest Assessment Predictive Modeling**
Peter D. Hart. Montana State University - Northern, Havre, MT. Email: peter.hart@msun.edu

**RESULTS**
- VO2max during session 1 (10.00 ± 2.46 min) was 47.0 ± 7.4 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 40.0 ± 18.5 s. No significant correlation was detected between VO2max and time to test termination after participants indicated they were 30 s from volitional exhaustion.

**CONCLUSIONS**
- Aerobic capacity did not affect the ability of healthy, recreationally active young adults to predict impending volitional exhaustion during maximal treadmill running.
- Time to test termination after the tap did not significantly change during a repeated trial.

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**3447 Board #135 June 1 9:30 AM - 11:00 AM Trauma Exposure Predicts Functional Movement Characteristics of Male Tactical Athletes**
Stephanie Coffin. Leidos/NHRC, San Diego, CA. Email: stephaniecoffin95@gmail.com

**PURPOSE**
- To determine the associations of combat exposure (CE) and traumatic exposure (TE), psychological salient factor, may influence FM characteristics. It is vital to understand psychological predictors of FM in tactical athletes to optimize performance and to help attenuate MSKI incidents. **METHODS:** Eighty-two male, active duty U.S. Navy Explosive Ordnance Disposal personnel (mean age ± SD = 34.0 ± 6.7 years) self-reported CE, FM characteristics (i.e., Functional Movement Screen [FMS], Y-Balance Test) were assessed by trained researchers, from which a composite functional status (CFS) measure was derived. Hypotheses were tested using correlational and multiple regression (causal) steps models. **RESULTS:**

- Unadjusted models, TE was inversely associated with FMS (r=−0.32, p=0.005) and CFS (r=−0.30, p=0.009). In adjusted models, these relationships were robust to the confounding influences of age and physical injury history as well as the mediating role of bodily pain. **CONCLUSION:** The primary objective was to determine if a correlation existed between VO2max and time to test termination after participants indicated they were 30 s from volitional exhaustion. A secondary aim was to ascertain if participants more accurately predicted impending exhaustion during a repeated trial. **METHODS:** Participants completed a familiarization trial to minimize learning effects and determine treadmill speed for maximal testing. During the familiarization trial, participants self-selected a zero-grade jogging speed associated with a value of 12-13 on Borg’s 6-20 RPE scale when steady-state. This speed was used during two maximal tests separated by 36-72 h. During maximal testing, grade was increased 2% every two minutes until volitional exhaustion. VO2max was measured as a 15-breath moving average via a metabolic cart. Participants were instructed before and during testing to tap on the treadmill when they perceived themselves to be 30 s from volitional exhaustion. **RESULTS**

- Thirteen (Females: 8, Males: 5) recreationally active individuals (20.7 ± 1.4 yrs., 72.4 ± 12.3 kg) completed the protocol. Mean VO2max during session 1 (10.00 ± 2.46 min) was 47.0 ± 7.4 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 36.2 ± 7.4 s. Mean VO2max during session 2 (10.08 ± 2.38 min) was 47.5 ± 7.7 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 40.0 ± 18.5 s. No significant correlation was detected between VO2max and time to test termination after the tap in session 1 (r = 0.032, p = 0.917) or session 2 (r = 0.315, p = 0.295). A dependent t-test (t(12) = 3.800, p = 0.039) did not reveal significant differences in time to test termination across the tap in both sessions 1 and 2.

**CONCLUSIONS**
- Aerobic capacity did not affect the ability of healthy, recreationally active young adults to predict impending volitional exhaustion during maximal treadmill running.
- Time to test termination after the tap did not significantly change during a repeated trial.

**S354 Board #132 June 1 9:30 AM - 11:00 AM The Relationship Between Health-Related Fitness and the Ability to Predict Impending Volitional Exhaustion**
Jay H. Heaney1, Melissa D. Laird1. 1Naval Health Research Center, San Diego, CA. Email: stephaniecoffin95@gmail.com

**CONCLUSIONS**
- Aerobic capacity did not affect the ability of healthy, recreationally active young adults to predict impending volitional exhaustion during maximal treadmill running.
- Time to test termination after the tap did not significantly change during a repeated trial.

**S472 Board #131 June 1 9:30 AM - 11:00 AM Physical Activity and Its Relationship to Health-Related Fitness**
Andrew J. Ordille1, Dale A. Hirsch1, John J. Fraser1, Trevor B. Vibo1, Aaron J. Wolf1, Valerie M. Costantini1, Heath Clifford1, Jay H. Heaney1, Melissa D. Laird1. 1Naval Health Research Center, San Diego, CA. Email: stephaniecoffin95@gmail.com

**RESULTS**
- VO2max during session 1 (10.00 ± 2.46 min) was 47.0 ± 7.4 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 40.0 ± 18.5 s. No significant correlation was detected between VO2max and time to test termination after participants indicated they were 30 s from volitional exhaustion. **CONCLUSIONS**
- Aerobic capacity did not affect the ability of healthy, recreationally active young adults to predict impending volitional exhaustion during maximal treadmill running.
- Time to test termination after the tap did not significantly change during a repeated trial.
The isometric midhigh pull (IMTP) has been shown to be able to predict change of direction (COD) ability. This is of interest for sports that require COD movements, as it could potentially be used to identify standouts athletes in their respective sports. However, no literature to our knowledge has assessed split stance isometric midhigh pull (SSIMTP) as a predictor of COD ability compared to the IMTP. **Purpose:** The purpose of this study was to determine whether SSIMTP is a better predictor of COD ability than the IMTP. **Methods:** Seventeen (12M and 5F) university aged participants completed the study. Mean height, weight, and age were 176±8.6cm, 172±24.2kg, and 22±3 years, respectively. Participants completed two sessions randomized in order that were two to five days apart; four trials of the SSIMTP (two trials per lead leg) and the other session involved two trials of the IMTP. Each day also consisted of four trials of the 505-gainy test. Two trials involved pivoting off of the left foot and two trials pivoting off of the right foot, which was randomized in order. **Results:** All results are Pearson Correlation Coefficients presented with their respective p-value. The combined peak force (PF) of the IMTP and the best 505-gainy time for the left and right foot had r values of -0.648 (p<0.09) and -0.464 (p<0.08), respectively. The r values during the SSIMTP condition were -0.722 (p<0.02) and -0.462 (p=0.07) when the leg is the lead leg and COD to the left and when the right leg is the lead leg and COD to the right, respectively. **Conclusion:** The main finding of this study is that the combined PF produced during the IMTP and the PF produced by the lead leg during the SSIMTP can both uniformly predict COD. For the SSIMTP condition, a strong inverse correlation exists between COD ability and the right leg when it is forward and a moderate inverse correlation between right COD ability and the right leg when it is forward. For the IMTP condition, there is a strong inverse correlation between the combined PF and COD ability to the left and moderate inverse correlation between the combined PF and COD to the right. Previous literature has found correlations between IMTP and COD ability anywhere between -0.47 to -0.89.

**During landing and pivoting movements female athletes have an increased lower extremity valgus alignment and knee abduction moment (KAM) making them four to six times more likely than males to sustain a sports-related, non-contact anterior cruciate ligament (ACL) injury. **Purpose:** To utilize a clinic-based ACL prediction algorithm developed by Myer, Ford and Hewett (2011) that determines the probability of high knee abduction moment (KAM) in Division III female soccer and basketball players. **METHODS:** Twenty female athletes were recruited (n = 10 basketball, n = 10 soccer players, this difference in KAM between the left and right leg was significant (p<0.05) during the 24-48h follow up visits, however the only one that was consistently lower across all 4 trials was concentric RFD (N/s/kg) (Pre v 24-48h post: Trial 1 = 36.03 ± 16.61 vs 20.64 ± 13.49; Trial 2 = 49.97 ± 32.29 vs 24.43 ± 21.87; Trial 3 = 50.45 ± 40.86 vs 27.59 ± 24.43; Trial 4 = 43.87 ± 32.37 vs 31.01 ± 29.41). No significant differences (p>0.05) were found for peak or average velocity during the MS across any trial. Lower body soreness was significantly greater (p<0.05) during the 24-48h follow up visits as assessed via a 0-10 visual analogue scale. The sprint protocol induced a high internal physiological load, evidenced by significantly elevated post-exercise blood lactate levels (pre: 5.10±0.50 vs post: 5.62±0.53). **CONCLUSION:** Concentric RFD determined using a CMJ was the best metric for detecting performance impairments, as it consistently declined 24-48h after completing a repeated sprint protocol. The other CMJ metrics, as well as MS performance did not decrease across all trials. A CMJ test that assesses concentric RFD may be a useful tool for coaches to determine readiness to train in female athletes. Future research should seek to replicate this protocol using higher sprinting volumes, to determine whether concentric RFD declines in a predictable dose-response manner. Limitations of this study were the small sample size and the lack of control for external damaging activity (i.e. rugby training). **Introduction:** Failure in elite sport climbing is associated with an inability to maintain isometric muscle contractions, the ability to supply adequate oxygen and utilise oxygen is the primary bioenergetic contributor to muscle contraction and can be examined locally using near-infrared spectroscopy (NIRS). Examining changes in NIRS derived muscle oxygenation (SmO2) has shown to be related to changes in performance output during gripping exercises. Purpose: The aim of this study is to measure SmO2 dynamics in a climbing specific test until task failure in varying conditions. Our prediction is that SmO2 should be a good marker to predict task failure. Methods: Eight elite level climbers performed a finger-hang test with four different intensities maintaining grip until voluntary exhaustion. During each trial SmO2 and time to failure (TTF) were measured. TTF was then compared to the minimally attainable value of SmO2 (SmO2min) and time to SmO2min (TTmin). Results: Two-one sided tests (TOST) resulted in SmO2min equivalence for the high intensity conditions (M = 21.9% SD = 5.0%; M2 = 25.4%; SD2 = 6.5%; M3 = 24.1%, SD3 = 5.9%), t(7) = 2.72, p = 0.015; t(7) = 3.85, p = 0.003, but failed to show equality for the fourth and lowest intensity condition (M4 = 32.4%, SD4 = 8.8%), t(7) = -1.01, p = 0.173. Equivalence was also found between TTmin and TTF for the high intensity conditions. Conclusion: The duration with which oxygen is extracted and utilised changes, while the attainable SmO2min remains constant at high intensity conditions and is related to the ability to maintain task performance.
Use of Traditional and Modified Functional Movement Screening to Predict Balance with Military Load

Eric M. Scudamore1, Sandra L. Stevens2, Dana K. Fuller3, John M. Coons3, Don W. Morgan, FACSM1, 2Arkansas State University, Jonesboro, AR; 3Middle Tennessee State University, Murfreesboro, TN.

PURPOSE: To determine if Functional Movement Screen (FMS) or modified Functional Movement Screen (mFMS) item scores predict dynamic balance scores of potential military recruits who wore a 24.2 kg military load.

METHODS: Thirty physically-active males and females who displayed anthropometric and physical fitness characteristics typical of military recruits entering basic training completed FMS and mFMS. Torso-loaded balance was assessed as loaded composite reach distance (LCR) and loaded overall stability indices (LOSI) measured using the Y Balance test and Biodex Balance System, respectively. RESULTS: FMS composite scores exhibited the strongest relationship with LOSI compared to other individual FMS items (p < 0.01). LCR was better in RT (p = 0.001) and ATH (p = 0.001) than in UT (p = 0.017). CONCLUSION: These findings indicate that both vertical jump and force plate biosequencing data may be useful predictors of water polo performance and could be employed to identify athletic capacities that need improvement.
Protocols for the prediction of maximal oxygen uptake (VO$_{\text{max}}$) on a cycle ergometer have been criticized for either being too long or aggressive for individuals of variable fitness and/or disease status. Current protocols typically increase workload by adding resistance to the flywheel at a fixed RPM. Increases in RPM rather than resistance later in the test may increase physiological efficiency, yielding a more valid prediction of VO$_{\text{max}}$. The purpose of this study was to design and validate a novel VO$_{\text{max}}$ protocol suitable for endurance athletes. Four-week increments based on the subject’s predicted heart rate reserve (HRR) in order to individualize the test protocol while adhering to well-documented VO$_{\text{max}}$ testing principles. Methods: Subjects included 12 females (20-27 y) who performed a VO$_{\text{max}}$ test using the new cycle ergometer protocol. Prior to testing, seat height on a Monark cycle ergometer was standardized with a 5-10 degree knee bend in the pedal-down position with the sole of the foot parallel to the floor. VO$_{\text{max}}$ blood pressure, rating of perceived exertion (RPE), and heart rate using ECG were measured at rest and throughout the cycle ergometer exercise test, as well as the assessment of signs and symptoms. Workload increases were based on pre-determined Incremental Target Heart Rates (ITHR) using HRR. Study commenced at a workload of 150 kg/min (0.5 kg; 50 RPM) and workload increased every 2 minutes by adding 0.5 kg or 1.0 kg resistance based on achievement of ITHR for each stage. When an ITHR representing ≥ 60% HRR was achieved, the workload increased by 10 RPM for each subsequent stage. Exercise tests were terminated when the subject could not maintain RPM or reached volitional exhaustion. Correlation between predicted (ACSM cycle equation) and measured VO$_{\text{max}}$ at peak workload was examined using Pearson’s r. Results: The range for measured VO$_{\text{max}}$ was 20.7 - 37.4 mL/kg/min and 23.29 - 37.57 mL/kg/min for predicted VO$_{\text{max}}$. There was a statistically significant correlation between predicted and measured VO$_{\text{max}}$ (r = 0.894; p < 0.001). Conclusion: This novel cycle ergometer protocol was demonstrated to be a valid predictor of VO$_{\text{max}}$ for the population tested. Further testing on other diverse populations is warranted.
3462
Board #150
June 1 9:30 AM - 11:00 AM
Do Physical Activity Behaviors Predict Fitness Gains To An Aerobic Exercise Trial?
Ryan J. Dougherty1, Elizabeth A. Boots2, Ozioma C. Okonkwo1, Dane B. Cook, FACSM. 1. University of Wisconsin - Madison, Madison, WI; 2.University of Illinois at Chicago, Chicago, IL. (Sponsor: Dane B. Cook, FACSM)

PURPOSE: Investigate whether baseline physical activity behaviors predict aerobic fitness adaptations following an individualized structured exercise intervention in an older adult population.

METHODS: Twenty-four cognitively healthy adults (age=64.8±6 years) from the Wisconsin Registry for Alzheimer’s Prevention participated in this study. Subjects were randomized to an individualized 6-month treadmill training program (3x week; 70-80% heart rate reserve) or a control group. Baseline and post-intervention measurements included a maximal exercise test and 7 days of physical activity monitoring via accelerometer. Aerobic fitness was defined as the highest oxygen consumption (VO2max ml/kg/min) value recorded during the exercise test and physical activity was defined as total minutes spent in moderate-vigorous physical activity. A repeated measure ANOVA design, adjusted for age, gender, APOE status, and BMI was used to examine changes in fitness. Bivariate Pearson correlations were used to investigate the relationship between baseline physical activity and baseline fitness across the entire group (n=24) and 2) baseline physical activity and changes in fitness (%ΔVO2max) within participants randomized to the exercise intervention (n=12).

RESULTS: For the entire sample, baseline physical activity was significantly and positively associated with baseline fitness (r= -.452; p=.026). Demonstrating the effectiveness of our trial we observed a significant group by time interaction for fitness (p=0.018; f2=0.260), participants randomized to aerobic exercise displayed on average, a 17.5% increase in their fitness level. This observed fitness adaptation was weakly associated to baseline physical activity behaviors (r= -.25).

CONCLUSIONS: Six-months of aerobic exercise training significantly improved fitness levels in our older adult population. As expected, baseline physical activity and fitness were positively associated. However, baseline physical activity did not predict aerobic fitness gains to a structured exercise training program. Future exercise trials with larger sample sizes are needed to determine whether it is necessary to recruit inactive participants.

3463
Board #151
June 1 9:30 AM - 11:00 AM
Body Composition Assessment Does Not Improve Prediction of VO2max Using a Yo-Yo Intermittent Shuttle Test
Sherry Barkley, FACSM, Brooke Bleeker. Augusta University, Sioux Falls, SD.
Email: sherry.barkley@augie.edu

The gold standard for determining aerobic fitness is VO2max testing, a time-consuming test which requires expensive equipment. The Yo-Yo Intermittent shuttle test is a field test purported to provide a more soccer-specific estimate of aerobic fitness, but its validity varies with the population being tested.

PURPOSE: To determine whether the addition of anthropometric measures and body composition data would strengthen the predictability of the Original Yo-Yo (YYO) test against the revised Yo-Yo (YYR) test.

METHODS: Yo-Yo R6 test data was used to compare the original (YYO) and revised (YYR) Yo-Yo formulas against the gold standard for determining aerobic fitness is VO2peak ml/kg/min. VO2peak was measured on a motor driven treadmill with gas analysis using a Parvomedics TrueOne metabolic system. The Yo-Yo test was performed as a group two days later. Regression analysis was used to determine which variables impacted the prediction equation, and correlation analysis was used to compare the original (YYO) and revised (YYR) Yo-Yo formulas against measured VO2max.

RESULTS: Analysis showed that the Yo-Yo distance (p = .00075) but not anthropometrics and body composition (p > 0.05) significantly impacted the VO2max prediction resulting in the following YYR formula: VO2max = (0.00574 x Yo-Yo distance (m)) + 30.952. Measured VO2max (45.2 ± 1.1 ml/kg/min) was correlated with predicted VO2max from YYR (45.4 ± 67 ml/kg/min, r = .58) and YYO (57.6 ± 98 ml/kg/min, r = .38).

CONCLUSION: The addition of body composition variables did not strengthen the ability of the Yo-Yo Intermittent shuttle test to accurately predict VO2max in women soccer players.

3464
Board #152
June 1 9:30 AM - 11:00 AM
Ability Of Oddvar-holton Diagram To Predict Repetitions Achieved At 60% And 80% Loads In Females.
Peter M. Magyari, FACSM,1 Caleb Williams2, Jeff T. Wight3, Mike Anton4, University of North Florida, Jacksonville, FL; 2LaGrange College, LaGrange, GA; 3Jacksonville University, Jacksonville, FL; 4Airrosti Rehab Centers, San Antonio, TX.

To determine the appropriate load for resistance training (RT), exercise professionals (EPs) commonly have clients complete one repetition maximum (1RM) testing. Then, submaximal loads can be easily estimated for RT sessions and expected repetitions can be determined utilizing published prediction tables. PURPOSE: To determine the ability of Oddvar Holton (OH) diagram to accurately predict repetitions achieved at 60% and 80% 1RM (load and order was randomized) for 8 cam-mediated variable resistance training exercises (bench press, leg press, shoulder press, pull-down, knee extension, knee flexion, elbow extension, and elbow flexion). First, for all 8 exercises, an error-score was calculated (for each individual) by comparing the actual number of repetitions completed to the OH 1RM prediction diagram. The OH predicted values for 80% 1RM and 60% 1RM were 11 reps and 30 reps, respectively. Then, for each exercise, the overall error score was calculated (mean error for all 19 subjects). A-t test was utilized to determine differences in mean error score between loads. RESULTS: For most exercises, the repetitions achieved deviated substantially from the expected repetitions (14 of 16 exercises deviated by 1 and more repetitions). These findings were most extreme at lower loads: 60% load error scores (11.9 ± 2.7 reps) were significantly greater (p < 0.01) than 80% loads error scores (3.9 ± 1.4 reps). Conclusion: Considerable variability exists among females in the repetitions achieved versus the repetitions predicted by OH. In all exercises, greater deviations from expected values occurred at lower loads.

3465
Board #153
June 1 9:30 AM - 11:00 AM
Maximal Oxygen Consumption Prediction Equation For Athletes Undergoing Cardiopulmonary Exercise Testing On A Treadmill Ramp Protocol
Rodrigo P. Silva1, Camila Duarte2, Cássia Campi2, Alan Barbosa1, Bárbara Gonçalves1, Evandro Sperandio1, Marcello Romiti8, Antônio Gagliardi2, Rodolfo Arantes1, Victor Dourado1, Federal University of São Paulo (UNIFESP), Santos, Brazil. 2Metropolitan University of Santos (UNIMES), Santos, Brazil.
3Angiopore Institute of Cardiovascular Medicine, Santos, Brazil.

PURPOSE: To develop an equation for predicting VO2max in athletes submitted to cardiopulmonary exercise test (CPT) using a treadmill ramp protocol. Secondarily, we evaluated the influence of the use of supplements on VO2max.

METHODS: 77 athletes were evaluated in a cross-sectional design. 65 percent of them were men (34.7 ± 7.9 years, BMI 24.7 ± 3.3) and 35 percent were women (36.8 ± 11.1 years, BMI 22.7 ± 2.5). The sample consisted of 66 percent of athletes practicing endurance sports, of which 55 percent were runners or triathletes. After participants answered an inquiry about the use of dietary supplements, time of practice and the weekly training volume, they underwent anthropometric evaluation, spirometry and CPT. CPT was performed on a treadmill using ramp protocol, where increments in speed and incline were empirically individualized. At least 14 mL/min/kg were added to the VO2max estimate of active performers so that the test lasted 10 minutes on average. Following univariate analysis, we evaluated the predictors of VO2max using stepwise multiple linear regression analysis.

RESULTS: BCAA (39 percent), creatine (13 percent) and why protein (43 percent) were the most frequent responses in the survey about the use of supplements. VO2max was 51.8 ± 9.2 and 44.1 ± 7.5 mL/min/kg for men and women respectively. In the univariate analysis significant correlations were found (p <0.05) between VO2max and age, sex, BMI, practice time, endurance sport modality, running practice, use of BCAA and use of creatine and supplements in general. In the multivariate model, running practice, age, BMI, sex, weekly training volume and supplement use in general together accounted for 68.4 percent of total VO2max variability. The equation was: VO2max (mL/min/kg) = 84.78 + (5.53 x running) - (0.39 x age) - (1.42 x BMI) + (8.05 x sex) + (0.21 x training volume) + (2.95 x use of supplements).

CONCLUSIONS: The developed equation accurately predicted VO2max and the supplement use in general represented a significant factor in VO2max variability.
The US Army Load Carriage Decision Aid (LCDA) is a planning tool composed of biomedical models that predict Warriorfighter physiological responses during dismounted operations. The LCDA’s metabolic model requires new equations to accurately predict the added metabolic cost of carrying varying types and amounts of military equipment.

**Purpose:** Develop an equation for the LCDA metabolic model that better predicts the metabolic costs of carrying backpack loads.

**Methods:** Thirteen studies in which volunteers walked while carrying heavy pack loads were obtained for analysis. Treadmill speeds ranged between 1.1 - 1.8 m·s⁻¹ with maximum pack loads exceeding 55% body mass. We used k-fold cross-validation to test how well the new model generalized to new data. Equivalence of predicted and measured metabolic rates was tested using the two one-sided t-test (TOST). We compared the new backpacking equation’s accuracy against the LCDA graded walking equation using the Concordance Correlation Coefficient (CCC).

**Results:** Predictions from the LCDA metabolic model were statistically equivalent to metabolic rates measurements during each step of the k-fold cross-validation (p < 0.05). Predictions from the new backpacking equation had a much higher correlation with measured energy expenditures (CCC = 0.93) than the existing LCDA graded walking equation (CCC = 0.44). The median absolute error was considerably lower for the backpacking equation (0.46 ± 0.36 kg·w⁻¹) compared versus the existing LCDA graded walking equation (1.61 ± 1.32 kg·w⁻¹).

**Conclusions:** The LCDA metabolic model accurately predicts the metabolic costs of backpacking. Military mission planners, backpackers, and trail walker can rely on improved guidance from the LCDA metabolic model for training, nutritional intake, and heat injury prevention.

**Abstracts were prepared by the authors and printed as submitted.**
The Freebounder™ Fitness and Rehab Machine consists of a spring-loaded platform attached to a metal frame and has characteristics similar to those of a mini-trampoline. The Freebounder™ purportedly reduced the impact forces on the lower body during an aerobic workout. PURPOSE: This study was designed to compare the ground reaction forces (GRF) and loading rate (LR) when subjects exercised on the Freebounder™ compared to walking and running on a treadmill and double leg-bouncing on a mini-trampoline. METHODS: Eighteen volunteers (9 M and 9 F) between 19-28 years of age completed 4 conditions, in random order: walking at 3.0 mph on a motorized treadmill, running at 6.0 mph on a motorized treadmill, double-leg bouncing on a mini-trampoline at 80 jumps/min, and double-leg bouncing on the Freebounder™ at 60 bounces/min. During all testing, plantar forces were collected using Loadsol in-shoe sensors. Data were recorded during the last 10 seconds of each trial, with 5 representative strides being analyzed for GRF and LR. RESULTS: The GRF (Freebounder™ = 564 ± 126.2, walking = 918 ± 232.5, mini-trampoline = 1415 ± 353.2, running = 1668 ± 395.4) and LR (Freebounder™ = 518 ± 260.2, walking = 5315 ± 1094.1, mini-trampoline = 7454 ± 1898.1, running = 14555 ± 1895.7) were significantly lower (P<0.05) when compared to walking and running on a treadmill and double-leg bouncing on a mini-trampoline. CONCLUSION: These findings suggest that the Freebounder™ is an excellent low-impact option for individuals looking for an alternative aerobic exercise modality compared to more traditional modes of exercise.

3471 Board #159 June 1 8:00 AM - 9:30 AM Effects of Whole Body Vibration Training on Muscular Strength and Balance Ability of Elderly Men Li Peng, Jie Zeng, Li Huang. South-West University, Chongqing, China. (Sponsor: Weimo Zhu, FACSIM) (No relevant relationships reported)

PURPOSE: As we age, various functional functions of our body such as muscular strength and balance ability will gradually decline. The decline of muscular strength associated with aging is a major cause of decreased balance ability and gait instability. The purpose of this study was to examine the effects of whole-body vibration training (WBVT) on muscular strength and balance ability of elderly men.

METHODS: 30 elderly men aged 60-79 years, who met the inclusion criteria, were recruited and randomly assigned into training and control groups. Training group carried out 12-wk WBVT at the same amplitude (3mm) and frequencies (25-30Hz) on the Power-Plate vibration platform, while control group had no any training. Muscular strength of back and knee, static and dynamic balance ability were measured respectively by portable digital muscle strength tester (microFET3, American) and dynamic balance assessment training system (Biodex-950-440, American) before and after the experiment. RESULTS: The core and lower extremity muscular strength of the subjects in training group were significantly enhanced after 12-wk WBVT, with the average increase of dorsal extensor muscular strength by 15.3% and extensor knee muscular strength by 7.8%; with the eyes open, the overall (1.93±0.49 vs. 1.70±0.27), left-and-right (1.71±0.42 vs. 1.57±0.51) static balance index decreased significantly and the overall (4.86±0.21 vs. 3.41±0.29), fore-and-aft (4.51±0.30 vs. 2.53±0.14), left-and-right (4.21±0.26 vs. 2.95±0.18) static balance index with the eyes closed also decreased significantly; the dynamic balance scores in the front (36.63±12.41 vs. 38.72±2.27), left (43.95±16.42 vs. 47.52±16.51) and right (44.34±14.92 vs. 47.39±18.91) enhanced significantly. Meanwhile, there was no obvious change in muscular strength and balance ability in the control group at the end of experiment. CONCLUSIONS: It was concluded that the core and lower extremity muscular strength as well as static and dynamic balance of elderly men could be improved with a 12-wk WBVT.

3472 Board #160 June 1 8:00 AM - 9:30 AM Energy Contributions of Short-distance Running with Change of Direction in Tennis Baseline Practice Bo Li, Xiaotian Li, Lu Jin, Yuchao Cao, Xinxin Wang, Lv Miao, Wei Yang, Yongming Li. Shanghai University of Sport, Shanghai, China. (Sponsor: Carl Foster, FACSIM) Email: 412001625@qq.com (No relevant relationships reported)

Short-distance running with change of direction (SR-COD) is one of the baseline practice regularity performed in tennis training, but the energy contributions of this practice is relatively lacking.

PURPOSE: To investigate the energy contributions of tennis SR-COD, with the emphasis on the duration, distance, and frequency. METHODS: 16 collegiate male tennis players (22.2 ± 1.7yrs, 173.2 ± 6.8 cm, 73.2 ± 6.1 kg) volunteered to this study. Two duration (1 and 2min), two distance (1 and 2min) and two frequency (20 and 30 stroke/min) were utilized, i.e. 1min-20stroke/min, 2min-20stroke/min, 1min-30stroke/min and 1min-30stroke/min. A portable spirometric system (K4b2, Cosmed, Italy) was utilized to measure the ventilatory activities. Capillary blood from earlobe was collected and analyzed with blood lactate analyzer (Biosen C-line, EKF, Germany) prior to and post the test. The aerobic (Aer), anaerobic lactic (Anl), anaerobic alactic (Aer) energy contributions were calculated with the method based on the accumulated oxygen uptake and blood lactate during the practice, as well as the first part of the oxygen uptake kinetics during the recovery, respectively. The relative energy contributions from the corresponding three pathways were also calculated as Aer%, Anl%, and Anl%.

RESULTS: The energy contributions of SR-COD was Anal 37.4–40.1kJ (32.1–41.7%), Aer 35.1–33.5kJ (14.8–30.4%) and Aer 37.6–100.8kJ (33.9–61.9%), respectively. With the increase of duration, distance and frequency, there was no significant change in Anal, there was significant increase in Anal and Aer (P<0.05, except Aer when increasing frequency). Further, %Anal decreased with the increase of duration, distance, and frequency (P<0.05), %Anl enhanced significantly with the increased distance and frequency (P<0.05), but declined insignificantly with increased duration (P>0.05). %Aer increased significantly with longer distance (P<0.05), but reduced with longer distance and higher frequency (P>0.05).

Conclusion: Longer duration of SR-COD mainly increases the stimulation on Aer system, while longer distance and higher frequency of SR-COD mainly increases the stimulation on Anal energy. These findings should be taken into account when designing the SR-COD training program in tennis.

3473 Board #161 June 1 8:00 AM - 9:30 AM The Effects Of Leg-drive On Bench Press Performance: Results Of A 5-week Training Study Jacob K. Gardner1, Kelsey L. Miller1, Justin T. Chia2, Brent Peterson1. 1Biola University, La Mirada, CA. 2Western Washington University, Bellingham, WA. Email: jake.gardner@biola.edu (No relevant relationships reported)

Among common resistance training methods, the bench press is often implemented to train upper body strength. Recently, curiosity regarding the potential impact of lower extremity involvement on overall bench press performance has gained in popularity. While the effectiveness of bench press training on strength has been shown in the literature, many suggestions as to the importance of leg-drive have been offered. Yet, to our knowledge, no studies have evaluated the impacts of leg-drive technique on bench press performance. PURPOSE: To determine if bench press training with leg-drive elicits similar strength characteristics to a standard bench press in strength and body fat measures after 5 weeks of bench press only training. METHODS: 23 apparently healthy, college-age men were randomized into two groups: standard bench press (STD) (n = 12, age 22.2 ± 2.3 yrs, height 173.2 ± 6.8 cm, mass 75.1 ± 7.5 kg), and leg-drive (LD) (n = 11, age 22.5 ± 1.9 yrs, height 176.8 ± 5.0 cm, mass 82.0 ± 10.4 kg). Pre and post analyses of bench press 1-repetition maximum (1RM), and changes in body fat percentage were conducted. Average bench-press volume was determined on a weekly basis. The training consisted of two sessions per week for five weeks of either standard bench press or bench press using leg-drive. For each session, participants completed four sets of bench press to volitional fatigue at 80% of his 1RM. During week three of training, a new 1RM was conducted to determine whether to move the participant up in weight. A 2 x 2 repeated measures ANOVA (RMANOVA) was conducted for 1 RM and body fat, and a 2 x 5 RMANOVA was conducted for average weekly lifting volume. RESULTS: Significant condition main effects were found with both groups experiencing an approximate 5% increase in 1RM strength (p-values < 0.001), and an approximate 0.5% reduction in body fat percentage (p = 0.040). A condition main effect was found for average lifting volume (p = 0.041) and post-hoc analysis revealed that week three was significantly higher than all other weeks. No significant group main effects were observed for any of the variables (all p-values >
0.05). CONCLUSIONS: Five weeks of bench press training did result in favorable strength outcomes for both groups, but leg-drive focused training did not produce noticeable changes in performance compared to the standard bench press.

3474 Board #162
June 1 8:00 AM - 9:30 AM
Effect of Vibration Intervention on Balance, Core Stability and Muscle Strength in Martial Arts Athletes
kun wang, junzhi sun. Chengu Sport Institute, Chengu, China. Email: 464535162@qq.com

(no relevant relationships reported)

Objective: To compare the effects of vibration training(V)and control training(C)on balance, core stability and muscle strength in young martial arts athletes. Methods: Fourteen athletes were recruited and randomly assigned to two groups: vibration group(V, n=7) and control group(C, n=7). Before and after the 12 weeks training, The SMART Balance Master system was used to measure scores in the limits of stability(LS): reaction time(RT), movement velocity(MVL), end point excursion(EPE), maximum excursion(MXE), and directional control(DCL). The core stability is indirectly evaluated by integrating electromyography(iEMG). Student t-tests were used for data analysis.

Results: the results indicated that vibration group had significant gains in movement velocity(MVL), end point excursion(EPE), maximum excursion(MXE), and directional control(DCL) compared to control group. RT and EPE were significantly smaller in vibration group than control group after 12 weeks of vibration training.

Conclusion: Vibration training improved balance, core stability and muscle strength in young martial arts athletes.

3475 Board #163
June 1 8:00 AM - 9:30 AM
Quantifying Training Loads During High-Intensity Functional Training Session: RPE Method
Justin DeBlauw. Kansas State University, Manhattan, KS. Email: jdeblauw@ksu.edu

(no relevant relationships reported)

High intensity functional training (HIFT), due to its constant variance and multi-modal approach presents a unique challenge in quantifying external loads. The session of perceived exertion (sRPE) method has been valid in determining training loads (TL) in a variety of sports. However, sRPE has yet to be psychometrically evaluated within HIFT. PURPOSE: To estimate the psychometric properties of the sRPE method within HIFT. METHODS: Ninety-six (65%) participants were moderately active men and women (n=65; age = 22.6 ± 3.5 years; body mass = 68.6 ± 13.0 kg; height = 178.8 ± 8.5 cm) and women (n=21; age = 21.0 ± 1.5 years; body mass = 70.5 ± 11.3 kg; height = 165.6 ± 5.7 cm) participated in six weeks (5 days a week) of HIFT. Heart rate was continuously monitored throughout each training session and rate of perceived exertion was recorded immediately following daily workouts completion. Daily TL was quantified using sRPE and compared to two heart rate-based criterion methods (i.e., Edwards’ TL and Banister’s TRIMP).

Results: the results indicated that sRPE had significant associations with both Edwards’ TL (n = 271, p < 0.001; R² = 0.10–0.27) and Banister’s TRIMP in group V and were generally poor. In training block 2 (weeks 4-6), these associations remained significant but also improved in their predictive capability for both Edwards’ TL (n = 268, p < 0.001; R² = 0.57–0.73) and TRIMP (n = 260, p < 0.005; R² = 0.45-0.62). In group C, the sRPE was not significantly correlated with the Edwards’ TL (n = 268, p > 0.05) or TRIMP (n = 260, p > 0.05).

Conclusion: sRPE was a valid tool across individual, group, and sex levels when compared to criterion heart rate and HR were generally poor. The percentage range was higher in group V (89% higher than C 45%). No significant differences were found in LS between the groups at 12 weeks of follow up. The full score of grade 8 abdominal stability was obtained in the vibration group, and the overall range was higher in group C than group V (p < 0.01). The scoring of core stability also revealed no differences between the groups. In group V left rectus abdominis iEMG value (nearly 100% mV/s, p < 0.01), left rectus abdominis (0.71 mV/s, p < 0.05) and left rectus abdominis anterior (0.39 mV/s, p < 0.05) were higher after 12 weeks training. In group C left rectus femoris (0.42 mV/s, p < 0.01), left tibialis anterior (0.12 mV/s, p < 0.05) were higher after 12 weeks training. After 12 weeks training, the iEMG value of left tibialis anterior (0.63 mV/s, p < 0.01), left rectus abdominis (0.34 mV/s, p < 0.05) in group V were higher than C. The core stability(LS): reaction time(RT), movement velocity(MVL), end point excursion(EPE), maximum excursion(MXE), and directional control(DCL). The core stability is indirectly evaluated by integrating electromyography(iEMG).

3476 Board #164
June 1 8:00 AM - 9:30 AM
Training Intensity Distribution In A Chinese Top-level Women's Single Sculls Rower Preparing For 2008 Olympic Games Season
Hongjun Yu1, Xiaoping Chen1, Wei Z1. Tsinghua University, Beijing, China. 2China Institute of Sport Science, Beijing, China. 3He Nan University, Kai Feng, China. (Sponsor: Carl Foster, FACSM). Email: yuhj12@mail.tsinghua.edu.cn

(no relevant relationships reported)

Purpose: This study was to report seasonal training intensity distribution characteristics in a Chinese top-level Women’s Single sculler during 2007-2008, while season preparing for 2008 Olympic Games. Methods: A Chinese top-level (33 y, height 177 cm, weight 71 kg) World Rowing Cup Champion Women’s Single Sculls rower participated in this case study. The season’s training load included overall duration (calculated in hours and km), frequency (calculated by overall sessions), and training intensity (measured by blood lactate and estimated by heart rate), Her performances at World Cup and Olympic competitions during the seasons, and 2000m ergometer test were also collected and analyzed. Results: A training program of 46 weeks (33 weeks of pre-season and 13 weeks of in-season) was analyzed. 193 training days was performed during the season. Total training hours were 737 hours. Total training time consisted of 48.9% on-water rowing (362 hours), 9.18% rowing (68 hours), 15.2% condition training (112 hours), and 18.4% warm-up and cool-down (129 hours). All training sessions were quantified using continuous heart rate monitoring, a subset of 117 training sessions were analyzed using blood lactate measurements. Intensity distribution across rowing and ergometer training hours (n=489 hours) based on heart rate analysis and blood lactate analysis was 91.12% in zone 1 (74.5% ≤2.0 mM blood lactate, 16.6% between 2.1 and 3.5 mM blood lactate), and 4.13% in zone 2 (>3.5 and 5 mM blood lactate) and 4.75% in zone 3 (over 5mM blood lactate). 2000m ergometer trials performed in weeks 2, 12 and 24 was in times 5 minutes 67 seconds, 5 minutes 55 seconds and 6 minutes 46 seconds, respectively. Maximal power test was 309 W, 313 W and 334 W, respectively. Rowing performance improved 1.29% and 6.27% during the period. She finished the season in 3rd place in the World Cup and fourth place in the 2008 Olympic Games. Conclusion: Training-intensity distribution with an emphasis on low-intensity training model led to the success in top Chinese top-level Women’s Single Sculls rower in the 2007-08 season. Possible mechanisms underlying the association between intensity distribution and performance success require further investigation.

3477 Board #165
June 1 8:00 AM - 9:30 AM
Impact of Workload on Time-Loss Incidence Rates in Elite Rugby Union Players.
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Rugby Union has one of the highest reported time-loss incidence rates of all professional team sports. However, the relationship between workload and time-loss incidence rate has not been well studied. PURPOSE: To investigate the impact of workload on time-loss incidence rates in elite Rugby Union players and compare different methods of workload quantification. METHODS: Sixty elite Rugby Union players were followed over one season (46 weeks) of competition. Workload was measured for all training and matches using subjective (RPE load; RPE x session duration) and objective (GPS, total distance and high-speed running (HSR) distance) methods and quantified using both the acute:chronic workload ratio (ACWR) and exponentially weighted moving average (EWMA). Chi-square analysis was used to examine the influence of workload on time-loss incidence rate. RESULTS: Of the 240 time-loss incidences that occurred across the season, 125 were contact injuries (106 during matches and 19 during training), 76 were non-contact injuries (25 during matches and 51 during training) and 39 were illnesses. Chi-square analysis showed that time-loss incidence rates were affected by ACWR RPE load (X2 = 12.3, p = 0.031), EWMA RPE load (X2 = 30.8, p < 0.01), EWMA total distance (X2 = 23.9, p < 0.01) and EWMA HSR distance (X2 = 18.0, p < 0.012), were yet unaffected by ACWR total distance (p = 0.067) and EWMA HSR distance (p = 0.894). EWMA RPE load and EWMA total distance exhibited an optimum range of 0.8-1.2 where actual time-loss incidence rate was lower than expected. Whereas for EWMA HSR distance values <1.0 led to a lower than expected time-loss incidence rate. ACWR RPE load had an optimum range of 0.6-1.2, whilst ACWR total distance and ACWR HSR distance did not affect time-loss incidence rates. CONCLUSION: This is the first study to compare different methods of workload quantification in elite Rugby Union and demonstrate that the EWMA method is better at explaining the variance in time-loss incidence risk compared to the ACWR method. When using the EWMA approach, an optimum range of 0.8-1.2 for RPE load and total distance and <1.0 for HSR distance demonstrated...
a reduced time-loss incidence rate. These findings suggest that the EWMA of each individual player should be monitored to minimise time-loss incidence risk in elite Rugby Union.

For collegiate football players, an outstanding performance at the NFL scouting combine or an athlete’s college pro-day may increase the likelihood of being drafted or signed to an NFL team. In recent years, it has become common for players to decline playing in bowl games to allow for additional preparation for combine and pro-day performance. PURPOSE: To determine if the duration of combine preparation training influences NFL Combine or Pro Day performance. METHODS: 23 college football players (22.6 ± 0.5 y, 108.8 ± 8.2 kg 1.88 ± 0.07 m) completed a preparation training program leading up to the 2018 NFL combine and college pro-days. Prior to training, all players were assessed in the 40yd dash, 225 bench press, 3-cone drill, pro-agility test, broad jump and vertical jump. Post-training values were obtained from the players combine or pro-day test data were then allocated to two groups: (1) athletes who completed 9–10 weeks of training (n=11) and (2) athletes who completed 6–8 weeks of the same training program (n=12). Combining training consisted of 4 resistance training sessions per week with position and test specific training occurring 6 days a week for the duration of the program. An analysis of variance with repeated measures was used to assess differences in training outcomes for each variable. RESULTS: Significant (p < 0.05) main effects for time were observed for improvements in 40-yard dash times (p = 0.046), 3-cone drill time (p = 0.002), along with 225 bench press repetitions, vertical jump height, broad jump distance, and pro-agility drill time (p = 0.001). There were no significant group by time interactions for any of the physical performance tests. Out of the 23 participants, 3 players were drafted and signed as practice squad contracts, while 5 other participants signed undrafted free agent contracts with various NFL teams. CONCLUSION: It appears that length of combine preparation did not produce significant differences in pro-day performance between the two groups. Therefore, NFL hopefuls can improve their combine performance even with a short duration combine training program.

Purpose: The aim of the study was to investigate the effects of suspension training in lower body muscle strength and balance in sedentary individuals. Methods: A total of 60 healthy, sedentary volunteer aged 30-45 years participated in this study. Participants were randomly divided into two groups that were suspension strength group (40.67±3.93 yrs) (SSG), and traditional strength group (TSG) (39.10±3.3 yrs). In SSG were applied suspension exercises 8 weeks, twice a week, 40-45 min. In TSG were applied traditional strength exercises 8 weeks, twice a week, 40-45 min. In both groups volunteers’ anthropometric, hand grip strength, push-up, static squat, crunch, plank and balance performances were measured before and after 8 weeks training programs. Results: As a result of the findings in this research which was made to determine the effects of suspension exercise on muscle strength development in sedentary individuals, suspension strength training studies differ from traditional strength training. At the end of eight-week strength training; all parameters in the suspension strength group and only squat (45.27±22.67 vs. 61.60±22.39, p<0.05), crunches (21.00±4.01 vs. 24.23±6.05, p<0.05), plank (54.73±19.47 vs. 58.53±23.76, p<0.05), flexibility (9.10±9.38 vs. 27.33±9.11, p<0.05) and balance (5.13±1.90 vs. 3.33±1.44, p<0.05) parameters were found significantly in traditional strength group. Conclusion: As a result, strength training (push-up, squat, crunches and plank) applied on unstable surfaces showed more improvement than traditional strength training. It is also thought that the suspension strength exercise method may be an alternative to force exercises and may be more useful for strength development.

Key words: Traditional Strength, Fitness, TRX

Unstable surfaces have been used to enhance the muscle activity (MA) in different strength and conditioning exercises. Some evidence supports that the unstable surface increases the motor unit recruitment and improves the neuromuscular coordination in order to maintain balance. Thus, an emerging trend is the utilization of suspension devices to increase the amount of instability.

Purpose: To examine the MA of the lower limb when perform a Bulgarian squat, suspended lunge and suspended lunge-Bosu. Methods: Seventeen physically active university students (age = 24±3.13, height = 1.78±0.06 m, weight= 74.99±9.39 kg) were recruited to perform a Bulgarian squat, suspended lunge and a suspended lunge-Bosu. The MA was assessed using sEMG on the front leg (FL) to measure the rectus femoris, RF (RF_FL, biceps femoris (BF), gluteus medius (Gmd), vastus medialis (VM), vastus lateralis (VL) and the RF of the rear leg (RF_RL). The activity of all analyzed muscle was expressed as percentage of maximum voluntary isometric contraction (%VMVC). A one-way repeated-measures ANOVA was carried out to determine the effect of exercise condition on MA.

Results: A main effect was found for exercise condition on muscle activation for RF_FL [F(3, 46) = 7.678, p = 0.002], BF [F(3, 46) = 4.076, p = 0.026], Gmd [F(3, 46) = 33.878, p = 0.000], VM [F(3, 46) = 3.508, p = 0.042] and RF_RL [F(3, 46) = 5.704, p = 0.008], except for VL [F(3, 46) = 2.346, p = 0.112]. The suspended lunge-Bosu showed a higher activation for RF_FL, Gmd, and VL (44.25±5.78, 66.50±4.84, 75.59±4.48, respectively) respect Bulgarian squat (RF_FL: 33.13±3.87, p=0.024; Gmd: 47.97±4.41 p=0.000) and suspended lunge (RF_FL: 33.86±3.82 p=0.006; Gmd: 47.89±3.21 p=0.000; VL: 63.87±4.69 p=0.041). However, the suspended lunge-Bosu reached a lower activity for RF_RL (25.98±2.60) in comparison with Bulgarian squat (RF_RL: 35.68±4.49, p=0.025).

Conclusions: These findings suggested that leaning the RL on the suspension device did not provoke the sufficient stimuli to increases the muscle demands of the FL, but adding the unstable device on the FL in a suspended lunge could be a challenge to
increase the MA. Funding for this project was provided by Secretaria d'Universitats i Recerca del Departament d'Empresa i Coneixement de la Generalitat de Catalunya i als Fons Socials Europeus.

### 3482 Board #170 June 1 8:00 AM - 9:30 AM Developing Muscular Power vs. Muscular Endurance: Results from Two Different Push-ups Training Programs

Austin McClinton, Istvan Kovacs, Wenhao Liu, FACSM. Slippery Rock University, Slippery Rock, PA. (Sponsor: Wenhao Liu, FACSM)

(No relevant relationships reported)

**PURPOSE:** While development of muscular power (MP) vs. muscular strength (MS) requires the use of different repetitions, weights, and movement velocity, push-ups involve overcoming constant resistance (body) weight and might be able to develop both MP and ME, especially among beginning trainees. This study examined whether two different push-ups training programs, one focusing on MP and the other on ME, would influence the development of MP and ME of the upper body differently among novice trainees.

**METHODS:** A six-week push-ups training with three sessions each week was administered to 46 college students (mean age: 21.36±1.67). Participants had limited experience in resistance training, and were randomly assigned to the MP group (MPG), the ME group (MEG), or the ME group (MEG), with each group having 14 males and 9 females. In each training session, the MPG performed six sets of ballistic plyometric push-ups with low (4-6 for females, 4-8 for males) repetitions at maximum velocity, and the MEG did six sets of regular push-ups with high (10-20 for females, 15-25 for males) repetitions. Two push-up tests were administered before (pretest) and after (posttest) the six-week training: (a) four consecutive ballistic push-ups for average flight height (T1), calculated from the flight time provided by a contact mat, and (b) regular push-ups for maximum repetitions (T2). The test results were compared within and between groups.

**RESULTS:** Paired-samples t-tests indicated significant within-group improvements in both push-ups tests (p < 0.05) in both groups. The MPG improved in T1 from 6.53±1.76 to 7.59±1.74 in., and in T2 from 26.63±13.31 to 30.08±18.93 reps. The MEG improved in T1 from 6.44±3.63 to 7.33±2.86 in. and in T2 from 23.13±13.31 to 26.9±11.10 reps. As for between-group comparisons, MANCOVA showed no significant differences (p > 0.05) in adjusted means in either push-ups test after controlling for pre-test differences: MP T1 = 7.48±1.74 vs. ME T1 = 7.06±2.87 in. (T1), and 29.01±8.93 vs. 27.39±11.10 reps. (T2).

**CONCLUSION:** While the two push-ups training programs each has a different focus (MP or ME), they have roughly the same results in developing both MP and ME. This may be related to the constant resistance (bodyweight) in push-ups, as well as the transfer effect between MP and ME in early stage of resistance training among novice trainees.

### 3483 Board #171 June 1 8:00 AM - 9:30 AM Actinin 3 Genotypes and Altitude Training

Orville Byfield, Rachael Irving. University of the West Indies, Kingston, Jamaica. (Sponsor: Melanie Poudievig, FACSM)

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(No relevant relationships reported)

Certain genotypes determine adaptation to certain exercise and can be used to monitor adaptability to training. **PURPOSE:** To gauge cardiovascular response by using oxygen saturation and heart rate change to determine adaptation to altitude training in athletes with 577RR/577RX and the 577XX genotypes. **METHODS:** Athletes who were previously genotyped for the actinin 3 genes were recruited for the study. Forty athletes consented to participate and were divided in two groups. One group participated primarily in running events (distances < 1000m (group M,n=5) and the other participated in running events ≤ 1000m (Group S,n=35). Each group was subjected to running up a steep slope of 5000m twice weekly for 12 weeks. Oxygen saturation was recorded using a pulse oximeter for each participant before the start of the 12 weeks and each 4 weeks up to 12 weeks. Blood pressure and heart rate values were recorded before the start of the 12 week trail and each 4 weeks up to 12 weeks.

**RESULTS:** Thirty five athletes had the 577RR or the weaker 577RX variant of the actinin 3 gene. Five had the 577XX genotype. Those with the 577RR and 577RX genotypes had no significant difference in their Spo2 values over 12 weeks (p>0.1). Their heart rate and blood pressure did not significantly decrease over 12 weeks (p>0.5). Group M athletes had significant increase in Spo2 values , heart rate and pulse rate also significantly decreased over 12 weeks (p<0.001).

**CONCLUSION:** Those with the 577XX genotype adapted better to altitude training than those with the 577RR and 577RX genotypes.

### 3484 Board #172 June 1 8:00 AM - 9:30 AM Effect of Progressive Unilateral Eccentric versus Concentric Training on Muscle Damage of the Contralateral Limb

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(No relevant relationships reported)

Muscle damage of the elbow flexors (EF) induced by maximal eccentric exercise (100%EC) is significantly less following the second bout of the same exercise performed at 1-28 days after the first bout by not only the ipsilateral EF but also the contralateral limb (CL-RBE). However, it is not known whether the magnitude of the CL-RBE of the opposite limb would be differently conferred if one limb received progressive unilateral eccentric training (PET) compared with progressive unilateral concentric training (PCT). **PURPOSE:** This study tested the hypothesis that a greater CL-RBE would be conferred upon the EF by PET than by PCT. **METHODS:** Untrained young men were placed into PET, PCT and control (CON) groups (n=8/group). Both the PET and PCT groups performed 5 sets of 6 contractions of the EF of one arm once a week for 5 weeks, in which the load was increased from 10 to 30, 50, 80 and 100% of maximal voluntary isometric contractile MVC), followed 1 week later by 5 sets of 6 100%EC. The CON group performed 100%EC with one EF, and repeated the 100%EC with the opposite EF 1 week later. MVC, range of motion, upper arm circumference, muscle soreness (SOR) and plasma creatine kinase activity were measured before to 3 days after each PET and PCT, as well as before and for 5 days after 100%EC. Changes in these variables after 100%EC were compared between groups by a mixed-design two-way ANOVA. RESULTS: The magnitude of increases in MVC for the trained (22%) and untrained arms (10%) after PET were greater (P<0.05) than after PCT (11%, 5%). Changes in all variables after 100%EC were smaller (P>0.05) for the PET group (e.g. MVC: -9% at 4 days post) compared with 100%EC for the PET group (-23%) and the first 100%EC of the CON group (-27%), without significant difference between the PET and CON groups. Changes for the PET group (e.g. peak SOR: 12 mm) were smaller (P<0.05) than those after 100%EC for the PCT group (34 mm) and after the second 100%EC for the CON group (25 mm), and changes in all variables after the second 100%EC for the CON group were smaller (P>0.05) than for the PCT group. **CONCLUSIONS:** These results supported the hypothesis and showed that the CL-RBE conferred after PET would be greater than that conferred after PCT. Supported by MOST, TAIWAN (MOST105-2410-H-003-052-MY3).

### 3485 Board #173 June 1 8:00 AM - 9:30 AM Comparison of Eccentric Utilization Ratio and Reactive Strength Index between Football Linemen and Backs

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(No relevant relationships reported)

Explosive generation of force is a fundamental component of many sports. Various jumping indices have become major indicators of player potential or for judging training improvement. However, there is limited information concerning these indices between college football players. **PURPOSE:** To compare two forms of reactive strength index (RSI) between college football linemen and backs. **METHODS:** Linemen (n = 12) and backs (n = 16) were tested for static jump (SJ) and drop vertical jump (DVK) on a force plate to determine flight time (Ft), ground contact time (GCT), and peak takeoff force (PTF). Peak landing force (PLF) was determined during DVK. Each player performed 2 trials of each jump with a 1-min rest between. RSI was calculated as a ratio of DVK to GCT (RSI-DVK/GCT) and MVC/FRC (RSI-MVC/FRC) with one fixed and set percentage. **RESULTS:** Linemen were significantly heavier (127.9 ± 7.8 kg) than backs (92.0 ± 7.8 cm) but the two were not statistically different in age (20.2 ± 1.3 vs 19.8 ± 1.6 yrs, respectively) or height (183.6 ± 6.0 cm, respectively). Reliabilities for GCT (ICC = 0.870), SJ Ft (ICC = 0.930), DVK Ft (ICC = 0.958), MVC (ICC = 0.952), and RSI were high. RSI was not significantly different between backs (2.75 ± 0.055) and Linemen (2.88 ± 0.039). RSI-1 and RSI-2 were greater in backs (1.26 ± 0.37 and 1.95 ± 0.42, respectively) vs. in linemen (0.77 ± 0.18 and 1.47 ± 0.23, respectively) with large effect sizes (ES = 2.78 and 2.11, respectively). RSI-1 (0.50 ± 0.98) was statistically greater than RSI-2 (1.74 ± 0.42), although highly correlated (r = 0.95). EURM was significantly higher in backs (0.91 ± 0.13) than in linemen (0.75 ± 0.14) with a large ES of 1.69. PLF/kg was not significantly different between linemen (47.2 ± 7.5 N/kg) and backs (49.5 ± 8.3 N/kg) but PTF/kg was significantly greater in backs.
MINIMALIST STYLE MILITARY BOOT DOES NOT IMPROVE WALKING ECONOMY UNDER LOAD IN TRAINED MALES

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MINIMALIST STYLE MILITARY BOOT DOES NOT IMPROVE WALKING ECONOMY UNDER LOAD IN TRAINED MALES

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Cortisol and Testosterone Awakening Response During Training in Elite Military Men


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(No relevant relationships reported)

Elite military training is highly stressful on the body and challenges the individual operator to maintain allostatics (i.e., the ability to adapt and recover from repetitive stressors). It is well understood that increased allostatic load, above that of allostasis, may lead to physiological imbalances in the hypothalamic-pituitary-adrenal (HPA) and gonadal (HPG) axes. However, it is not well understood if elite military training elevates allostatic load enough to disrupt the HPA and HPG axes. PURPOSE: To determine the cortisol awakening response (CAR)—an outcome metric of the HPA axis—and the testosterone awakening response (TAR)—an outcome metric of the HPG axis—over the course of a 9-month unit level training (ULT) cycle.

METHODS: Active duty, male operators (n = 37; age: 28.6 ± 3.8 years; height: 178.0 ± 5.3 cm; weight: 87.0 ± 8.6 kg) participated in this study. Operators were stratified into 3 groups based on age (20-26, 27-29, and 30-41 yrs). Daily self-administered saliva samples were completed by each operator at the time of Wake, Wake + 30 min, and Wake + 60 min post- and post-ULT cycle. All CAR and TAR data were calculated as area under the curve from the ground (AUCγ) Differences and interactions between age groups and days were examined using a 3 (age) x 2 (day) mixed effects model. RESULTS: There was a significant interaction between age groups and days for CAR (p < .0001) and TAR (p < .0001) AUCγ. Simple effects comparing differences in the CAR AUCγ from operators aged 27-29 yrs exhibited a 22.8% decrease in CAR following ULT (AUCγ: pre = 17.5 ± 7.2 vs. post = 13.6 ± 7.5, p < .01). Overall, CAR did not correlate with PSS scores (r = -.03, p > .2) and addition of the PSS score to CAR analysis did not alter the findings. There was a significant reduction in CSR post-intervention (19 ± 10 vs. 14 ± 11 mmHg, p < .02) however, this was not significantly different between groups (p > .05). PSS score did not change with the intervention (14 ± 7 vs. 13 ± 6, p > .05). There was a significant interaction between age groups and days for TAR (p < .03). Results indicate the middle-aged group (27-29 yrs) has a decrease in CAR over the 9-month ULT cycle compared with the younger and older age groups. Additionally, the youngest operators, aged 20-26 yrs, have the highest TAR, regardless of time point.

CONCLUSIONS: Various ratios indicating the ability of players to handle their body weight during explosive movements may be useful in classifying playing position and evaluating training improvement.

ECONOMY UNDER LOAD IN TRAINED MALES

D.W. Sharp1, M.T. Pace1, J.C. Swain1, R.T. Albino1, J.M. Green1, L.G. Killen1, H. Sayeed1, A. Niederberger1, M. T. Pace1, J. C. Swain1, R. T. Albino1, J. M. Green1, L. G. Killen1, H. Sayeed1.

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(No relevant relationships reported)

Walking Economy Under Load

In Trained Males

D.W. Sharp1, M.T. Pace1, J.C. Swain1, R.T. Albino1, J.M. Green1, L.G. Killen1, H. Sayeed1, A. Niederberger1, M. T. Pace1, J. C. Swain1, R. T. Albino1, J. M. Green1, L. G. Killen1, H. Sayeed1.

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RESULTS: Various ratios indicating the ability of players to handle their body weight during explosive movements may be useful in classifying playing position and evaluating training improvement.

The Effectiveness Of Neuromuscular Training Versus Traditional Training On Dynamic Balance In Athletes: A Meta-analysis

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(No relevant relationships reported)

Neuromuscular training has been viewed as an effective approach to improving dynamic balance through enhancement of unconscious motor responses in athletes. However, it is still unclear whether neuromuscular training is better than traditional training in improving dynamic balance through a systematic review and meta-analysis of the available research articles. Methods The meta-analysis was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Relevant articles were searched independently by two researchers through PubMed, web of science, Google scholar, CNKI, which was completed before September 2018. The randomized controlled trials involving the effects of neuromuscular training and traditional training on athletes’ dynamic balance were included. Results 6 RCT studies with 162 athletes met inclusion criteria for this review and were included. On average sessions went for 45 ± 20mins; 3 ± 2 times a week for 6 ± 2 weeks. Compared with traditional training, there was a significantly improve in Star excursion balance test (SEBT), the anterior (MD = 6.92 cm, 95%CI: 3.22 to 10.63), anteromedial (MD = 3.64 cm, 95%CI: 0.86 to 6.43), lateral (MD = 6.3 cm, 95%CI: 3.21 to 9.48), posterior (MD = 10.19 cm, 95%CI: 7.29 to 13.10), posteromedial (MD = 9.69 cm, 95%CI: 7.2 to 12.19) and posterolateral (MD = 7.5 cm, 95%CI: 1.81 to 9.69) scores of SEBT, respectively. There was a significant difference in Star excursion balance test (SEBT), the anterior (MD = 6.92 cm, 95%CI: 3.22 to 10.63), anteromedial (MD = 3.64 cm, 95%CI: 0.86 to 6.43), lateral (MD = 6.3 cm, 95%CI: 3.21 to 9.48), posterior (MD = 10.19 cm, 95%CI: 7.29 to 13.10), posteromedial (MD = 9.69 cm, 95%CI: 7.2 to 12.19) and posterolateral (MD = 7.5 cm, 95%CI: 1.81 to 9.69) scores of SEBT, respectively. No significantly differences in anterior (MD = 11.68, 95%CI: 0.03 to 23.38), medial (MD = -0.51 cm, 95%CI: -7.20 to 6.17) of SEBT between neuromuscular training and traditional training were found in the available research articles. Conclusions Neuro muscular training could be an effective training method for improving the dynamic balance of athletes in different sports and could be applied to athletes’ training programs. More attention is needed in future research on validating the effectiveness of neuromuscular training between different sports programs through large randomized controlled trials and exploring the underlying physiological mechanisms.

CORDIOVASCULAR STRESS REACTIVITY: DOES BASELINE PSYCHOLOGICAL STRESS MATTER?

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(No relevant relationships reported)

Cardiovascular stress reactivity (CSR) is associated with cardiovascular risk factors such as hypertension and carotid intima media thickness. It may also be influenced by baseline perceived psychological stress. Isometric handgrip training (IHGT) has been shown to reduce CSR in hypertensive adults, however, the impact of IHGT on CSR in normotensive adults is unclear.

PURPOSE: To examine the effect of IHGT on CSR in young, healthy males and to assess the potential influence of variability in baseline perceived stress across the intervention.

METHODS: Young, healthy male subjects were randomly assigned to a control group (n=11, 22±3 yrs) or IHGT group (n=11, 23±3 yrs). The Perceived Stress Scale (PSS) was administered and mean arterial pressure (MAP) was assessed during the Trier Social Stress Task. CSR was calculated as the difference in MAP from baseline to peak during stress. A single training session consisted of 4 alternating right and left 2 min isometric handgrip contractions (30% maximal voluntary contraction) and this was performed 5 days/week for 5 weeks. All measurements were performed before and after the intervention.

RESULTS: There was a significant reduction in CSR post-intervention (19±10 vs. 23±11 mmHg, p<0.02) however, this was not significantly different between groups (p=0.45). PSS score did not change with the intervention (14±7 vs. 13±6, p=0.56) or between training groups (p=0.16). Overall, CSR did not correlate with PSS scores (r=-0.03, p=0.2) and addition of the PSS score to CSR analysis did not alter the findings. However, there was a significant negative correlation between CSR and PSS scores of
Resistance exercise (RE) has been demonstrated as a superior modality for increasing muscle strength, muscle endurance, power, and motor performance. The sled used in this study is a novel device that provides a proportional increase in resistance with increased speed.

**PURPOSE:** To examine the impact of resistance on gait temporospatial parameters using a sled in healthy young adults while walking and running.

**METHODS:** Fifteen young adults (ages 21-35) were recruited to participate in this study. Mobility Lab sensors (accelerometers and gyroscopes) were placed on each subject at the chest, waist, and both wrists and ankles. Each participant performed three trials of 40 feet for the following conditions: self-paced walking (W), self-paced running while pushing the sled (Wp), and maximal speed running while pushing the sled (RP).

**RESULTS:** A repeated measures MANOVA was conducted to compare gait temporospatial parameters across conditions. Results indicate significant differences (P < 0.005) between all conditions for stride length, cadence, double support time, swing %, and stance %. Stride length decreased across all conditions: W (85±3.0), WP (66±4.1), and RP (56±7.0). Cadence decreased while WP (92±10.1) increased more than RP (149±14.9), compared to W (109±6.7). During resistance conditions (WP and RP) participants demonstrated greater gait cycle percentage in stance phase [[W, stance phase: 56±1.0, swing phase: 34±1.6] and [RP, stance phase: 57±0.7, swing phase: 42±2.7]] when compared to W (stance phase: 37±2.1, swing phase: 37±2.2).

**CONCLUSIONS:** Longer stance phase with a proportional increase in resistance could be utilized as a combined resistance and gait training tool as supposed to only gait training. This resistance as an intervention might be a viable option to improve the push off of patients with limitations such as neurological disorders. Future studies should focus on neuromuscular activation of the lower extremity, specifically the muscles involved in the gait cycle stance phase when walking or running with resistance.

**Board #178**

June 1 8:00 AM - 9:30 AM

**Pushing A Sled: Assessing Its Impact On Gait Temporospatial Parameters In Young Healthy Adults**

Martin G. Rosario1, Anesah Hyde2, Monica Mathis1, Stephanie Tinton1, Heather Taylor1, Chad Swank1. *Texas Woman’s University, Dallas, TX. Texas Woman’s University, Denton, TX.* (Sponsor: Alexis Ortiz, FACSM)

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**Board #179**

June 1 8:00 AM - 9:30 AM

**The Specificity of Muscular Coordination between Front Crawl Swimming and Dry-land Resistance Training Exercises.**

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**Board #180**

June 1 8:00 AM - 9:30 AM

**Effects Of Lower-leg Kinesio Taping On Ankle Strength, Foot Pressure And Balance**

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The use of kinesio tape among health care professional has grown recently in efforts to efficiently prevent and treat joint injuries. However, limited evidence exists regarding the efficacy of this technique in enhancing joint stability and neuromuscular control.

**PURPOSE:** To compare the effect of the lower-leg kinesio taping and traditional taping method on ankle strength, foot pressure and static and dynamic balance.

**METHODS:** In a double-blinded, randomized, crossover trial, and twenty healthy adults were applied lower-leg kinesio taping and traditional taping method for 1-week. The two taping methods were separated by a 2-week. All subjects were evaluated for isokinetic strength (plantar flexion, dorsiflexion, inversion and eversion of 30°/sec and 60°/sec), foot pressure during gait and static and dynamic balance.

**RESULTS:** Results showed that backward, leftward and rightward of dynamic balance were significantly increased in lower-leg kinesio-taping compared to CON (p < 0.05, respectively). Leftward and rightward of dynamic balance were significantly increased in traditional taping compared to CON (p < 0.05, respectively). However, no significant difference in the ankle strength, foot pressure and static balance were observed between the taping methods.

**CONCLUSIONS:** Both taping methods applications are recommended for improving dynamic balance ability. Further research might investigate how this affects participants with a history of injury.

**Board #181**

June 1 8:00 AM - 9:30 AM

**Effects Of Whole-body Electrostimulation On Concurrent Training Related To Explosive Strength, Anaerobic Power And VO 2 max.**

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(No relevant relationships reported)

Training programs typically involve the concurrent use of strength and endurance training sessions. Moreover, whole-body electrostimulation has also been used by athletes in the context of training programs to develop strength and physical performance. We postulate that the addition of whole-body electrostimulation (WB-ES) to concurrent training may improve explosive strength, anaerobic power and aerobic performance.

**PURPOSE:** To identify which of two concurrent training protocols-consecutive (weightlifting + HIIT) or simultaneous (WB-ES + HIIT)-is more effective in enhancing explosive strength, anaerobic power and aerobic performance in recreationally trained subjects.

**METHODS:** Twenty-two recreationally trained subjects (Age 20.08 ± 2.08 yr, Weight 72.49 ± 5.20 kg, BMI 22.23 ± 2.47 kg/m²) were randomized into 3 groups: Concurrent Consecutive (CC), Concurrent Simultaneous (CS) or Control Group (CG), who carried out 5 weeks of training 2 days per week. The CC group performed a circuit strength training of 4 exercises (bench press, front pull down, back squat and femoral curl); 4 x 8 reps 60-65% 1RM, followed by HIIT (4 x 4 min 90-95% maximal aerobic power with 3 min of recovery) on a cycle ergometer. Conversely, the CG group demonstrated temporal overlaps (TO) for each muscle. 2D data were collected during the propulsive (PRO) phase of FC and eccentric (ECC) and concentric (CONC) phase of BP and PU.

**RESULTS**

The individual results show little TO between FC and BP and FC and PU. Furthermore, FC and BP had significantly (P < 0.05) greater TO compared to FC and PU. The ratio of the ECC and CONC phase during the 3RM, BP and PU, show significant (P < 0.01) differences compared to the recovery (REC) and PRO phase of FC. Additionally, duration of time under tension during the CONC phase, of BP (P < 0.01) and PU (P < 0.01), was significantly higher than during the PRO phase of FC.

**CONCLUSION**

The EMG data shows different individual responses and little specificity between FC and BP and FC and PU. The targeted prime movers show little TO between FC and RT. These findings may question the validity of this method for assessing specificity, as it does not account for their dynamic nature. The lack of specificity between RT and FC shows further differences as the ratio and duration of time under tension of the RT compared to FC show significant differences. Velocity based training may be a viable method to target specific movement velocities and increase specificity.
completed the same HIIT training combined with a strength program with WB-ES (WiensPro, USA). Participants were evaluated in three moments; PRE, POST, and after a detraining period. Testing included Wingate test for anaerobic power, CMJ for explosive strength and an incremental maximal test for VO2max. Analysis was performed using two-way ANOVA with repeated measures. RESULTS: CS and CG increased mean power in Wingate test between all measurements (CC 471±87 W vs 562±77 W vs 553±70 W; CS: 457.74 W vs 566±112 W vs 563±105 W p<0.01). CMJ increased in CS from 33.42±11 cm to 34.00±10 cm and in DES (29.75±3.87 cm vs 33.68±4.48 cm p<0.05). However, CS group only improve CMJ after DET with respect to PRE measurement (28.40±3.78 cm vs 30.94±3.82 cm p<0.05). No differences were found in VO2max. CONCLUSIONS: Concurrent training is more effective at improving lower-limb explosive strength, however both concurrent training protocols are effective at improving anaerobic power even though concurrent simultaneous protocols take half the time to complete. Supported by CTS036 GR18

3494 Board #182
June 1 8:00 AM - 9:30 AM
Improving Shoulder Internal Rotation Motion of In-season Throwing Athletes: A Randomized Controlled Trial
David Roskin1, Kimberly Keyser1, Christina Alperi1, Heather Myers1.1Duke University Health System, Durham, NC. 2North Carolina School of Science and Mathematics, Durham, NC. (No relevant relationships reported)

PURPOSE: Throwing athletes commonly experience loss of shoulder internal rotation (IR). This adaptation, when combined with compromised resting posture, has the potential to increase risk of rotator cuff and biceps tendinopathy, labral tears, and elbow injuries. This study investigated the effectiveness of two methods prescribed to restore IR: the Sleeper Stretch (SS), which aims to stretch the capsule, and the Balloon Blow (BB) which aims to optimize breathing, posture, and scapular stability. Because the BB is less stressful to the shoulder joint, it may be a superior alternative. We hypothesized that when using the BB, IR would be increased either as effectively, or more so, than the SS.

METHODS: Healthy in-season baseball and softball players were randomly assigned an intervention (BB or SS) to the dominant arm 2x/day for 5 consecutive days. After a 2-week period of no intervention, both groups crossed over and performed the alternate intervention. IR was passively measured in supine at baseline, immediately after a throwing session on day 1, after intervention on day 1, and prior to practice on days 2-5. On the last day of the study, each subject was asked if he/she had a preference for either exercise. Statistical analysis for comparisons of differences in IR among intervention type (SS and BB) were performed using an analysis of covariance (ANCOVA) for the 6 instances as listed above. Statistical significance was set a priori at α≤0.05.

RESULTS: 12 softball players (17.49 ± 0.63 yrs.; BMI 28.40±3.78 cm vs 33.68±4.48 cm p<0.01). However, CS group only improve CMJ after DET with respect to PRE measurement (28.40±3.78 cm vs 30.94±3.82 cm p<0.05). No differences were found in VO2max. CONCLUSIONS: Concurrent training is more effective at improving lower-limb explosive strength, however both concurrent training protocols are effective at improving anaerobic power even though concurrent simultaneous protocols take half the time to complete. Supported by CTS036 GR18

3495 Board #183
June 1 8:00 AM - 9:30 AM
The Influence Of Previous Training Intensity On The Rating Of Perceived Exertion
Jos J. de Koning, FACSM1, Ios de Haan1, Carl Foster, FACSM1. 1Vrije Universiteit, Amsterdam, Netherlands. 2University of Wisconsin - La Crosse, La Crosse, WI. Email: j.j.de.koning@vunl.nl (No relevant relationships reported)

A discrepancy between coach- intended session-intensity, and the intensity as experienced by the athlete has been found in many sport settings. To avoid deconditioning as well as non-functional overreaching, it is important that athletes execute and perceive the training as prescribed by the coach. PURPOSE: The aim of this study is to find an explanation for the difference between intended and perceived RPE (dRPE). METHOD: Thirteen athletes completed 1392 training sessions. Athletes and coach rated each session on BORG-CR10 scale (RPE). dRPE was calculated as athlete’s RPE minus coach’ RPE. Linear regression was used to analyze the relation between dRPE and the average RPE from, respectively, the previous 1, 2, 3, and 7 days. RESULTS: A weak correlation was found between the coach intended RPE and athlete executed RPE (r = 0.302, P = 0.01). Mean dRPE was 0.51 (sd = 2.07). Easy sessions (RPE < 4.8) were underestimated by the coach, and harder sessions (RPE > 4.8) were overestimated by the coach. A significant linear regression was found between dRPE and all 4 predictor variables. CONCLUSION: This study demonstrates evidence for dRPE to be influenced by the intensity of training sessions during the previous days. Intended intensity has shown to be overestimated when previous days were of low intensity and underestimated when previous days had a severe intensity. This information might help the coach to adjust the program and avoid these problems in advance.

3496 Board #184
June 1 8:00 AM - 9:30 AM
The Effects of 12-week Yoga Practice on Flexibility and Dynamic Balance of Female College Students
Siu Kuen NG. The Chinese University of Hong Kong, Hong Kong, China. Email: sarobert1218@gmail.com (No relevant relationships reported)

The effects of 12-week yoga practice on flexibility and dynamic balance of female college students

INTRODUCTION: In recent years the practice of yoga has gained popularity as a means to improve health, sports performance and psychological wellbeing. PURPOSE: The aim of this study was to evaluate the effects of a 12-week yoga intervention on flexibility and dynamic balance of female college students.

METHODS: A one-group pretest-posttest design was employed. Seventy females (20.8 ± 1.9 years; 1.62 ± 0.15 m; 54.2 ± 9.6kg; BMI 21.2 ± 3.18 kg·m-2) attended yoga practice for a total of 12 weeks, consisting of one 90-min session per week. All participants have no previous experience on the Star Excursion Balance Test (SEBT) and yoga practice. Lumbar and hamstring flexibility and dynamic balance were assessed using the sit and reach test and SEBT before and after 12-week intervention. Participants performed the anterior (ANT), posterior lateral (PL), and posteromedial (PM) reach directions of both legs in the SEBT.

RESULTS: A statistically significant increase in post-intervention normalized reach distances from 4.5% to 9.9% was seen in all directions of both legs. Results of paired sample t-test also displayed a significant normalized reach distance difference before and after the intervention. Left leg: (ANT: 76.8 ± 9.9% versus 67.0 ± 13.1%; t(69)=5.78, P<0.01; PL: 88.0 ± 11.8% versus 81.4 ± 17.3%; t(69)=3.29, P<0.05; PM: 91.2 ± 10.9% versus 86.7 ± 17.6%; t(69)=2.23, P<0.01; Right leg: (ANT: 75.2 ± 10.8% versus 68.0 ± 16.6%; t(69)=3.25, P<0.01; PL: 86.6 ± 10.5% versus 83.7 ± 17.4%; t(69)=3.17, P<0.01; PM: 92.3 ± 11.1% versus 85.9 ± 17.2%; t(69)=2.54, P<0.05). The increase in flexibility was observed after the intervention (39.3 ± 5.8cm versus 37.8 ± 6.5cm; t(69)=6.44, P<0.01).

CONCLUSIONS: The dynamic balance ability and flexibility of the female college students were significantly enhanced after 12-week yoga intervention.

3497 Board #185
June 1 8:00 AM - 9:30 AM
Original Mat Pilates in Classic Ballet: A Case Study
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Abstract
Dance is an art form in which it is necessary to develop various physical abilities because for a ballet dancer to achieve high performance it is necessary to acquire technical, athletic and aesthetic capacities so that the movements flow in a coordinated way and without apparent effort. To generate positive effects on the performance, it is necessary to complement the training program with a method that maintains the technical ballet characteristics and principles. One type of training is the Mat Pilates method.

PURPOSE: To verify the effect of a training periodization with the original Mat Pilates on the performance of strength and flexibility in a ballerina.

METHODS: A female ballet dancer (age: 19 yrs; height: 1.54 m; body mass: 56 kg; BMI: 23.6 kg·m-2), without lesions, was submitted to the Mat Pilates method during 8 weeks, with a duration of 1 hour per training session, performed 2 times a week with a 48-hour interval between the sessions. The pre- and post-intervention tests were: strength and resistance abdominal test, isometric test of the column extensor, sit and reach, My Jump, and hip flexion with extended knee.

RESULTS: The highest post-intervention response value was for the abdominal resistance test, possibly because the exercises of the Mat Pilates contemplate this musculature. However, the jump test showed a negative post-intervention response (Table 1).

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit and reach</td>
<td>12.5 cm</td>
<td>9.0 cm</td>
</tr>
<tr>
<td>My Jump</td>
<td>40 cm</td>
<td>30 cm</td>
</tr>
</tbody>
</table>

Table 1. Results of the pre- and post-intervention tests.
CONCLUSIONS: The original Mat Pilates Method applied in the present study potentiated the increase in the flexibility, abdominal and lumbar resistance and strength levels, but did not influence the performance of the vertical jump. New studies are suggested with a greater number of participants, with Pilates exercises in machines, in both sex ages and with subjects of other sports and artistic modalities.

Coaches are responsible for designing training sessions to optimize athlete progression while decreasing the incidence of treatments and fatigue by monitoring training loads. Training loads (TL) consist of the external load (work done by the athlete) and internal load (athlete’s perceived intensity of that work). Multiple methods are used to monitor both external and internal TL’s such as the utilization of heart rate, lactate concentration, rate of perceived exertion (RPE) and training session duration (Gabbett et al, 2004). Among NCAA Division II athletics, monitoring team training loads necessitates a cost-effective method, like that of RPE and session duration. Purpose: To determine the relationship between cumulative training load, and number of visits to the Athletic Trainer for treatments, in a Division II women’s swimming team. Methods: For one season, twenty-four collegiate female swimmers (mean ± SD, age 20.2 ± 1.23 years; height 169.03 ± 6.18 cm; mass 68.7 ± 8.87 kg) were surveyed after each practice and competition, and asked to report the date, the duration of training in minutes and the session rate of perceived exertion (RPE) for that session. TL was calculated as the product of the RPE and training session duration and reported as arbitrary units (au). All treatments (visits to the athletic trainer) were recorded by the athletic trainer, ranging from a cosmetic treatment (ice pack) to a soft tissue injury. TL’s were averaged daily across the whole team, and a weekly cumulative TL was compared to total treatments for that week. The relationship between TL’s and number of treatments was examined using a Pearson correlation.

Results: On average the athletes recorded weekly an average TL < 4000 au. A weak negative correlation was found between TL’s and treatments, possibly contributing to a latent increase in treatments after consecutive high TL’s (>4000 au) is expected based on the cumulative load theory and may explain the negative correlation between TL and treatments over the entire season.

## Table

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pre-test</th>
<th>Total Test</th>
<th>% Post-test</th>
<th>Result (%)</th>
<th>Absolute Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat and Reach</td>
<td>30</td>
<td>40</td>
<td>133.3</td>
<td>33.3</td>
<td>10</td>
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<tr>
<td>Abdominal</td>
<td>20</td>
<td>30</td>
<td>150.0</td>
<td>50.0</td>
<td>10</td>
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<td>Lumbar hyperextension</td>
<td>4</td>
<td>5</td>
<td>125.0</td>
<td>25.0</td>
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<tr>
<td>Hip flexion (right)</td>
<td>90</td>
<td>110</td>
<td>122.2</td>
<td>22.2</td>
<td>20</td>
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<tr>
<td>Hip flexion (left)</td>
<td>100</td>
<td>130</td>
<td>130.0</td>
<td>30.0</td>
<td>30</td>
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<td>Jump height (cm)</td>
<td>17.12</td>
<td>19.0</td>
<td>110.9</td>
<td>10.9</td>
<td>1.9</td>
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<tr>
<td>Flight time (ms)</td>
<td>351.33</td>
<td>393.0</td>
<td>111.9</td>
<td>11.9</td>
<td>41.7</td>
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<tr>
<td>Velocity (m/s)</td>
<td>0.86</td>
<td>1.0</td>
<td>111.6</td>
<td>11.6</td>
<td>0.1</td>
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<td>Force (N)</td>
<td>1527.30</td>
<td>1345.4</td>
<td>88.1</td>
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<td>-181.93</td>
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<tr>
<td>Power (W)</td>
<td>1322.60</td>
<td>1298.7</td>
<td>98.2</td>
<td>-1.8</td>
<td>-23.86</td>
</tr>
</tbody>
</table>

**Purpose:** The purpose of this study was to investigate the effect of core strength training (CST) on core endurance, dynamic balance and agility in collegiate korfball players.

**Methods:** Twenty-two college students (age = 20.9 ± 1.4 years; height = 179.8 ± 8.9 cm, weight = 72.4 ± 12.2 kg) were randomly divided into two groups as training group (TG, N=11) and control group (CG, N=11). The TG completed CST twice a week, for 8 weeks. The CG trained according to the original plan. Star Excursion Balance Test (SEBT), Illinois Agility Test, and the core endurance tests were used to evaluate all subjects. Paired sample T-test and factor analysis were used as data analysis.

**Results:** There were significant increases in core endurance tests (t=−7.5, p<0.05) and direction of SEBT (t=−3.1, p<0.05) after the experiment in the TG. However, no significant change was observed for agility (t=0.9, p>0.05). In addition, there were significant increases in core endurance tests (t=−4.7, p<0.05), no changes in the directions of SEBT (t=0.8, p>0.05) and agility (t=1.3, p>0.05).

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3501 Board #189 June 1 8:00 AM - 9:30 AM Results of a Six Week Training Protocol for Dancers to Achieve Pointe (Toe Shoe) Readiness

Marijeanne Liederbach1, Kristen Stevens1, Emily Sandow1, Karl Orishimo2, Ian J. Kremenicki3. 1’NYU Langone Orthopedic Hospital, New York, NY. 2Lenox Hill Hospital, New York, NY. (Sponsor: Malachy P. McHugh, PhD, FACSOM)

Email: marijeanne.liederbach@nymc.org

No relevant relationships reported

PURPOSE: It is estimated that 2 million children study dance each year in USA public schools alone, and that more than 35% of all adolescent girls participate in some form of dance training. Their most common injury is ankle sprain, with recurrence as high as 80%. This study aimed to test the efficacy of a six-week, pre-pointe (toe shoe) progressive training program that, if effective, would subsequently be put into a 3-year prospective epidemiologic study examining the intervention’s effect on ankle sprain rate. METHODS: 16 pre-pointe students, (average age 11 yrs), at a professional ballet school assented, (along with parent/guardian consent), to participate. Three motor control-based concepts were incorporated into a 50 minute progressive exercise class taught twice per week for 6-weeks. The motor control principles underlying all of the exercises were: 1) identification and maintenance of trunk-heel neutral; 2) appropriate weight shift; 3) dissociation of the limbs from the trunk. Tests of lower extremity and trunk strength were assessed using hand-held dynamometry and Kendall methods. Four functional tasks, (single leg eyes-closed balance; topple; airplane and sauté tests), were assessed along with one IMU-based jump task. Jump height and GRF were estimated using an inertial sensor (BTS G-Sensor, Brooklyn, NY). The sensor, worn in a pouch on a velcro belt wrapped around the dancer’s trunk at umbilicus level, contained a triaxial accelerometer, gyroscope and magnetometer and connected wirelessly via Bluetooth® to a computer. Based on the accelerations measured by the sensor and the weight of the subject, several parameters were estimated.

RESULTS: Paired t-tests revealed changes from the pretest to posttest assessment day: hip abduction (p=0.009) and trunk strength (p=0.045), balance (p<0.001), and free-position shots (p=0.035), points (p=0.034), shots (p=0.035), and free-position shots (p=0.014) with the 3D MOT group having lower values versus C. CONCLUSIONS: Athletic performance is multifactorial in uncontrolled environments such as competitive ice hockey and lacrosse, which may suggest that performance benefits of 3D MOT training may be overshadowed by the complexities of game play. Significant differences found between groups may be due to player skill differences versus a 3D MOT effect. Further research is warranted to determine the effectiveness of 3D MOT training and its impact on sport performance.

3502 Board #190 June 1 8:00 AM - 9:30 AM Effect Of 3d Multiple Object Tracking Training On Collegiate Ice Hockey And Lacrosse Game Performance

Erin Manning, Jesse Hall, John Rosene. University of New England, Biddeford, ME.

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No relevant relationships reported

3D multiple object tracking (3D MOT) aids in improving working memory and spatial awareness by stressing foveal and peripheral vision while demanding multi-faceted attentional focus. 3D MOT also improves cognitive processing which may improve the ability to rapidly extract data from the environment thereby enhancing decision making capabilities. These attributes have the potential to enhance sports performance.

PURPOSE: The purpose of this study was to determine if 3D MOT training increases in-game performance during a competitive season. METHODS: 79 athletes from four NCAA DIII collegiate athletic teams (ice hockey n=34; lacrosse n=45) participated. Athletes were assigned either to a 3D MOT (n=38) training intervention or control (C) group (n=41). Athletes completed 24 sessions of 3D MOT training, 2-4 times per week over 12 weeks during the respective competitive seasons. At the conclusion of the seasons, independent samples t-tests were used to compare performance measures (game statistics) between 3D MOT and C groups for ice hockey (men’s and women’s combined), men’s lacrosse, women’s lacrosse and free-position shots. RESULTS: There were no significant differences in performance measures between 3D MOT and C groups for ice hockey (p>0.05). For men’s lacrosse, faceoff winning percentage was significantly different (p=0.009) between the two groups, favoring the 3D MOT group (30% vs. 0%). For all other performance measures there were no significant differences (p>0.05) between groups. For women’s lacrosse, there were significant differences for assists (p=0.045), points (p=0.034), shots (p=0.035), and free-position shots (p=0.014) with the 3D MOT group having lower values versus C. CONCLUSIONS: Significant improvements in strength, balance, and alignment were demonstrated by this cohort. Jump performance did not show improvement, but was an unfamiliar task to the subjects at the beginning of the training; it will be monitored intermittently as training continues.

3503 Board #191 June 1 8:00 AM - 9:30 AM Pelvic and Core Strength Training Improves Pelvic Posture, Hamstrings-to-Quadriceps Ratio, and Vertical Jump Performance

Chee-Hoi Leong, Cassandra York, Zachary Bohling. Central Connecticut State University, New Britain, CT.

Email: c.leong@ccsu.edu

No relevant relationships reported

Poor pelvic posture demonstrated through anterior pelvic tilt have been known to produce musculoskeletal imbalances involving muscular weakness of the abdominal and pelvic regions. While stretching and massage techniques have been reported to be effective in alleviating anterior pelvis tilt, it remains unclear if similar improvements can be elicited by pelvic and core strength training. PURPOSE: To examine the effect of an 8-week pelvic and core strengthening program on anterior pelvic tilt (APT), hamstrings-to-quadriceps (H:Q) strength ratio, and vertical jump performance in healthy individuals. METHODS: Nine healthy males (age=27.11±12.15 years; mass=82.78±8.84 kg; height=178.76±0.07 cm) performed resistance training (2×/week; 30-40 min) involving a combination of abdominal and hip extensors strengthening exercises for 8 weeks. APT (*), vertical jump height (m), vertical jump power (W), and H:Q ratio at 60, 180, and 300 °/s were assessed prior to and following the 8-week pelvic and core strengthening program. Paired samples t-tests were used to evaluate pre- to post-training changes in APT, vertical jump height and power, and H:Q ratio. Effect sizes (ES) were calculated for all analyses and ES magnitudes of < 0.50, 0.50-1.0, and > 1.0, were interpreted as small, medium, and large effects, respectively.

RESULTS: APT was significantly decreased, and vertical jump height and the H:Q ratio at the angular velocity of 300 °/s were significantly increased, following 8 weeks of pelvic and core strength training (all p<0.05, Table 1).

CONCLUSION: Resistance training emphasizing pelvic and core strengthening was effective in reducing APT, improving vertical jump performance and H:Q ratio. Our findings have potential implications for clinicians prescribing resistance exercises to improve pelvic posture in patient populations with musculoskeletal imbalances, and for injury prevention and maintenance of postural equilibrium in healthy individuals.

Table 1. Pre- versus post-training responses (mean±SD) following pelvic and core strength training.

<table>
<thead>
<tr>
<th></th>
<th>Pre-training</th>
<th>Post-training</th>
<th>%Δ</th>
<th>П</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>APT (°)</td>
<td>14±8.32</td>
<td>9±3.27</td>
<td>18</td>
<td>0.04</td>
<td>0.70</td>
</tr>
<tr>
<td>Vertical jump power (kW)</td>
<td>4.45±8.76</td>
<td>4.56±1.02</td>
<td>2</td>
<td>0.18</td>
<td>0.12</td>
</tr>
<tr>
<td>Vertical jump height (m)</td>
<td>0.45±0.099</td>
<td>0.49±0.090*</td>
<td>8</td>
<td>0.004</td>
<td>0.36</td>
</tr>
<tr>
<td>H:Q ratio @ 60 °/s</td>
<td>0.49±0.07</td>
<td>0.56±0.12</td>
<td>14</td>
<td>0.06</td>
<td>0.92</td>
</tr>
<tr>
<td>H:Q ratio @ 180 °/s</td>
<td>0.50±0.15</td>
<td>0.57±0.12</td>
<td>15</td>
<td>0.06</td>
<td>0.49</td>
</tr>
<tr>
<td>H:Q ratio @ 300 °/s</td>
<td>0.51±0.13</td>
<td>0.60±0.13*</td>
<td>18</td>
<td>0.04</td>
<td>0.70</td>
</tr>
</tbody>
</table>

*Significantly different compared to pre-training (P<0.05).

Supported by CCUSU Faculty-Student Research Grant 2016/17.
analysed using mixed model ANOVAs. **RESULTS:** STROOP task showed reaction time in both groups decreased at post-test. However, BET decreased significantly more compared to control group (p < 0.02) despite no significant differences in accuracy. BET group completed accuracy test significantly faster than the control group (p < 0.05) and with lesser errors (p = 0.03). During the RSA Random Test no significant differences were found between the groups for linear acceleration phase (first 10 m). However, BET group completed significantly faster (p = 0.05) the decisional phase (second 10 m). Equipment analyzed during the 30-15 test showed there was no difference in the performance of the BET group. However, control group showed a significant decrease (p = 0.05) in performance. **CONCLUSION:** The results of this study prove evidence that the combination of BET and standard football training is more effective than standard training alone in boosting cognitive and physical performance in elite football players.

**3505 Board #193 June 1 8:00 AM - 9:30 AM**

**Effect of Wheelchair Tai Chi Ball Exercise on Physical & Mental Health among Elderly**

Jingle Xu1, Shiqi Yu1, Chung-Hyun Goh1, Ting Liao1, Xuanliang Nie1, Dong1, Gloria Duke1, Danita Alfred2, Yong Tai Wang3, FACSM1. 1The University of Texas at Tyler, Tyler, TX. 2Wuhan Sports University, Wuhan, China. (Sponsor: Yong Tai Wang, FACSM)

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(No relevant relationships reported)

Mind-body exercise and strength training are crucial for elderly with disability. In this project, we developed an innovative exercise of Wheelchair Tai Chi Ball 12 forms (WTCB12), which combines mind-body exercise with strength training for elderly with disability. **PURPOSE:** To examine the effect of a 3-month WTCB12 intervention on physical and mental health and functional abilities among elderly.

**METHODS:** Twenty-six participants from a local senior living facility participated in the WTCB12 intervention with 13 in each group. Nine completed the study in WTCB group (age: 86.55 ± 3.39 yrs; height: 1.69 ± 0.17 m; mass: 75.54 ± 20.28 kg) and ten completed in the control group (age: 81.78 ± 14.39 yrs; height: 1.64 ± 0.07 m; mass: 68.31 ± 15.17 kg). The weights of the WTCB ranged from 1 pound to 2 pounds selected by the participants based on their physical conditions. The WTCB group practiced WTCB12 twice a week, one hour each time. The control group did their daily routine without WTCB intervention. The following variables were measured: Pain Self-Efficacy Questionnaire (PSEQ), heart rate (HR), blood pressures, range of motion (ROM) and muscle strengths of the dominant arm at the shoulder, elbow and wrist joints, and SF-36v2 for physical and mental health. The Independent t test and paired t test were employed to examine the differences between and within the two groups in the pretest and posttest.

**RESULTS:** The results indicated that the PSEQ was significantly improved in WTCB group after WTCB intervention (Pre-test: 41.44 ± 13.89 vs Posttest: 50.11 ± 14.02, p < 0.05), but no significant differences were found in HR, blood pressures, ROM and SF-36v2 physical and mental health variables. The WTCB group showed significantly greater muscle strengths at the shoulder extension, abduction and adduction, elbow flexion and extension and wrist flexion and extension in the posttest than the control had since the WTCB group’s joint muscle strengths maintained and the control group’s muscle strengths at these joints decreased.

**CONCLUSIONS:** WTCB12 exercise may help with pain management, maintain upper extremity muscle strength and is a feasible exercise for elderly with disability. Supported by Paralyzed Veterans of America Education Foundation Grant #819

**3506 Board #194 June 1 8:00 AM - 9:30 AM**

**Interventions and Training Programs for Football Performance**

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(No relevant relationships reported)

**PURPOSE:** The project examined an 8-week commercial group exercise regimen for comprehensive health and fitness indices. Study duration gauged the time required to integrate women into combat-arms military occupational specialties represents an opportunity to refocus training protocols for optimized performance in specific components of military physical and combat fitness tests. The United States Marine Corps will incorporate new standards in 2019 which include requiring more pull-ups for female Marines. The pull-up requirement is often difficult for Marine recruits to achieve and the overabundance of training protocols potentially confuses recruits and minimizes potential gains in event specific muscle strength.

**PURPOSE:** To examine changes in completed pull-ups in two training protocols to determine an optimal program for improved performance in college-aged females.

**METHODS:** Twenty-nine female subjects volunteered to participate and were randomized to either a control group or one of two training programs (Control [n = 3]; Free Weights [n = 14]; Machines [n = 12]). The two training programs consisted of pre-programmed workouts 3-4x per wk focused on upper body and core exercises. There was at least 1 d of recovery between workouts. Subjects were monitored for the first 2 wk of training to ensure compliance and proper technique. Maximum number of pull-ups were assessed at baseline, 3 wk, and 6 wk. Data were analyzed using a 3x3 repeated measures ANOVA. **RESULTS:** There were: no significant differences in age, height, or weight between the groups; mean ± SD; age: control 21 ± 1 yr; Height: 164 ± 6 cm; Weight: 64.2 ± 9.9 kg. Over the 6 wk period a total of 5 subjects withdrew from the study (Control [n = 3]; Free Weights [n = 11]; Machines [n = 10]). No significant interaction effect was observed between programs (p = .7); and there was no main effect for time (p = .1). **CONCLUSION:** Overall the training protocols improved pull-up performance with 4 of the free weight participants and 3 of the machine-based participants improving from zero to one or more pull-ups. Results are limited due to the dropout rate of ~17% over the training period which is not unexpected given the duration of this study. Future research should focus on improved adherence, and subject monitoring, to optimize performance in the pull-up event.

**3508 Board #196 June 1 8:00 AM - 9:30 AM**

**Effect Of Suspension Training On Functional Movement Screen (FMS) and Mobility, Activation, Posture, and Symmetry (MAPS)**

Megan Jackson1, Emily Hilliard1, Ann T. Shields1, Alex McDaniel1, Ryan Swickey1, Rachel Willilly1, Courtney K. Milleson1, Andrew Ortiz2, Brad Hollsworth1, Sarah Noland1, Raechel Sante1, Phillip More1, Lauren Ackerman1, Emma Schmid1, Kelsey D. Bryan1, Frances M. Livingston1, Tiago Barreira1, Wayland Tsel1, 1University of North Carolina Wilmington, Wilmington, NC. (Sponsor: Joan Eckerson, FACSM)

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(No relevant relationships reported)

**INTRODUCTION:** Although suspension training is used in various exercise routines, there has been insufficient research to determine the effect of suspension training on functional movement. **PURPOSE:** To examine the effect of suspension training on functional movement, assessed via the FMS and MAPS and 2) to identify the correlation between the FMS and MAPS. METHODS: Twenty-seven participants (19 females; 8 males; Age = 26.0 ± 11.1 yrs; Height = 167.9 ± 9.1 cm; Body Mass = 69.6 ± 14.1 kg) completed 28 exercise sessions over a 14-week course. Throughout each 40-minute exercise session, six body positions were utilized on the suspension training straps which included pull, pull, rotational, squat, and lunge movements; participants also utilized a stability ball and resistance bands. Pre- and post-fitness assessments included the FMS, MAPS; body composition, muscular endurance, muscle strength, and flexibility. Dependent t-tests were used to determine if there were mean changes in functional movement status. Due to multiple comparisons, Bonferroni correction was used, therefore, alpha level was set at .007.

**RESULTS:** There were significant positive changes in FMS (14.6 ± 2.7 to 15.9 ± 2.1, p < 0.001) and MAPS (52.9 ± 10.3 to 56.3 ± 9.7, p < 0.001) values, as well as mean quantity of push-ups (24.9 ± 11.5 to 29.4 ± 13.9, p = 0.004) and hangdrum dynamometer (78.0 ± 21.7 kg to 85.6 ± 24.0 kg, p = 0.006). There were no significant changes in

Abstracts were prepared by the authors and printed as submitted.
mean body mass, fat mass, lean mass, percent body fat, and sit-and-reach values. Pearson correlation was used to determine the relationship between FMS and MAPS both at pre- and post-testing. At both time points, pre- and post-testing, the correlations were significant (r = .52 and .43, respectively). CONCLUSIONS: Participation in suspension training produced significant improvements in overall functional movement, muscular strength, and endurance. Although there were significant positive changes in both FMS and MAPS from pre- to post-assessment, a weak correlation existed between the FMS and MAPS assessments.

3509 Board #197 June 1 8:00 AM - 9:30 AM
Biomechanical Analysis of Collegiate Baseball: Training Implications for Enhancement of Pitching Endurance
Andria C. Moitoza1, William P. Lydon1, J. Mark VanNess1, Alexis C. King2, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2University of Illinois at Urbana-Champaign, Champaign, IL.

Endurance is critical to a starting pitcher’s success. However, the repetition of pitching stress can decrease performance and increase risk of injury in later innings. Improving arm endurance likely enhances late-game performance. PURPOSE: To evaluate predictors of mechanical endurance in collegiate pitchers. METHODS: 10 Division-1 pitchers were tested using Proteus technology (Boston Biomotion, Inc.). They completed 6 sets of 5 pitches; each set changed in resistance, ranging from ½ to 5 lbs. Endurance was a calculation of the ability to preserve power in each set on a continuous scale of 0.00% (preservation) to 1.00% (100% preservation). Mean endurance was the mean value of all 6 sets. Protocols also assessed biceps curls, triceps extensions, internal and external rotation, and horizontal adduction and abduction. Pitchers were tested during the 2017 season and data were compared to in-game performances. Linear regressions tested the relationships between endurance, performance on other tests, and in-game statistics. RESULTS: Pitchers were 72.0 ± 2.7 inches in height, had a mean fastball velocity of 86.4 ± 3.9 mph, a mean earned run average (ERA) of 5.8 ± 2.8, and a mean endurance of 97.7 ± 1.9%. Endurance was unrelated to class year (p=0.857) and was not related to anthropometric measurements, including height (p=0.460), arm length (p=0.350), and leg length (p=0.464). Maximum squat strength (p=0.917), fastball velocity (p=0.832), and three-dimensional measurement of pitch range of motion (p=0.730) were also unrelated to pitch endurance. Biceps curl endurance (p=0.035) and triceps extension explosiveness (p=0.089) of the dominant arm correlated with pitching endurance. These relationships lost significance on non-dominant arm for curls (p=0.241) and extensions (p=0.187). Given a larger sample, other associations may be found; of interest, there may be relationships between endurance and innings per appearance (β= -0.353, R²=0.196; p=0.232) and ERA (β= -0.559, R²=0.49; p=0.305). Post-hoc power analyses revealed samples of 30 and 38 respectively to reach significance (power=0.80; p=0.05). CONCLUSIONS: Fatigue results from repetitive overloading, elevating risk of injuries. Use of Proteus may provide modes of exercise unrecognized by traditional baseball training.

3510 Board #198 June 1 8:00 AM - 9:30 AM
Automated Impact Corroboration From Game Video In Ice-hockey Using Computer Vision Approaches
Muhammad Sohaib Arif1, Aaron Pilotto-Riley1, Erik Bollt2, Stephen J. McGregor2, Davor Stojanov2. 1Eastern Michigan University, Ypsilanti, MI. 2Clarkson University, Postdam, NY. (Sponsor: Marif Peterson, FACSM)

Purpose
Video corroboration of on-ice impacts identified by wearable sensors (WS) is a time-consuming task. To automate this, we attempted a computer vision approach to recorded game video to corroborate impacts identified using WS among national ice-hockey team members. Methods
23 U.S. National U18 Hockey team members consented to procedures approved by EMU HSRC. Impacts were previously validated from data collected at 100 Hz (Impact Processor, Zephyr MD) from 8 players with the top activity levels determined by WS in 4 games. Game video was manually synchronized, and timestamps were used to extract frames from the video that allowed for visually identifying and labeling impacts. A convolutional neural network (YOLO) was used to detect impacts in video and generate a training dataset from 1060 images from 3 game videos that included 86 impacts. Video and timestamps were used for training instead of still frames. Denoising filters were used to account for time shift errors due to manual labeling and anomalous detections appearing and disappearing in up to half a second of video. Thus, we removed any impacts detected by video for less than 30 or 60 continuous frames (0.5 or 1.0 second, respectively). An smaller version of the model (YOLO-tiny) was also tested on a Note 8 (Samsung) smartphone to determine applicability to real-time game setting. Results
The trained YOLO network was applied to the 4th game video that had 32 validated sensor identified impacts. The model successfully detected all 32 impacts but generated 1000 false positives. With a 30 frame filter, the model detected 20 false, but false positives were reduced to 211. With a 30 frame filter, the model detected all 32 impacts but false positives increased to 391. Interestingly, the mobile model and 30 frame filter detected all 32 impacts with 222 false positives, of which, 99 were classified as “Pass Bys” or players that occluded each other on the video but did not make physical contact. Conclusion
These results demonstrate that computer vision techniques can be used to identify validated impacts with high success, but with many false positives. The high false positive rate presents a challenge, but since a large proportion of false positives were simple pass-bys, using a real-time sensor fusion approach with WS, the false positives may be reduced substantially.
PURPOSE: Patients with ACL reconstructed knees (ACLR) commonly experience persistent muscle weakness. Altered oxygen consumption (OC) during voluntary rehabilitation exercises of the quadriceps may be a contributing factor. The purpose was to compare quadriceps muscle OC during knee extension exercises in patients with ACLR versus healthy controls.

METHODS: 10 patients with primary, unilateral ACLR (7M/3F, 22.9±3.5y, 170.8±7.9cm, 73.7±15.1kg) and 10 matched controls (7M/3F, 22.9±3.5y, 170.4±10.7cm, 68.86±9.51kg) participated. Each participant completed a single data collection session consisting of 5-second isometric contractions at 25, 50 & 75% of the volitional maximum followed by a 30s maximal isometric knee extension contraction. We continuously recorded measures of oxygenated hemoglobin (O2Hb) on the reconstructed thigh (versus the non-dominant thigh of healthy controls) using three wearable, wireless near-infrared spectroscopy units placed superficial to the vastus medialis, lateralis and rectus femoris muscles. Relative changes in OC were ensemble calculated for statistically significant changes were defined as portions of the exercise contraction intensities. Statistically significant differences were defined as portions of the exercise trials where confidence intervals of the O2Hb graph did not overlap. Effect sizes were calculated for statistically significant results. RESULTS: We observed significantly lower relative change in O2Hb for ACLR compared to healthy controls in the rectus femoris at 25% (2.1±1.5-2.7), 50% (2.8±2.6-2.9), and 75% (2.0±1.9-2.2) and for the vastus lateralis at 25% (2.4±1.6-3.2), 50% (2.9±2.9-3.5), and 75% (2.0±1.9-2.2) and for the vastus medialis at 75% (1.5±1.4-1.5) and 100% (2.6±2.5-2.7) (Figure 1). No other statistically significant differences were observed. CONCLUSION: Differences exist in quadriceps muscle OC between patients with ACLR during the same exercises versus healthy controls. However, not all portions of the quadriceps are affected uniformly across contraction intensities.

Anterior cruciate ligament (ACL) reconstruction is frequently performed to restore knee stability and function following ACL injury. Traditionally, ACL injury people older than 40 years received non-operative treatments because of not performing high-demanding activities and possible inferior surgical outcomes. According to increasing sports activities, there are more chance to injury and surgical reconstruction in patients older than 50 years. However, a few numerous research with knee function and stability outcomes had been reported following ACL reconstruction in age over 50 years.

PURPOSE: The aim of this study was to evaluate muscle strength, ligament stability, and functional outcomes in comparing older (>50 years) and younger (<40 years) patients at 1 year after ACL surgery. METHODS: A retrospective analysis of prospectively collected data was performed in 40 younger (29.0±5.1yr) and older (52.5±2.1yr) ACL reconstruction patients each. All patients were evaluated for isokinetic extensor and flexor muscle strength, laxity, and functional scores at 1 year after operation. The highest peak torque at each velocity was compared with the uninjured side by isokinetic device. The knee laxity was assessed by the KT-2000 arthrometer. The comparing injured and uninjured knee side-to-side difference was measured at anterior maximum manual tension. Knee functional score were evaluated using the validated International Knee Documentation Committee (IKDC) and Lysholm scores. RESULTS: There was no statistically significant difference in extensor strength deficits between older and younger groups at 60°/s and 180°/s (p = 0.495, p = 0.419, respectively). In addition, there was no differences in knee flexor strength deficits between the groups (p = 0.417, p = 0.449, respectively). There was also no statistically significant difference in ligamentous laxity (p = 0.06) and Lysholm scores (p = 0.126). However, IKDC scores in the younger group showed significantly greater improvement than those in the older group (p = 0.009). CONCLUSION: Older patients with ACL reconstruction surgery would have similar results for knee strength and ligament laxity. This study showed that ACL reconstruction is more effectiveness and safety for restoration of knee strength and stability in older than 50 years patient group.
Deficits in quadriceps function are common in patients who sustain an anterior cruciate ligament (ACL) injury and undergo subsequent ACL reconstruction (ACLR). Quadriceps atrophy is among the notable changes in muscle tissue after ACLR. The relationship between muscle morphology and self-reported function should be considered to further improve function after ACLR. PURPOSE: (1) To evaluate rectus femoris (RF) cross-sectional area (CSA) and intramuscular fat percent (PF) in the injured and uninjured limb from 9 weeks post-ACLR to return to activity (RTA) and (2) identify associations between injured limb quadriceps CSA, PF, and self-reported function. METHODS: 28 individuals with primary unilateral ACLR (Age=16.6±2.7 years, Weight=71.8±17.7 kg; 64% female; 18 bone-patellar tendon-bone; 2 quadriceps tendon; 5 hamstring tendon) were recruited for this study. RF was imaged at 15 cm proximal of superior border of the patella. Quadriceps CSA and PF of the injured and uninjured limb were used for analysis. Self-reported function was evaluated using the International Knee Documentation Committee score (IKDC). Paired-samples t-tests were used to compare inter-limb differences in CSA and PF and changes from 9 weeks to RTA. Partial correlations adjusting for sex were used to analyze the relationship between RF morphology and IKDC scores. RESULTS: Injured limbs had smaller RF CSA at each time point (4.5±1.6 cm² vs 5.2±1.9 cm², p<.01) compared to the uninjured limb. Injured limb CSA increased at RTA (4.5±1.6 cm² vs 5.2±1.9 cm²; p<.01) while the uninjured limb did not (p=.05). No differences in PF were found between limbs (p=.18, and p=.43, respectively) or time point (p=.67, and p=.92, respectively). After adjusting for sex, larger injured limb CSA was associated with higher IKDC scores at 9 weeks and trended toward significance at RTA (r=-.32, p=.05, and r=-.26, p=.09, respectively). Injured limb PF was negatively associated with IKDC scores at both time points (r=-.55, p<.01, and r=-.39, p=.02, respectively). CONCLUSIONS: Intermuscle differences in RF muscle CSA are not ameliorated at RTA. RF CSA and PF are associated with self-reported function in individuals with ACLR and should be treated targets to improve patient function following injury.

Lower extremity injuries are common in sport. Anterior cruciate ligament (ACL) injuries often result in muscle atrophy in the thigh and calf muscles of the injured leg. Evaluating muscle atrophy via circumferences to document asymmetry has been recommended and is often used clinically (1). Previous studies have shown a small loss of skeletal muscle mass (SMM) may cause a greater loss in muscular strength (1), thus investigating muscle mass and girth may be beneficial in evaluating return to play post-ACL injury. PURPOSE: The purpose of this study was to examine SMM and circumference discrepancies between injured and uninjured limbs post-ACLR reconstruction. METHODS: Participants (n = 7, 4 F, 3 M; 21.9 ± 4.3 y; 5.24 ± 4.74 y post injury) were tested using bioelectrical impedance analysis (BIA). Fat mass, fat-free mass, body fat percentage, and SMM (kg) for extremities and torso were obtained. Circumference measurements were taken on the injured (I) and un-injured (NI) limbs at the mid-patella, and superiorly and inferiorly of the patellar poles at 10, 15, and 20 centimeters, using a standard, non-elastic tape measure. RESULTS: There was no significant difference between SMM (1.14±0.53 kg; NE14.48 ± 3.80 kg; 66.2% ± 10.2%, p=.46, p = .660). Roughly half of participants had greater SMM in the injured leg versus un-injured leg. There were no significant differences in circumference measurements between the limbs. CONCLUSIONS: There was evidence of decreased SMM in some participants following ACL injury. It is possible that continued study with more participants may find difference in muscle mass following injury. SMM and circumferences provide useful information concerning muscular atrophy and discrepancies between limbs. SMM obtained via BIA may be utilized as a cost-effective measure indicative of knee stability and limb strength for return to play protocol (1). Future research should include measurements made pre and post injury/surgery to understand muscle mass progression following injury.

Individuals who have undergone anterior cruciate ligament reconstruction (ACLR) have reduced muscle function that has been shown to persist for many years post-surgery. The ability to predict future levels of neuromuscular function with the use of early-on inflammatory markers may assist clinicians to better target common muscle function deficits seen after ACLR. PURPOSE: The purpose of this study is to determine if levels of inflammation and patient reported outcomes one month post-surgery predict muscle function at six months post-surgery. METHODS: Nineteen patients who underwent ACLR (n=8; 18±3 years; 5.2±3.7 months post surgery) participated in the study. Participants completed this study. One month post-surgery (1.1±0.3 months) individuals completed the Knee Outcome Survey (KOS), and visual analog scale (VAS) for pain. Patients were also aspirated one month post-ACLR and commercially available ELISA kits were used to determine concentrations of interleukin-1β (IL-1β) and tumor necrosis factor-alpha (TNF-α) in synovial fluid. At six months (6.1±0.3months) patients completed maximal isometric contractions of the involved limb at 60 degrees of knee flexion. Rate of torque development (RTD) was calculated as the slope of the time-torque curve taken from onset of torque to peak torque. Multiple linear regressions were run to determine if levels of IL-1β, VAS scores and KOS scores were predictors of RTD. An alpha value of 0.05 was used. RESULTS: Levels of IL-1β, and patient reported outcomes one month post-surgery did not significantly contribute to the variance of RTD (R²=68.8±0.06; R²=68.8±0.06; R²=35.1±0.1, respectively). A multiple regression analysis of IL-1β and KOS scores were used to determine the variance of peak torque. CONCLUSION: Although levels
Anterior cruciate ligament (ACL) injury results in quadriceps atrophy and fibrotic changes in the extracellular matrix of the muscle that may not resolve. To date, some warrants have used a muscle biopsy; however, this is an invasive procedure and impractical on a wide scale. Magnetic resonance imaging (MRI) techniques, such as T1ρ, hold promise to measure fibrotic changes. This technique has been used to study cartilage degeneration and liver fibrosis, but has not been widely applied to muscle. Whether T1ρ relaxation time is different between the quadriceps of the injured and non-injured limbs, as well as its relationship to quadriceps strength, is not established.

**PURPOSE:** To investigate the variance in T1ρ relaxation times in the vastus lateralis (VL) between the injured and non-injured limb following an ACL tear and possible correspondence to quadriceps strength.

**METHODS:** 17 ACL deficient patients (8M, 9F, 21 ± 4.5 y, BMI 25.05 ± 3.83, days since injury 26 ± 17.26) underwent an MRI. T1ρ acquisition included a single 6 mm thick slice at the location of the largest cross-sectional area of the VL with 8 echoes collected within spin lock times of 0-70 ms (spin lock amplitude 300Hz, matrix 256x256, 2 excitations with 4 shots per slice). Data was fitted to a mono exponential decay curve using custom MATLAB code. Quadriceps strength was assessed via maximal voluntary isometric contractions on a dynamometer. Paired t-tests and Pearson product moment correlation coefficients were used to analyze the data.

**RESULTS:** T1ρ times were significantly longer in the involved limb compared to the non-involved limb (involved: 0.0296 ± 0.0032 s; non-involved: 0.0280 ± 0.0031 s; 5.7% difference; p=0.04). Peak isometric torque was significantly less in the involved limb as compared to the non-involved limb: (1.91 ± 0.71 Nm/kg; non-involved: 2.65 ± 0.52 Nm/kg; 27.7% difference; p=0.001); however, was not significantly correlated with longer T1ρ time (r=0.07; p=0.70).

**CONCLUSION:** T1ρ was significantly longer soon after injury, indicating that this tool is sensitive to measure early changes in muscle organization. Contrary to our hypothesis, a relationship to quadriceps strength was not found. Potentially, T1ρ, hold promise to measure fibrotic changes. This technique has been used to study cartilage degeneration and liver fibrosis, but has not been widely applied to muscle. Whether T1ρ relaxation time is different between the quadriceps of the injured and non-injured limbs, as well as its relationship to quadriceps strength, is not established.

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**ACKNOWLEDGMENT:** This study was supported by the National Institute of Health (NIH R01AR071398).
Nitric Oxide-dependent Myogenic Satellite Cell Activation in Human Skeletal Muscle Following Blood-flow Restricted Exercise

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(No relevant relationships reported)

PURPOSE: Skeletal muscle contractions performed under concurrent blood-flow restriction (BFR) have been shown to affect myogenic satellite cell (MSC) proliferation and differentiation, however, the upstream signaling events governing MSC activation with BFR exercise remains unknown. A potential important upstream regulator of MSC activation initiated by BFR exercise may be nitric oxide (NO). Thus, the aim of the present study was to investigate the effect of endogenous nitric oxide (NO) synthesis on MSC activation in human skeletal muscle in response to BFR exercise.

METHODS: Eight male subjects (20.9 ± 2.7 SD) performed five sets of low-load knee extensor exercise (20% IRM) with concurrent BFR applied with a pressure cuff (100 mmHg) positioned at the proximal thigh. Concurrently, local arterial infusion of the NO synthase (NOS) inhibitor, NG-nomonomethyl-L-arginine (L-NMMA) or Placebo was applied in a within-subject cross-over design. Arterio-venous blood samples were obtained before and after exercise (30min) for assessment of leg blood-flow and oxygen extraction. Muscle biopsies were obtained at Baseline as well as 1, 3, 24 and 48h post exercise (Post1-48) for assessment of myogenic satellite cell (Pax7+) content using immuno-fluorescence techniques. RESULTS: Resting leg blood-flow decreased 37% (0.57 ± 0.14 L/min to 0.36 ± 0.12 L/min) and oxygen extraction increased 98% (26.8 ± 9.2 to 53.1 ± 7.9 %) with NOS inhibition (P<0.001), while remaining unchanged in the Placebo condition. MSC counts increased (47-94%) increased 98% (26.8 ± 9.2 to 53.1 ± 7.9 %) with NOS inhibition (P<0.001), while remaining unchanged in the Placebo condition. MSC counts increased (47-94%), while oxygen extraction increased 98% with NOS inhibition (P<0.001), while remaining unchanged in the Placebo condition.

CONCLUSIONS: This study is the first to show that inhibition of endogenous NO synthesis leads to blunted MSC activation in response to muscle contractions performed during conditions of partial blood-flow restriction in human skeletal muscle. In conclusion, the present data suggest that NO is a key signaling molecule activating MSC in human skeletal muscle in vivo.

Endurance is Augmented By Greater Blood Flow Restriction Pressures: Muscle Size and Strength Are Not

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Purpose: The importance of training to failure, especially when using low-loads (i.e., 30% 1RM) is well established. However, it remains unknown if lifting 15% IRM can disrupt muscular blood flow enough to induce failure and stimulate adaptation. This study was designed to compare muscular adaptations between training with 15% IRM and 70% IRM, to determine if blood flow restriction (BFR) could augment the response to 15% IRM, and if the effect of BFR is pressure dependent [40% versus 80% arterial occlusion pressure (AOP)].

Methods: 40 untrained participants performed 4 sets of unilateral knee extension 2x/week for 8 weeks, with two conditions, one per leg. Conditions (label) were: 15% IRM 0% AOP (15/0), 15% IRM 40% AOP (15/40), 15% IRM 80% AOP (15/80), 70% IRM 0% AOP (70/0). Sets were stopped at 90 repetitions or volitional failure, as determined by an inability to maintain metronome cadence (2 s/contraction) or full repetitions. Inter-set rest was 30 s for 15/0, 15/40, 15/80 and 90 s for 70/0. A 10 cm wide nylons cuff was used for BFR.

Results: Data presented as [mean change (95% CI)]. There were condition x time interactions for IRM (P<0.001) and endurance (P<0.028). 70% increased IRM [3.15 (2.04, 4.25) kg]; 15/0 [0.50 (-1.13, 1.01), 15/40 [0.06 (-1.06, 1.20), and 15/80 [0.68 (-0.41, 1.79)] did not. Increased endurance was greatest for 15/80 [2.4 (3.4, 8.0)] compared to 15/0 [2.4 (2.4, 6.0)], 15/40 [4.7 (2.8, 6.5)], and 70/0 [4.0 (2.2, 5.8)]. There were main effects of time for isometric MVC [10.51 (3.87, 17.16) Nm, P<0.002] and isokinetic MVC at 180°/s [change = 8.61 (5.54, 11.68) Nm, P<0.001]. Isokinetic MVC at 60°/s did not change [2.45 (-1.84, 6.78) Nm, P=0.261]. There were no condition x time interactions for muscle thickness sites (all p≥.33), which increased over time (all p<0.001). There were main effects of condition for each site (70/0 was greater, all p<0.001) except 30% lateral (p=0.59).

Conclusion: Most muscle strength and size changes appear similar despite large discrepancies in training load and restriction pressure. While the change in 1RM with high load may be due to motor learning or practicing, the greater endurance adaptations favoring high restriction pressures should be explored further regarding underlying mechanisms. These results are relevant to mechanistic exploration, therapeutic purposes, and program design.
in knee extension 10-RM strength than the BFR group (60.7±56.0% vs 35.3±25.5%; P<.05). The growth in quadriceps CSA was significant (time main effect P<.01) and to similar magnitudes (time x group interaction P=.62) following HL training (6.5±3.1%), and BFR training (7.8±9.2%). The HL group experienced a faster progression of load when compared to BFR training (46.2±10 kg session−1 vs 15.2±10 kg session−1; P<.006). The BFR training group progressed at a rate of 1.8±63 repetitions session−1 while the HL group progressed at 1.1±21 repetitions session−1 (P=.003).

CONCLUSIONS: The training model resulted in better strength gains than BFR resistance training because of distinctive rates of progressive overload.

Supported by NIH grant IR15 A6040700-01A

3526 Board #214
June 1 9:30 AM - 11:00 AM
Blood Flow Restricted Exercise and Reduced Oxygen Tension Decrease Mitochondrial ROS Emission in Human Arm

Heather L. Petrick, Christopher Pignanelli, Tyler A. Churchward-Venne, Luc J.C van Loon, Jamie F. Burr, FACSM, Gijs H. Goossens, Graham P. Holloway. 1University of Guelph, Guelph, ON, Canada. 2McGill University, Montreal, QC, Canada. 3NUTRIM School of Nutrition and Translational Research in Metabolism, Maastricht University Medical Centre+, Maastricht, Netherlands. (Sponsor: Jamie F. Burr, FACSM)

(No relevant relationships reported)

Low volume blood flow restricted (BFR) training has been proposed to induce comparable adaptations to traditional resistance training, however the underlying mechanisms remain unknown. Despite the absence of direct support, a suggested mechanism of BFR is an increase in reactive oxygen species (ROS). PURPOSE: We aimed to determine if the rate of mitochondrial ROS emission was altered following an acute bout of occluded (BFR) or non-occluded resistance training (RT), and to mechanistically investigate the role of skeletal muscle O2 partial pressure (pO2) in this response.

METHODS: Ten males (25±1yrs) performed 3 sets of single leg squats to failure at 30% 1RM, with either BFR (60-70% occlusion), or without occlusion (RT), while skeletal muscle tissue oxygenation was estimated using near-infrared spectroscopy. Muscle biopsies were obtained at rest and 2-hours post-exercise to determine mitochondrial respiration and ROS emission in permeabilized muscle fibers. In a separate cohort, muscle biopsies were obtained from six males (25±2yrs) to examine the effects of pO2, on in vitro mitochondrial bioenergetics.

RESULTS: Resistance exercise, with or without BFR, did not alter maximal respiratory capacity or mitochondrial sensitivity to ADP. While maximal mitochondrial respiration was unchanged following RT, decreased this response compared to rest (66.6 vs. 86.2 pmol min−1 mg dry wt−1, p<0.05). Skeletal muscle oxygenation was lower in the BFR compared to RT leg, both during (41.4% vs. 46.1% saturation respectively, p<0.001) and between (50.3% vs. 61.1% saturation respectively, p<0.001) exercise sets. Further evaluation of mitochondrial bioenergetics in vitro revealed that mild O2 restriction (50µM) dramatically attenuated maximal mitochondrial ROS emission (~4-fold), and fraction electron leak to ROS (~3-fold) compared to room air (200µM). This effect was especially evident in the presence of non-saturating ADP, as submaximal ROS emission was almost completely suppressed during O2 restriction, without a reduction in submaximal respiration.

CONCLUSIONS: These data indicate that a reduction in skeletal muscle pO2 attenuates the propensity of mitochondria to produce ROS, a mechanism which may contribute to the acute responses to BFR training. This research is supported by NSERC funding.

3527 Board #215
June 1 9:30 AM - 11:00 AM
B.F.R. For Proximal Benefit: Blood Flow Restriction Therapy For The Shoulder?

Bradley Lambert, Corbin Heddle, Eden Epner, Kalyan Chaliki, Chadurance Wang, Joshua Lee, Aydin Roxochos, Michael Moreno, Patrick McCulloch. 1Houston Methodist Hospital, Houston, TX. 2Rice University, Houston, TX. 3Texas A&M University, College Station, TX.

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(No relevant relationships reported)

Blood flow restriction (BFR) therapy has been observed to improve post-operative recovery in the limbs when combined with low intensity resistance exercise (LIX). Little data exists regarding use of BFR for proximal benefit of the upper limbs (shoulders). PURPOSE: (1) Determine if rotator cuff (RC) exercises combined with BFR (BFR-Rx) promote greater increases in strength, muscular endurance, and lean mass compared to exercise alone (NoBFR-Rx); (2) Determine if BFR applied to the arm during acute LIX increases activation of RC muscles.

METHODS: Eighteen healthy adults (♂8, ♀10; 32.3±15.5kg; 1.78±1.7m; 24.2±4.1) were recruited and randomized into 2 groups (BFR-Rx, NoBFR-Rx). Each performed 8wk of LIX (2/wk) using 4 RC exercises: cable external rotation (ER), cable internal rotation (IR), dumbbell scapulation, and side-lying dumbbell ER. 20%IRM; 1set/30reps followed by 3sets/15reps (30sec rest between sets, 2min rest between exercises; ±10% rest for each week all repetitions achieved). For the BFR-Rx group, BFR was applied to using a tourniquet system (Delфи®) that maintained 50% limb occlusion pressure during each exercise with pressure released between exercises. A group x time ANCOVA (covar-ied on baseline) followed by a tukey’s post hoc test was used to detect absolute & relative changes in strength (pre/post training), lean mass (pre/post training; DXA, GE®), and achieved weekly exercise volume (sets x reps x resistance). A two-tailed paired samples t-test was used to detect differences in RC muscle activation (EMG, Delフィ®) recorded during acute ER and IR fatigue tests in all subjects. Type I error was set at α=.05.

CONCLUSIONS: Combined BFR-Rx using RC exercises may yield greater increases in shoulder/arm lean mass, strength, and muscular endurance compared to exercise alone. These findings may be partially due to a greater activation of shoulder musculature while using BFR. Data collection is ongoing and will be completed prior to conference.

3528 Board #216
June 1 9:30 AM - 11:00 AM
The Perceived Tightness Scale Does Not Provide Reliable Estimates Of Blood Flow Restriction Pressure

Zachary W. Bell, Scott J. Dankel, Robert W. Spitz, Raksha N. Chattakhodi, Tika Abe, Jeremy P. Loenneke. The University of Mississippi, University, MS.

(No relevant relationships reported)

When completing blood flow restriction, use of a perceived tightness scale is recommended as a method for setting sub-occlusive pressures. However, whether or not participants can consistently rate a similar pressure using this scale is unknown.

PURPOSE: To determine the reliability of a perceived pressure when asking participants to rate a 7 out of 10, considered a moderate pressure with no pain, during blood flow restriction. METHODS: Participants (12 men, 12 women) were tested across 3 visits, involving measurements for arterial occlusion and the relative pressure at which participants deemed a 7 out of 10. Participants arrived to the lab and proceeded to lie supine for a 10-minute rest period. Measurements were completed in one limb for the upper and lower body. A repeated measures analysis with a between subject factor of sex was used to compare relative arterial occlusion pressures across days and sex with a default prior of 0.5 for the fixed effects and 1 for the random effects.

An independent samples t-test was used to determine if there were sex differences in %CV for a default prior of 0.707. A Bayes factor (BF0) of 3 or 33 suggested evidence for the alternative and null hypotheses, respectively. RESULTS: The %CV for the measurement in the upper body was 12%, with no effect of sex (men: 12.3% vs. women 12.2%; BF0.6.403; median δ (95% credible interval): 0.616 (-741, 752)). The %CV for relative arterial occlusion pressure in the lower body also did not differ between sexes (men: 13.7% vs. women 10.5%; BF0.180; median δ (95% credible interval): -30.6 (-396, 999)). Participants rated a 7/10 pressure above the arterial occlusion pressure for the upper body and below for the lower body. At the group level, participants rated a 7 out of 10 at a higher relative pressure on day 1 compared to days 2 (BF10: 4.482, median δ (95% credible interval): -0.694 (-1.307, -0.130) and 3

Abstracts were prepared by the authors and printed as submitted.
Purpos e: To demonstrate the effect that the presence of the metabolic syndrome (MetSy n) has on the physical performance of American football players of a college team in México

Methods: Seventy-six players were included in the study, thirteen had MetSyn (21.7±1.5 yrs) and sixty three were not diagnosed with MetSyn (21.8±1.5 yrs). In order to establish a statistical significance between the physical performance and MetSyn, the data was analyzed in two different ways: With MetSyn (WMS) or absence of MetSyn (AMS) and by groups of similarity of Body Mass and type of execution (21.7±1.5 yrs) and sixty three were not diagnosed with MetSyn (21.8±1.5 yrs). In

Results: The physical performance tests that were measured were: Maximum strength, explosive strength, Isometric hand strength, muscular resistance, power of upper and lower body, lumbar flexibility, agility, speed and cardiovascular resistance

Conclusions: The weight and BMI of the body fat percentage were variables that presented significance difference in the WMS group, coinciding with the authors who affirm that the weight and the percentage of fat have an influence on the physical performance. The physical performance tests in the WMS group revealed better performance in maximum chest force, explosive strength with Snatch and Jerk tests, as well as muscular resistance suggesting a possible favorable relationship to presence MetSyn. We observed a lower athletic performance in the tests of speed, agility and cardiovascular resistance in the players with the presence of MetSyn negatively relating the MetSyn with these motor skills.

Type 2 Diabetes Mellitus (T2DM) is a fast-growing epidemic and skeletal muscle insulin resistance may be the onset point in the development of T2DM. Recent data have suggested that microRNAs (miR) may play an important role in T2DM glucose intolerance. Specifically, reduced miR-16 content in muscle has been noted in human and rodent models of T2DM. However, regulation of miR-16 and its relation to muscle insulin resistance is largely unexplored. Purpose: To investigate how miR-16 content affects insulin resistance and glucose regulation in myotubes during insulin resistant states. Methods: This study was performed in three experiments.

1. To test if miR-16 is necessary for muscle insulin sensitivity, C2C12 myoblasts were cultured to become myotubes. Cells were transfected with a plasmid to inhibit function of miR-16. Ex 2: To test if miR-16 is sufficient to improve insulin resistance, myotubes were transfected with a 1-octyl-2-acetyl-sn-glycerol (OAG), to simulate lipoid overload-induced insulin resistance, cells were transfected with plasmid to overexpress functional miR-16. Ex 3: To test if primary-MiR-miR16 (Pri-miR16) is differently expressed in insulin resistance state, Pri-miR16 level was measured by RT-PCR in both in vivo and in vitro models of insulin resistance. In experiment 1 and 2, glucose uptake and insulin signaling by uptake of 2-NBDG (a fluorescent analog of glucose), and immunoblot of phosphorylation of AKT and IRS1.

Data were analyzed by ANOVA or t-test as appropriate, significance was denoted at p<0.05. Results: Ex 1: Insulin-stimulated glucose uptake was ~25% lower in myotubes following miR16 inhibition (p<0.01). Insulin signaling was lower in myotubes with miR16 inhibition (31%; p<0.002). Ex 2: OAG-induced insulin resistant myotubes exhibited lower glucose uptake (p=o.01; 12%). However, overexpression of miR16 did not improve OAG-induced insulin resistance (p<0.05). Ex 3: Pri-miR16 level was not different between control and OAG. Conclusion: Reduction of miR-16 content seems to be necessary for insulin handling, however, miR-16 overload is not sufficient to rescue glucose regulation and synthesis of pri-miR16 was not a culprit for reduced miR16 during insulin resistance, therefore it may be due to either degradation or export of miR16 during the miRNA process.

Purpose: Diabetes has been known to result in attenuated growth and atrophy in skeletal muscle. Recently, it has been reported the Carbon dioxide (CO2) exposure leads to an increase of muscle mass in normal rats. Therefore, the aim of the present study was to investigate the effects of transcutaneous CO2 exposure with the hydrolgel (eCO2GEL) on diabetic-associated muscle atrophy.

Methods: Male Goto-Kakizaki (GK) rats were divided into control (GK) and CO2 exposure (CO2) groups and male Wistar rats used as a non-diabetic control. The hair was removed from the limbs and sealed, and CO2 gas was administered into the adaptor for 30 min. The CO2 exposure was performed everyday for 8 weeks.

Results: The muscle weights of soleus and tibialis anterior in the GK group decreased compared with those of the control group. CO2 exposure attenuated decreased muscle weights in diabetes-associated muscles (P<0.05). In addition, the blood flow in skeletal muscle was increased by CO2 exposure compared with non-CO2 exposure condition (P<0.05). Furthermore, the level of fasting glucose in the CO2 exposure group was significantly decreased compared with the control group (P<0.05).

Conclusions: These results indicate that the transcutaneous CO2 exposure may have a therapeutic potential for diabetic-associated muscle atrophy. This amelioration may associate with increased blood flow in skeletal muscle.

A dense dual layered mucus barrier, comprised of the muc2 mucin glycoprotein, protects the colon epithelium from luminal microbes and the external environment. The complexity and high secretory output of muc2 makes it prone to misfolding which results in a dense sub-occlusive pressures. The use of a perceived tightness scale does not appear to provide a reliable method for the prescription of blood flow restriction pressure. Future work should consider alternative methods or modifications to the scale for improving reliability when setting sub-occlusive pressures.
had free access to a running wheel in their cages. Food intake was monitored every other day and body weights once per week. After 12 weeks animals were sacrificed. Total RNA was extracted from fed liver tissue fixed in RNAlater and converted into cDNA using the RNeasy Mini and First Strand kits. qRT-PCR was performed using a custom RT2-profiler PCR array (Qiagen). Ct values were normalized to GAPDH and a one-way ANOVA with LSD post-tests was used to analyze group means of ΔCt values for each sex. A difference of mean with a p value of ≤ 0.05 was considered statistically significant. mRNA expression was expressed relative to the ΔCt method. RESULTS: For females, Alb and Irel expression was increased in VHFX mice (0.9 and 1.1-fold times) compared to VHFS (0.6-fold times; p = 0.001 and p = 0.008). Muc2 expression was significantly increased in CDX mice (2.3-fold times) compared to VHFS (0.7-fold times; p = 0.02). In males, no significant differences in the expression of any factor was observed. CONCLUSION: High-fat diets coupled with exercise increase the expression of endoplasmic reticulum membrane protein sensors involved in the unfolded protein response in females. Exercise increases muc2 expression in females.

Methods:

3533 Board #221
June 1 9:30 AM - 11:00 AM
Hypocaloric High Fat and High Carbohydrate Diets on Visceral Adipose Tissue and Body Composition
Jarrett Walbolt, Yunsuk Koh. Baylor University, Waco, TX.
(No relevant relationships reported)

Introduction: Excess visceral adipose tissue (VAT) is strongly associated with increased cardiometabolic risks. High-fat (HF) diets are a popular method for improving body composition. Purpose: To determine the role of HF diets in body composition and VAT. Methods: In a randomized, cross-over design, 12 healthy, sedentary individuals were assigned to either a HF or HC diet trial with a 20% reduction in total caloric intake from their typical diet. Participants maintained their 1st assigned diet for 2 weeks followed by a 1-week washout period where they consumed their typical diet. After the 1-week washout period, participants began the opposite diet trial (either HF or HC) for 2 weeks. The HF diet consisted of 70% fat and 30% carbohydrate and protein, with a limit of 50 grams of carbohydrate. The HC diet consisted of 70% carbohydrate and 30% fat and protein. Body composition including VAT in mass and volume were determined using dual-energy x-ray absorptiometry. Results: Total body mass decreased up to 1.5 kg from the pre-intervention (78.07±17.63 kg) following either the HF (76.65±15.99 kg) or HC (76.24±15.71 kg) trial, yet it was not statistically significant. VAT in mass and volume decreased following either the HF or HC diet from the pre-intervention (429.57±225.43g and 464.42±244.022cm³). However, the magnitude of change in VAT was greater in the HF diet (374±159.59g and 404.14±172.54cm³) than the HC diet (388.71±184.73g and 420.42±199.93cm³). Although it was not statistically significant. Notably, percent body fat decreased only following the HF diet (pre-intervention: 29.70±9.75, HF: 27.65±10.55, and HC: 29.15±11.43%). Conclusion: Although a short-term hypocaloric diet with either HF or HC did not yield a significant change in body composition, there was a strong trend showing that hypocaloric diets, whether HF or HC, can lower total body weight. HF diets though may be more effective than HC at decreasing body fat percentage and VAT. Our study only looked at changes after intervention, with exercise increase the expression of endoplasmic reticulum membrane protein sensors involved in the unfolded protein response in females. Exercise increases muc2 expression in females.

Introduction:

3534 Board #222
June 1 9:30 AM - 11:00 AM
Exploring The Utility Of Muac In Classifying Adult Metabolic Syndrome Risk Using NHANES 2015-2016
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Metabolic syndrome (MetS) is a constellation of cardiometabolic risk factors (visceral adiposity, dyslipidemia, hyperglycemia, and hypertension) that, when presented in tandem, exponentially increases the risk of heart disease and insulin resistance. Finding a simple and validated screening method is critical to proactively intervene and attenuate the development of these cardiometabolic diseases, thereby improving healthcare outcomes such as quality of life and associated costs. The utility of mid-arm circumference as a metric of MetS risk has not been widely investigated. There is paucity in the literature exploring the relation between mid-arm upper arm circumference (MUAC) and MetS. Purpose: This study defined and attempted to validate a risk criterion for MetS using MUAC as a valid alternative criterion for MetS classification risk. Methods: The target sample was derived from National Health & Nutrition Examination Survey (NHANES) 2015-2016 data that included adults over the age of 18 (N = 9,971). MetS was defined using the NCEP ATP III 2005 MetS diagnosis criteria. A recursive partitioning methodology (RPM), using the Classification & Regression Tree Algorithm, was employed to create binary MUAC criterion by sex, using 75% of the total sample. Validation of the criteria was performed with the remaining 25% of the total sample, selected at random.

Results:

SEVENTEEN percent (17%) of the total sample presented with the MetS. The RPM resulted in sex specific MetS criteria with the MUAC criterion being <32cm (p = 0.024) and ≥49cm (p = 0.024) for males and females, respectively. Specifically, those presenting with the risk criteria were 9.84, for males, and 9.23, for females, times more likely to present with MetS than without the MUAC criterion. The overall classification accuracy for both the training and validation models were 83% with no statistical difference between models (p = 0.983). Conclusions: MUAC shows promise in being an effective screening method for MetS in guiding further diagnostic tests to prevent associated cardiometabolic morbidity and mortality.

Introduction:

3535 Board #223
June 1 9:30 AM - 11:00 AM
Patterns of Interrupting Prolonged Sitting and Postprandial Triglycerides in East-Asian Young Men with Central Obesity
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(No relevant relationships reported)

Prolonged sitting is related to an increased risk of morbidity and mortality. In the literature, frequent interruptions to prolonged sitting, e.g., every 30 min of sitting, have been found to be beneficial for cardiometabolic health. Interrupting prolonged sitting less frequently, however, may be preferred due to practical issues. Purpose: To examine the acute effect of different frequency of interrupting prolonged sitting on postprandial triglycerides (TG) in young men with central obesity compared with prolonged sitting.

Methods: Twenty-one East-Asian men with central obesity (mean age: 22.4± 3.65 years; body mass index: 29.78± 3.17 kg·m⁻²; waist circumference: 98.71± 7.08 cm) completed three randomized 7-h laboratory-based trials including 1) a prolonged sitting trial (SIT), 2) 3-min walking every 30 min (3-min), and 3) 6-min walking every 60 min (6-min) at 3.2 km·h⁻¹. TG concentrations were changed to total area under the curve (tAUC) using the Trapezoidal method. One-way (trial) and two-way (trial x time) ANOVAs with repeated measures were used to compare tAUC value and TG concentrations, respectively.

Results: Regarding the tAUC, the main effect of trial (F₁,₈₈ = 4.210, P = 0.022, η² = 0.174) was significant with 6-min trial (10.58± 3.62 mmol·L⁻¹ per 7 h; P = 0.020) being lower than SIT trial (11.83± 3.52 mmol·L⁻¹ per 7 h). There were no differences on the 7-h tAUC for TG concentrations between 3-min (11.52± 3.47 mmol·L⁻¹ per 7 h, P = 0.05) and SIT trials as well as between 3-min and 6-min trials (both P > 0.05). Regarding TG concentration, the main effect of trials (F₁,₈₈ = 4.488, P = 0.018, η² = 0.182) was significant with 6-min trial being lower than SIT trial (P = 0.013). The main effect of time was also significant (F₁₉,₈₈ = 66.589, P < 0.001, η² = 0.769) with the TG concentrations significantly increased from 1 h to 6 (all P < 0.05) compared with the baseline (the average of TG concentrations between -1 and 0 h).

Conclusions: Interrupting prolonged sitting with 6-min trial elicited superior beneficial effect on reducing postprandial TG than SIT trial in East-Asian young men with central obesity.

Introduction:

3536 Board #224
June 1 9:30 AM - 11:00 AM
The Relationship Between a High Sugar-Low Fiber Dietary Food Intake and Obesity in a Clinical Setting
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(No relevant relationships reported)

Diet high in simple sugars and processed foods, and low in whole, fibrous plant foods have been linked to insulin resistance and weight gain. To prevent obesity and cardiometabolic disease, it is recommended that Americans limit intake of sugary beverages, fruit juices, added sugars, and processed carbohydrates, in favor of more fiber-rich foods such as whole grains, nuts, and beans, seeds, and vegetables. Purpose: To examine the relationship between frequency of foods consumed high in sugar and low in fiber (HSFL) with BMI. We hypothesized that a HSFL diet would be significantly higher among obese individuals (BMI ≥ 30) than non-obese (BMI < 30). Methods: A total of 2,703 adults (1,521 females and 1,182 males) from a HealthSnap wellness assessment used in physicians’ offices across the country were evaluated for anthropometric measurements and nutritional behaviors. HSFL consumption was evaluated from patients’ self-reported intake of soda, juices, energy drinks, and other high sugar foods versus selection of whole grains, whole plant foods, nuts, beans, and seeds. To identify the association between HSFL and obesity, a

Abstracts were prepared by the authors and printed as submitted.
3537 Board #225
June 1 9:30 AM - 11:00 AM
Acute Exercise Intervention Combined with Metformin's Influences on Glucose Homeostasis in T2D Mice

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Purpose: The aim of our investigation was to determine the effects of different ways of acute exercise intervention combined with high dose of metformin on glucose homeostasis and its relative molecular mechanisms in type 2 diabetic mice.

Methods: 4-week high fat diet (HFD) and one-time Streptozocin (100mg/kg) intraperitoneal injection were used for building T2D mice. 24 mice were divided into normal control (NC), normal acute resistance training (NCR) and normal acute endurance training (NCE) group, all n=8, fed in normal chow. Finally 48 mice were developing T2D and divided into diabetic control (DC), diabetic acute resistance training (DCR), diabetic acute endurance training (DCE), high dose of metformin (200mg/kg) control (HMC), metformin combined with acute resistance training (HMR) and metformin combined with acute endurance continuous training (HME) group, all n=8.

Results: The two ways also enhanced blood glucose and lipid metabolism in T2D mice. Compared to HMC group, hepatic G6Pase mRNA expression in HMR and HME group showed opposite trends, one was down and the other was up. Compared to HMC group, hepatic PEPCK mRNA expression in HMR group mice was notably raised and hepatic AMPKα and CREB mRNAs expression in HMR and HME group mice were notably increased and only hepatic AMPKα mRNA expression in HMR group was significantly increased. Conclusion: Acute resistance training (ART) and acute endurance training (AET) combined with metformin can effectively improve glucose homeostasis in T2D mice. And the two ways can improve blood glucose and lipid metabolism in T2D mice. ART combined with metformin was better to improve glucose homeostasis and inhibit hepatic gluconeogenesis relative mRNA expression in T2D mice probably via the signaling pathway of AMPKα-PGC1α-CREB.

3539 Board #227
June 1 9:30 AM - 11:00 AM
Lactate Response During Graded Exercise Test In Individuals With Prediabetes After Aerobic Exercise Training

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Purpose: Our results indicate that NT improves aerobic fitness, BMI, and glucose control in patients with T2D compared to C, despite no changes in the REE among groups.

3538 Board #226
June 1 9:30 AM - 11:00 AM
Effect Of Combined Training On Metabolic Control In Type 2 Diabetes Overweight Patients.

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Purpose: Aerobic exercise is accepted as therapy for control of glucose levels and body fat in type 2 diabetes (T2D). High-intensity interval training (HIIT) is a new aerobic training method with benefits for T2D patients. There are few documented studies of traditional exercise plus HIIT effect on resting energy expenditure (REE) in T2D. The purpose was to compare the effect of traditional training (aerobic constant intensity+resistance) with new training (HIIT + aerobic constant intensity + resistance) on REE and metabolic control in patients with T2D.

Methods: Forty two sedentary people (Age = 50.7 ± 6.1 years) with T2D were randomized to one of three groups for 16-week training program with dietary recommendation: new training (NT; n = 14) (85-100% HRmax 10 intervals of 1 minute; resistance: 12 repetition maximum (12RM); dietary recommendation), traditional (TT; n = 14) (65-75% HRmax, resistance: 12RM, dietary recommendation) and control (C; n = 14 dietary recommendation). Body composition was measured by bio-electrical impedance (INBODY S10), REE was evaluated by indirect calorimetry (COSMED, FITMATE model). Maximum oxygen uptake (VO2max), HRmax and Power (Watts/Kg body weight) were recorded during incremental exercise test (Monark 828 e), Glycosylated hemoglobin (HbA1c) and lipid profile were measured in fasting blood (12 h). Measurements were evaluated at baseline and 16 weeks.

Results: The decrease in HbA1c was greater in NT compared to C (23.1% ± 10.2 vs -8.6% ± 10.2; p = 0.005). BMI decreased in the NT compared to C group (-3.1% ± 2.1 vs -0.3% ± 2.9; p = 0.003) and power increased in NT compared to C (p = 23.9% ± 25.3 vs 6.3% ± 20.5; p = 0.05). VO2peak was increased in NT compared to C (19.8% ± 18.1 vs 2.8% ± 13.3; p = 0.02).

Conclusions: Our results indicate that NT improves aerobic fitness, BMI, and glucose control in patients with T2D compared to C, despite no changes in the REE among groups.

Purpose: Prediabetes (PD) is a metabolic disorder that precedes type 2 diabetes. The lactate concentration at rest, the response of lactate during graded exercise test, and the effect of aerobic training (AT) on lactate adaptation in subjects with prediabetes is little known. The aim of this study was to measure the lactate response adaptation to AT in individuals with prediabetes.

Methods: Twenty-one subjects participated (age 39 ± 6 y; BMI 29 ± 5.4 kg/m2); after a glucose tolerance test, they were classified as normoglycemic (NG, n=11) and PD (n=10) group according to the criteria of the American Diabetes Association. All participants performed a graded exercise test in cycloergometer (MONARK 828 e). VO2peak, HRmax and Power (Watts/Kg body weight) were recorded during incremental exercise test (Monark 828 e). Glycosylated hemoglobin (HbA1c) and lipid profile were measured in fasting blood (12 h). Measurements were evaluated at baseline and after AT.

Results: Participants in both groups showed no change in blood glucose and lipid profile. VO2max increased similarly (p < 0.01) in both groups (NG: 33.5 ± 5.3 vs 37.9 ± 6.5 ml/kg/min; PD: 33.5 ± 4.1 vs 36.8 ± 3.8 ml/kg/min). The lactate at rest was similar in both groups before intervention and did not change significantly after AT (NG: 1.39 ± 0.5 vs 1.17 ± 0.4 mmol/L; PD: 1.76 ± 1.8 vs 1.59 ± 0.8 mmol/L). However, after AT, it was observed that the workload needed to reach the lactate threshold (4 mmol/L) increased significantly in each group (NG: 80.9 ± 16 vs 120 ± 22 W; p < 0.05; PD: 87.6 ± 16 vs 101 ± 15 W, p < 0.01), without a difference between groups.
CONCLUSIONS: Nine weeks of AT resulted in increased exercise capacity in both NG and PD, which indicates that patients with PD manage to respond and adapt to an exercise program and increase their aerobic capacity.

RESULTS: Compared with CON, the heart function of DCM gradually changes from preserved to impaired diastolic function to impaired systolic function, with heart developed hypertrophy at onset and gradually cardiac walls became thinner with large LV cavity. The aortic valve and mitral valve function were deteriorated, and echocardiography results revealed that AIT prevent the thinners of cardiac wall hypertrophy at onset and gradually cardiac walls became thinner with large LV cavity.

CONCLUSION: AIT intervention may reverse the process of DCM by activating GLP-1R signaling.

Approximately 30.3 million adults in the United States have diabetes. Diabetic complications include stroke, myocardial infarction, nerve damage, and renal failure, among others. In addition to being the seventh leading cause of death in the country, the medical costs due to diabetes is over $325 billion annually. Clinical evaluation for type II diabetes can be assessed in a variety of ways: fasting blood glucose (FBG), hemoglobin A1c (HbA1c) percentage, and the homostatic model assessment of insulin resistance (HOMA-IR). The PURPOSE of this study was to evaluate the relationships between these clinical indicators and body composition, physical activity level, and glucose response to mixed nutrient challenge in older adults.

METHODS: In 38 subjects (7 m/31 f) 1) body composition (bioelectrical impedance); 2) fasting blood glucose (FBG), insulin resistance (IR) and GLP-1 levels was measured. HE staining and immunohistochemical staining were performed to detect the localization of FAT/CD36. Other fatty acid transporters were determined by semi-quantitative reverse transcription polymerase chain reaction (RT-PCR). The mRNA levels of FAT/CD36 and other fatty acid transporters were determined by quantitative reverse transcription polymerase chain reaction (RT-PCR). The protein levels of FAT/CD36 and insulin signaling pathway related molecules were examined by western blot analysis.

RESULTS: Compared with the aging CON group, the mRNA levels of FAT/CD36 (1.000 ± 0.156 vs. 0.543 ± 0.051, P < 0.05) and CPT-1β (1.033 ± 0.167 vs. 0.528 ± 0.055, P < 0.05) in the EX group were significantly increased. The protein levels of FAT/CD36 and other fatty acid transporters were determined by western blot analysis.

CONCLUSION: Exercise intervention protects against aging-induced insulin resistance by regulating FAT/CD36 expression and translation.

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Purpose: Diabetes mellitus (DM) is an important risk factors of cardiovascular disease. Long-term hyperglycemia, hyperlipidemia and insulin resistance may lead to diabetic cardiomyopathy (DCM). No rodent models fully captured the whole process of cardiac morphology and function changes during the course of DCM. Aerobic interval training (AIT) has been advised as a non-pharmacological strategy against type 2 diabetes (T2D). However, little is known whether impose AIT intervention at the onset of DM will reverse the process of DCM. In this study, we sought to evaluate the cardiac function during the development of DCM and explore whether AIT will reverse the process of DCM.

METHODS: 60 Wistar male rats were randomly divided into two groups: (1) control group (CON; n = 6) and (2) endurance exercise group (EX; n = 6). The treatment was administered for one year. The mRNA levels of FAT/CD36 and other fatty acid transporters were determined by quantitative reverse transcription polymerase chain reaction (RT-PCR). The protein levels of FAT/CD36 and insulin signaling pathway related molecules were examined by western blot analysis. The localization of FAT/CD36 were detected by immunofluorescence. The differences in means were analyzed by t test. RESULTS: Compared with the aging CON group, the mRNA levels of FAT/CD36 (1.000 ± 0.156 vs. 0.543 ± 0.051, P < 0.05) and CPT-1β (1.033 ± 0.167 vs. 0.528 ± 0.055, P < 0.05) in the EX group were significantly increased, while other fatty acid transporters were not significantly changed (FATP4: 1.000 ± 0.153 vs. 0.832 ± 0.036, P < 0.05) and (FABPpm: 1.000 ± 0.048 vs. 0.718 ± 0.036, P < 0.05). When compared to the aging CON group, the protein levels of FAT/CD36 were also significantly decreased in the EX group (0.415 ± 0.053 vs. 0.337 ± 0.021, P < 0.05), as well as the phosphorylation levels of AKT (0.177 ± 0.012 vs. 0.290 ± 0.034, P < 0.05) and ERK (0.098 ± 0.014 vs. 0.322 ± 0.088, P < 0.05) were significantly increased. The immunofluorescence pictures showed that FAT/CD36 were localized to the caveolae of plasma membrane, but not the mitochondrial membrane.

CONCLUSION: Exercise intervention protects against aging-induced insulin resistance by regulating FAT/CD36 expression and translation.

A family history of type 2 diabetes (FH) is considered a risk factor for the development of type 2 diabetes (T2D). However, it is unclear whether exercise induced improvements in insulin sensitivity (IS), maximal aerobic fitness (VO2max), and mitochondrial maximum ATP synthesis rate (ATPmax), are impacted in FH+. PURPOSE: The purpose of this study was to 1) determine if normoglycemic, sedentary healthy individuals with FH+ have a lower IS, VO2max, and ATPmax compared to those without a family history of T2D (FH-) and 2) if exercise induced changes in IS, VO2max, and ATPmax is impeded in those with a FH+. METHODS: Fourteen normoglycemic sedentary males with (n=6; age=27.33 ± 2.65 years; BMI=24.64 ± 1.25 kg/m2) or without (n=8; age=26.63 ± 1.44 years; BMI=26.46 ± 0.57 kg/m2) FH were trained on a stationary bicycle for 30-55 minutes/session on alternate days of continuous and interval training for 13 days over 3 weeks. Non-exercising control (n=8; age=25.75 ± 1.85 years; BMI=24.38 ± 1.31 kg/m2) with a without a FH completed the same testing procedures at baseline and after 3 weeks. IS was assessed by hyperinsulimemic euglycemic clamp. ATPmax was measured by magnetic resonance spectroscopy, and VO2max was measured by a standardized graded exercise test.

RESULTS: There were no differences in IS, ATPmax, and VO2max between groups at baseline (one-way ANOVA all p>0.05). Three weeks of exercise increased VO2max of FH+ (Mean±SEM, Control 25.2 ± 6.8 to 31.2 ± 1.05 mL/kg/min, p<0.03; FH+ 29.64 ± 6.09 to 31.49 ± 2.07 mL/kg/min, p<0.14), increased ATPmax only in FH+ (Control 0.68 ± 0.04 to 0.69 ± 0.04 mM ATP/s, p<0.08; FH+ 0.70 ± 0.04 to 0.73 ± 0.03 mM ATP/s, p=0.81; FH+ 0.61
Previous study reported that hyperbaric treatment with 36% oxygen decreases glucose and insulin level in type 2 diabetes rats, and the improvement could be due to increased oxygen saturation and blood flow during hyperbaric treatment. However, the effects of simple hyperbaric treatment without high oxygen remain unknown.

**PURPOSE:** To investigate the effects of hyperbaric treatment with normal air on hyperglycemia in type 2 diabetes, focusing on skeletal muscle hemodynamics.

**METHODS:** 24-week-old male Otsuka Long-Evans Tokushima fatty (OLETF) rats and Long-Evans Tokushima Otsuka (LETO) rats were used as diabetes model and non-diabetes model, respectively. All rats were assigned to hyperbaric treatment or non-treatment groups. The rats in the hyperbaric treatment group were exposed to hyperbaric chamber at 1.3 ATA with normal air for 8 hours a day for 16 weeks. The oxygen saturation and total-hemoglobin (Hb) changes in the calf muscle during hyperbaric treatment were measured by near-infrared spectroscopy. Oral glucose tolerance test was performed at 40-week-old.

**RESULTS:** Oxygen saturation and total-Hb were significantly increased during hyperbaric treatment from 73.3 to 76.7% and 25.0 to 26.3×10⁴/mm³ in OLETF rats, 71.1 to 74.8% and 20.1 to 22.5×10⁴/mm³ in LETO rats (p < 0.05). The glucose and insulin levels were significantly higher in OLETF rats than LETO rats at both fasting and after glucose administration (p < 0.05). Among OLETF rats, the glucose levels at 30, 60, 120 min after glucose administration were significantly lower in the hyperbaric treatment group than the non-treatment group (30 min: 325 ± 71 vs. 385 ± 48, 60 min: 332 ± 67 vs. 421 ± 111, 120 min: 216 ± 45 vs. 230 ± 20 mg/dL, p < 0.05). Additionally, the fasting insulin level and the levels at 120 min after glucose administration were significantly lower in the hyperbaric treatment group than the non-treatment group (Fasting: 3.6 ± 1.1 vs. 4.3 ± 2.7, 120 min: 4.4 ± 1.6 vs. 5.2 ± 3.9 ng/mL, p < 0.05).

**CONCLUSIONS:** The present study demonstrated that hyperbaric treatment with normal air also prevents the progression of hyperglycemia in OLETF rats, and the treatment without high oxygen increases oxygen saturation and blood flow in the skeletal muscle.

Exercise training is often prescribed to treat non-alcoholic fatty liver disease (NAFLD). However, body-weight training, as a simple and convenient exercise method, the effectiveness on NAFLD is still unclear.

**PURPOSE:** To determine the effects of 12-week individualized body-weight training combined with aerobic training on body composition, blood lipid and liver function of NAFLD. **METHODS:** Thirty participates (male: 10, female: 10, age 45.8±7.55 years) who were clinically diagnosed as NAFLD were randomized allocated to the experimental group (EG) with a trained program that 3 times per week over 12 weeks (30 min body-weight training, 30 min walking exercise at 40-60% heart rate reserve) or a control group (CG) with health education. Body composition, blood lipid and liver function were measured at baseline and after intervention.

**RESULTS:** At 12th weeks there were significant changes within group in body weight (−6.1±1.87 kg, p < 0.01), body mass index (−1.57 ± 0.78 kg/m², p < 0.01), waist circumference (−5.20 ± 2.81 cm, p < 0.01), hip circumference (−5.07 ± 2.28 cm, p < 0.01), body fat percent (−1.86 ± 1.62%, p < 0.01), body fat mass (−1.69 ± 0.87 kg, p < 0.01) and visceral fat (−1.90 ± 0.78 cm, p < 0.01) in EG. There was no significant change in body composition of CG (p > 0.05), all these changes were significant different between EG and CG (p < 0.05). EG resulted in a significant increase in triglyceride (−0.56 ± 0.91 mmol/L, p < 0.05), low-density lipoprotein cholesterol (−0.33 ± 0.53 mmol/L, p < 0.05).
Postprandial hyperglycemia is a risk factor for future CVD events. Lifestyle interventions to blunt postprandial glucose are needed to reduce diabetic and CVD risk. Apple cider vinegar, a “functional food”, has been shown to attenuate the rise in glucose following a meal. Aerobic exercise may also reduce blood glucose (BG) levels when performed before or following a high-glycemic meal. Purpose: This study aimed to compare the effectiveness of post-meal vinegar ingestion and pre-meal walking in reducing postprandial hyperglycemia in elderly individuals. We also investigated whether this population will self-select walking speeds sufficient to reduce postprandial glucose spikes. Methods: Participants (n=12) reported for testing following a 3 hour fast. Baseline BG was measured upon arrival, after which participants completed one of three conditions in a randomized, crossover order: (1) Consumption of a standard meal followed by 2 hours of sitting, (2) Consumption of a standard meal with apple cider vinegar (3g/kg BW) or (3) Consumption of a standard meal followed by 15 minutes of self-paced walking. BG was measured by finger stick at 30, 60, 90, and 120 minutes following meal consumption. The meal was designed to be high glycemic-index (GI) and included a bagel, butter, and orange juice. Total energy content of the meal was 478kcal (79g CHO [28g sugar], 12g FAT, 1g PRO).

Results: The control trial confirmed BG rose significantly following the meal at 30 (167.8±6.1 mg/dl vs. 91.8±2.4 mg/dl, p<0.005) and 60 minutes (172.8±11.8 mg/dl vs. 91.8±2.4 mg/dl, p<0.024). There was no difference in BG area under the curve (AUC) at any time point following vinegar or walking interventions vs. control. However, following vinegar and walking, the absolute increase in BG at 30 minutes following the meal was significantly reduced vs. control (A30BG in control 76.1±7.0 mg/dl vs. vinegar 46.8±9.2 mg/dl vs. walking 44.3±7.5 mg/dl, p<0.05). Speed was found to be correlated with BACUC, such that an increase in walking speed was associated with a greater reduction in 2-hour glucose AUC (R=−0.590). Conclusions: Lifestyle interventions such as walking and vinegar ingestion may effectively lower postprandial glucose spikes. For elderly individuals this represent alternative therapies to aid in glucose management and improve metabolic health.

Purpose: To examine the impact of exercise on autophagy and inflammation response in visceral adipose tissue in obesity in order to explore the relationship between them in adipose tissue after exercise. Methods: 42 obese mice were randomly divided into four groups as follows: high fat diet (HC, n=9), normal diet (NC, n=9), normal diet combined with endurance exercise intervention (NE, n=12), and normal diet combined with resistance exercise intervention (NR, n=12). NE and NR conducted treadmill and ladder climbing exercise respectively for 8 weeks. Then to detect the gene and protein expression of autophagy, inflammation, ER stress and antioxidant markers using RT-PCR and WB, in addition, TEM and IHC were used to observe the autophagosome in visceral adipose tissue.

Results: BW, BW% and BFI were significantly decreased in all three intervention groups, and there is a great decreasing in the two exercise group, but no difference between them. Atg5, Beclin1 expression and LC3II/I were decreased significantly in NE and NR group compared with HC, meanwhile p62 protein expression were significantly increased. When compared with NC group, p62 protein expression were significantly increased in NE and not happened in NR group. Beclin1 mRNA expression increased and p62 protein expression decreased significantly in NR group when compared with NE group. IL-1β was decreased significantly in NC and NE group compared with HC. In addition, IL-6 and IL-10 protein expression increased significantly both in NE and NR group. When compared with NC group, IL-6 and IL-10 protein expression increased and IL-1β was decreased significantly both in NE and NR group except IL-6 protein expression in NR group. IL-6 increased and IL-10 decreased significantly in NR group when compared with NE group. Finally we found that IL-10 showed a negative correlation with almost every autophagy markers used in this study.

Conclusions: The effectiveness of 8wks different exercise intervention had no difference on weight reduction. The autophagic activity and inflammation in visceral adipose tissue was inhibited after exercise, especially after aerobic exercise. Aerobic and inflammation enjoy the same trend before and after exercise in visceral adipose tissue in obesity, and the IL-10 is the most sensitive factor in reflecting the relationship between autophagy and inflammation.

“Living high-training low” (LHTL) is effective for weight loss in nutritional obese individuals. But whether the LHTL improves hepatic steatosis is unknown. Purpose: To explore the effect of LHTL on serum lipids and hepatic steatosis in obese mice. Methods: High-fat diet induced obese mice (male C57BL/6J) were randomly divided into obesity (OB, n=9) and “Living high-training low” group (LHTL, n=9), both of which were fed a high-fat diet that provides 60% calories (Research D iets). Mice in OB group were kept quiet, while mice in LHTL group conducted hypoxia exposure (Mixing nitrogen and air, PO2 14.7%, from 08:30 to 16:30, 8 h/d, 6 d/w) and exercise training (starting at 20.00, treadmill slope is zero, 14 min, 840 ml, 6 d/w) intervention for 4 weeks. Animals were euthanized after the intervention. Body weight (BW), fat mass (FM), body fat percentage (BFP), liver index, serum High/low density lipoprotein cholesterol (HDL/LDL-C), Triglyceride (TG), Alanine aminotransferase (ALT), Free fatty acids (FFA), liver FFA and Histological staining (HE & Oil red O) were measured. Results: LHTL reduced BW (38.41±1.74 vs. 44.21±1.74 g, p<0.01), FM (2.06±0.09 vs. 2.45±0.14 g, p<0.05) significantly, while BFP (5.76±0.30 vs. 6.49±0.29%, p<0.05), serum HDL-C (0.72±0.01 vs. 0.72±0.01 μg/μl, p<0.05), LDL-C (0.66±0.02 vs. 0.68±0.01 μg/μl, p>0.05), TG (0.20±0.02 vs. 0.20±0.03 pmol/L, p>0.05) and FFA (72.59±40.74 vs. 60.06±15.97 μmol/L, p>0.05) levels showed no significant difference between the two groups; 2) reduced liver index (3.58±0.12 vs. 4.45±0.19%, p<0.01), serum ALT (5.06±12.6 vs. 2.68±3.01 μL/L, p=0.01) and liver fat content significantly while liver FFA (0.11±0.01 vs. 0.13±0.01 μmol/L, p<0.131) only showed a downward trend. Conclusions: “Living high-training low” is effective for weight loss and improves hepatic steatosis without attenuating circulating dyslipidemia. Supported by NSFC (Grant No. 81472148; 31672142). No potential conflicts of interest relevant to this abstract were reported. Corresponding author: Ru Wang (wangru0612@163.com).
The most potent lifestyle intervention for treatment of Type II Diabetes (T2D) is consistent exercise. However, for many patients with the condition, other comorbidities such as osteoarthritis, extension, and high body mass indexes prevent them from being able to exercise intensively and consistently enough to experience optimal metabolic benefits. Recent research has supported the use of compression exercise in physically limited populations and demonstrated physiologic responses at lower intensities (10-20% one repetition maximum vs. 70% for hypertrophic response in conventional resistance exercise). The combination of compression technology with core cooling further lowers the exertional requirements and has been used in cardiopulmonary rehabilitation populations to provide a safe and reliable exercise intervention. Compression exercise has also been shown to significantly increase muscle hypertrophy, with a greater growth in type II fibers (higher expressers of GLUT4). Therefore, this technology could directly address basal metabolism through increasing muscle protein turnover, reducing glucose storage in skeletal muscle mass, and improving glycemic control. This capacity to attenuate the insulin response combined with the accessibility of the platform suggests a clinical implication for diabetes management.

**PURPOSE:** To establish safe use of cooled compression exercise in Type II Diabetics and to examine the effect of 6 months of training on biomarker markers, especially Glycohemoglobin levels and weight.

**METHODS:** Thirty Type II Diabetics agreed to 3 training sessions a week for 6 months. Biomarker markers via blood draw were analyzed at 0, 3, and 6 months. RESULTS: Midpoint data from 16 participants at 0 and 3 months were analyzed with a two-tailed T-test, revealing significant differences in Glycohemoglobin level and weight. There was an 8% average decrease in Glycohemoglobin levels (8.5 ± 2.2 vs. 7.8 ± 1.8 mg/dl, p = 0.002) and an average weight loss of 3.6 lbs (211 ± 50 vs. 208 ± 48 lbs, p = 0.032).

**CONCLUSION:** The preliminary results of this study suggest exercise with compression and cooling contributes to a reduction in biomarker markers of diabetes. This intervention has promise in contributing to effective management of T2D with a low physical burden.
Aerobic Exercise Reduced Body Weight through Midbrain-striatal Dopaminergic Plasticity in Obese Mice

Wei Chen, Juan Li, Yuxiu He, Yakai Niu. Hebei Normal University, Shijiazhuang, China.
(No relevant relationships reported)

PURPOSE: Previous research indicates that midbrain-striatal dopaminergic disruption is associated with obesity and involved in feeding behavior and voluntary physical activity. Since the action of exercise on midbrain-striatal dopamine, it may be an effective strategy to improve physical inactivity and overtaking induced by food reward dysfunction in obesity. We therefore explored the mechanisms.

METHODS: Male C57BL/6 mice were randomly divided into control group (C, n=12), exercise group (E, n=12) fed a normal diet (13% fat), and an additional group (H, n=40) fed a high fat diet (51% fat). Obese mice in H were further divided into obesity group (O, n=12) and obesity + exercise group (OE, n=12). The CE and OE mice underwent treadmill exercise (5-13 min min⁻¹, about 58%-75% VO₂max, 50 min/d, 5 d/wk for 8 wks). The food preference test and open-field test were used to assess food reward, and voluntary physical activity. Tyrosine hydroxylase (TH) neurons were detected by immunohistochemistry, and the expression of TH protein in midbrain-striatum were measured by western blot.

RESULTS: Body weight of OE was 15.2% lower than that of O (P < 0.01). Sucrose preference, physical activity level and time were decreased by 25.8%, 46.77% and 37.56% in O compared to C (P < 0.05, P < 0.01, P < 0.01), but were 18.2%, 37.28% and 26.35% higher, respectively, in OE compared to O (P < 0.05). TH cells in substantia nigra pars compacta (SNc) and ventral tegmental area (VTA) decreased by 15.41% and 18.45%, respectively, in O compared to C (P < 0.05), but increased by 12.62% and 15.53% in OE compared to C (P < 0.05). TH fibers in dorsal striatum nucleus accumbens were 16.36% and 17.48% lower in O than C (P < 0.05), but was 12.54% and 14.13% higher in OE vs. O (P < 0.05). In addition, the expression of TH protein in midbrain and striatum decreased by 18.46% (P < 0.05) and 16.35% (P < 0.05) in O compared with C, but increased by 12.23% and 11.58% in OE compared to O (P < 0.05).

CONCLUSIONS: The aerobic exercise inhibits body weight gain, improves food reward and voluntary physical activity in obese mice. The exercise-induced midbrain-striatal dopaminergic plasticity may be one of the important mechanisms for this adaptation.
Exercise throughout cancer treatment can positively affect clinical and patient-reported outcomes. However, adverse side effects (e.g., fatigue) may reduce exercise adherence during chemotherapy. To potentially further improve patient prognosis, developing strategies to maximize exercise participation across the cancer treatment trajectory is warranted. Purpose: To compare adherence and attendance to a supervised multimodal exercise intervention completed during chemotherapy for breast cancer to the same intervention completed after chemotherapy. Methods: Women with stage I-III breast cancer were randomized to: 1) immediate exercise during chemotherapy (IE); or 2) delayed exercise after chemotherapy (DE). The exercise intervention matched the length of each participant’s chemotherapy regimen (8-12 wks) and included 3x/wk supervised aerobic (50-75% HRR, 30-35 min), resistance (1-2 sets, 10-12 reps, 50-65% estimated 1-RM), and balance training. Mean attendance and adherence to aerobic (i.e. intensity/duration) and resistance (i.e. sets/reps) exercise were calculated. Exercise trainers recorded reasons for missed sessions. Results: 26 women enrolled and attended ≥1 session (IE: n=12, DE: n=14). Attendance did not differ between groups (IE=79±24%, DE=81±21%, p=0.32). No group differences were found for adherence to aerobic duration (IE=94±12%, DE=98±12%, p=0.28) or intensity (IE=78±30%, DE=82±17%, p=0.64), or resistance training (IE=73±35%, DE=90±9%, p=0.13). Among IE participants, top reasons for missed sessions were treatment-related symptoms (39%) (i.e. fatigue) and non-treatment related illness (17%) (i.e. cold/flu). Missed sessions for the DE group were most often due to non-treatment-related injury (43%) and travel (23%). Conclusion: Adherence to an identical supervised exercise intervention did not vary based on whether it was completed during or after chemotherapy. Barriers to attendance differed by group, thus strategies to maximize exercise participation during chemotherapy should be unique to the time of intervention delivery. Although feasibility data was not available to quantify participation, further analysis is required to determine if the timepoint of exercise delivery has differing effects on physical and psychological benefits.

Exercise as Supportive Care Has Selective Benefits for Chemotherapy Tolerance and Weight Gain

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(Please note: no relevant relationships reported)

Purpose: To determine whether chemotherapy tolerance and side effects differ among women with breast cancer who do and do not participate in an exercise program.

Methods: Women with early stage breast cancer who were offered supervised exercise programming as supportive care during adjuvant chemotherapy (n=73) were compared to a randomly selected, retrospective, usual care group (n=87). Exercise programming included supervised moderate-intensity aerobic and whole-body resistance training 3x/week plus home-based aerobic training 2x/week. Clinical data were extracted from medical records in a standardized manner for both groups. Weight gain was defined as ≥0.5 kg increase in body weight from chemotherapy records. Complete blood counts were extracted to determine prevalence of anemia and neutropenia.

Results: The groups were matched on age, body mass index, medical history, diagnosis, and treatment characteristics. The relative dose intensity and risk of a dose reduction of any chemotherapy type did not differ between groups. Neutropenia was the most common reason for a dose reduction and the prevalence did not differ between groups. Dose reductions due to neutropenia or fatigue were significantly less common, while dose reductions due to mucositis were more common in the exercise group (all p<0.04). The severity, frequency, and risk of experiencing neutropenia and anemia did not differ between groups. Most (95%) patients experienced anemia, while one-third experienced neutropenia for at least 1 treatment cycle. There were some agent-specific effects of exercise including 1) a relative risk reduction of a doxorubicin dose reduction (relative risk, RR=0.40, 95% CI=0.17-0.94, p=0.04), but not for docetaxel or paclitaxel; and 2) risk reduction of weight gain with receipt of docetaxel and cyclophosphamide (RR=0.61, 95% CI=0.37-1.00, p=0.05) but not with receipt of doxorubicin and cyclophosphamide.

Conclusions: Women who participated in a supportive care exercise program did not experience greater overall tolerance for chemotherapy treatment. However, exercise may have some selective effects on tolerance for doxorubicin chemotherapy, weight gain with docetaxel chemotherapy, and dose reductions due to neutropenia and fatigue.
Cardiotoxicity is the leading non-cancer related cause of morbidity and mortality in cancer survivors. Cardiac rehabilitation (CR) improves function and reduces morbidity and mortality in patients with heart failure, but little is known about its ability to ameliorate or attenuate the known cardiotoxic effects of chemotherapy agents. PURPOSE: Determine if participation in CR improves fitness and quality of life (QOL) in patients undergoing treatment with either Doxorubicin or Trastuzumab who exhibit markers of subclinical cardiotoxicity. METHODS: 20 female patients with breast cancer and evidence of subclinical cardiotoxicity (i.e. >10% decrease in global longitudinal strain (GLS) or a cardiac troponin > 20 ng L−1) were randomized to 10 weeks of CR or usual care (UC). Exercise training was performed at a cardiac rehabilitation facility and included 2-3 days per week of interval training on a treadmill or cycle at 70-90% of heart rate reserve for 40 minutes. RESULTS: Cardiorespiratory fitness, as measured by peak oxygen uptake (VO2 peak) during the six minute walk test was 60.4%±17.9 of the VO2max. There was no significant difference between low and high cardiorespiratory fitness level of relative exercise intensity during the 6MWT (p=0.69). We observed a trending difference in relative exercise intensity during the 6MWT depending on risk factors (SR=63.3%±17.8 vs HR=58.1%±18.4; p=0.051). CONCLUSIONS: Although the physical cardiorespiratory fitness of survivors is lower, our results demonstrate that with a self-paced exercise (i.e. 6MWT) participants reached similar level as those of a healthy population. Their physical fitness level does not impact the relative intensity levels measured during the 6MWT. Criteria link to the disease (ALL risk prognostic: SR and HR) needs to be considered while prescribing PA to this population. Survivors have greater chances of overcoming their disease than in past history, but specific and increased knowledge about physical activity is needed to prevent late-effects related to the treatments.

### RESULTS

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<th>Control post test</th>
<th>P value</th>
<th>Control post test</th>
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<td>21.9 ± 11.4</td>
<td>31.2 ± 14.1*</td>
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<td>21.9 ± 11.4</td>
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### CONCLUSIONS

Androgen deprivation therapy (ADT) results in adverse effects on body composition (BC) and places prostate cancer (PCa) patients at increased risk for sarcopenic obesity. Accurate BC assessment across the treatment continuum is an important aspect of integrating successful supportive care strategies. Dual-energy x-ray absorptiometry (DEXA) and air displacement plethysmography (ADP) are valid methods and have exhibited excellent reliability in various populations. Evaluation of the relationship between methods when used to detect BC changes in PCa patients across an active treatment timeline would inform future trials of their respective clinical relevance. PURPOSE: The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of an exercise and dietary intervention, implementing a group-mediated cognitive behavioral approach, relative to standard of care treatment among PCa patients undergoing ADT. In the current study, we evaluated the reliability and absolute agreement of estimates of percent body fat (%BF), fat mass (FM) and fat-free mass (FFM) between DEXA and ADP in PCa patients to establish efficacy for detecting change in BC during treatment. METHODS: Change in BC estimates (baseline to 3-month) from a total of 30 PCa patients (M age = 66) on ADT were analyzed by DEXA and ADP. Degree of interrater reliability between methods was evaluated using mean-rating (k = 2), absolute-agreement, 2-way mixed-effects model intraclass correlation coefficients (ICC) and 95% confidence intervals. Potential bias between DEXA and ADP was examined using Bland-Altman plots analysis. RESULTS: A high degree of reliability and agreement was found for measurements of %BF and FM change between methods with average mean ICC = 0.865 (95% CI = 0.719, 0.936; p < .001) and 0.904 (95% CI = 0.880, 0.954; p < .001), respectively. Bland-Altman plots of change in %BF, FM and FFM revealed no evidence for proportional bias between DEXA and ADP. CONCLUSIONS: Findings from this study suggest DEXA and ADP measure change in BC with similar sensitivity across time. These results support the clinical application of DEXA and ADP as valid and reliable methods of BC quantification for PCa patients undergoing ADT. Supported by NIH/NCI R03 CA16296901

Email: n.hart@ecu.edu.au (No relevant relationships reported)
quality of life. Exercise has been shown to be feasible, safe and effective in other cancer populations to mitigate treatment-related side-effects, improve quality of life and minimise dose limitation. Exercise may therefore have clinical utility within pancreatic cancer.

**Purpose:** To establish the safety and feasibility of a supervised exercise program for patients with histologically confirmed adenocarcinoma of the pancreas.

**Methods:** This non-blinded, single cohort feasibility study provided patients with a 3-month supervised exercise program consisting of resistance and aerobic exercise two days per week. Upper and lower-body muscle strength, physical function (6MWT, 400m Walk Test), and body composition (DEXA) were examined at baseline, 12 and 24 weeks.

**Results:** Thirty nine patients (M=23, F=16) were referred with approximately 50% of referrals leading to enrolments (n=22; M=11, F=11). Patients who declined to participate reported feeling too unwell (41%), unable to travel easily (23%), not interested (17%), lost to follow-up (17%), and in one case, the patient deceased during the screening period (2%). Twenty two patients aged 60±9.2±12.8 years attended baseline testing and commenced exercise, however, a 50% withdrawal rate was observed during the intervention consisting of 8 females (73%) and 3 males (27%). Increased appendicular lean mass at baseline was significantly associated with patient completion, using gender and age as covariates (F = 4.609; p = 0.046). For those who exercised, improvements (p<0.05) were observed at 12 weeks and maintained at 24 weeks for 6MWT, 400m Walk Test, IRM Seated Row and IRM Leg Press. Diastolic BP was also significantly reduced following training (p<0.012).

**Conclusion:** Exercise programs are safe for pancreatic cancer patients. Appendicular skeletal muscle (ASM) appears critical to facilitate program completion. Focusing on increasing ASM could be a priority for this patient population. RCT’s are required to confirm these results.

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**Board #255 June 1 9:30 AM - 11:00 AM The Intersection Of Cognitive Performance, Physical Function, Aging, And Multiple Sclerosis: A Cross-sectional Comparative Study**

Rachell E. Bollaert1, Brian M. Sandroff2, Elizabeth Stine-Morrow1, Bradley P. Sutton1, Robert W. Motla1, 1Marquette University, Milwaukee, WI. 2University of Alabama at Birmingham, Birmingham, AL. 3University of Illinois, Urbana, IL.

Email: rachel.bollaert@marquette.edu

(No relevant relationships reported)

**Purpose:** Older adults with MS have worse physical and cognitive function than older adults without MS and young and middle-aged adults with MS. To date, there is no evidence regarding the associations, or coupling, of cognitive and physical function outcomes in older adults with MS. The purpose of this study was to examine the associations between physical (i.e., walking speed and endurance and functional mobility) and cognitive (i.e., information processing speed and verbal memory) functions in older adults with multiple sclerosis (MS) and healthy controls.

**Methods:** 40 older adults with MS and 40 demographically-matched controls undertook measures of physical and cognitive function. Bivariate linear relationships were examined with Pearson correlations in the overall sample and subsamples of older adults with MS and healthy controls. Linear regression analyses were further used to examine the independent associations between demographic characteristics and physical and cognitive function variables in the subsamples.

**Results:** Cognitive function (i.e., information processing speed) was significantly correlated with all physical function variables in the overall sample, and these correlations were driven by the subsample of older adults with MS. The linear regression analyses further indicated that information processing speed and years of education consistently explained variance in all physical function variables, beyond the influence of demographic variables, in older adults with MS.

**Conclusions:** Information processing speed and physical function are strongly correlated in older adults with MS. Future research should examine underlying neurobehavioral mechanisms associated with cognitive and physical function and behavioral strategies for jointly improving these functions in older adults with MS.

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**Board #256 June 1 9:30 AM - 11:00 AM Influence of Acute Aerobic Exercise on 24-hour Ambulatory Central Blood Pressure**

Malvina Shoukri, Thomas Burke, Brandon Kistler, Bradley Fleenor, Matthew Harber, FACSM, Ball State University, Muncie, IN. (Sponsor: Matthew P. Harber, FACSM)

(No relevant relationships reported)

Ambulatory central blood pressure (cABP) assessed for 24-hours is a relatively new measurement that may be predictor of cardiovascular disease (CVD). Acute bouts of exercise lower peripheral blood pressure; however, it is currently unknown if an acute bout of vigorous exercise reduces 24-hour cABP. **Purpose:** To examine the response of cABP over 24 hours after an acute bout of aerobic exercise. **Methods:** Apparently healthy adults (N=10; 6 males; age 25.9±1.8 years; body mass index 26.4±0.6 kg/m²; VO₂max 45.1±2.7 ml/kg/min) completed two trials in a randomized order. Trials consisted of a progressive maximal treadmill test to assess VO₂max or a non-exercise control. During each trial, participants were ambulatory ABP (AP) monitor to record brachial and central BP variables over 24 hours. Hemodynamic variables between trials were analyzed as mean for 24 hours and by time-of-day: Daytime (0800-2200 hours), and Nighttime (2200-0800 hours). Dependent t-test were used to compare 24-hour averages between control and exercise. A 2-way ANOVA with repeated measures was performed to examine time of day differences between trials. **Results:** Over the course of 24 hours, average brachial systolic BP (sSBP) (119.6±2.2 vs. 122.0±2.5 mmHg) central systolic BP (cSBP) (108.1±2.2 vs. 111.2±2.4 mmHg), and mean arterial pressure (MAP) (86.9±1.5 vs. 89.4±1.9 mmHg) were lower (p<0.05) after exercise compared to control. A main effect for time (p<0.05) indicated that sSBP, cSBP, brachial pulse pressure, MAP, CSBP, and cDBP, were lower during nighttime compared to day time, independent of exercise. **Conclusion:** A single, vigorous bout of aerobic exercise lowers ambulatory central hemodynamics for at least 24 hours. These novel findings provide insight into the regulatory effects of exercise on blood pressure.

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**Board #257 June 1 9:30 AM - 11:00 AM Leucocyte Telomere Length, Inflammation and Oxidative Stress in Master Athletes: The Interplay**


Email: hs.simos@gmail.com

(No relevant relationships reported)

Leucocyte telomere length, chronic inflammation and oxidative stress play a self-feeding loop that may be cause and consequence of several age-related diseases. However, the interplay of markers of biological aging, oxidative stress and inflammation were not investigated in master athletes who follow an anti-aging lifestyle. **Purpose:** To analyze the leucocyte telomere length (LTL), inflammatory markers and redox profile of master athletes and compare to young and age-matched untrained controls. **Methods:** Subjects (n=45) were 23 middle-aged master athletes (MA, 51.95±8.87 yrs.), 11 young controls (YC, 21.81±3.97 yrs.) and 11 middle-aged untrained controls. **Results:** LTL was negatively correlated with inflammatory parameters (sTNF, IL6 and sIL6), while the LTL was negatively associated with oxidative stress markers of oxidative stress and inflammation, with improved antioxidant defense and longer LTL. Increased appendicular lean mass at baseline was significantly associated with patient completion, using gender and age as covariates (F = 4.609; p = 0.046). For those who exercised, improvements (p<0.05) were observed at 12 weeks and maintained at 24 weeks for 6MWT, 400m Walk Test, IRM Seated Row and IRM Leg Press. Diastolic BP was also significantly reduced following training (p<0.012).

**Conclusion:** Exercise programs are safe for pancreatic cancer patients. Appendicular skeletal muscle (ASM) appears critical to facilitate program completion. Focusing on increasing ASM could be a priority for this patient population. RCT’s are required to confirm these results.

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**Board #257 June 1 9:30 AM - 11:00 AM Leucocyte Telomere Length, Inflammation and Oxidative Stress in Master Athletes: The Interplay**


Email: hs.simos@gmail.com

(No relevant relationships reported)
An interruption in the training routine may have deleterious effects on cardiorespiratory fitness (CRF) and body composition. Particularly the decline that can occur in the phase-angle (PhA), derived from the tangent value of the ratio of reactance to resistance (X/R) is a predictive marker for cellular integrity, sarcopenia, muscular function, and frailty in older adults.

**PURPOSE:** To determine the effects of 2-week detraining period on CRF and body composition (including PhA) in older trained adults.

**METHODS:** A total of 11 older adults (4 females) aged ≥ 65 years were assessed at baseline and follow-up for CRF and body composition in the early morning in fasting condition. Fat-free mass (%FFM), fat mass (%FM), and gynoid fat mass (%FM) were estimated with dual-energy X-ray absorptiometry (DXA) and PhA was assessed with BIA. CRF was evaluated with a breath-by-breath gas analyser system (Quark RMR, Cosmed) with a modified Bruce protocol. During the 15-day detraining period, participants were instructed to refrain from structured and supervised exercise sessions. One-way repeated measures ANOVA were performed and all analyses were adjusted for sex.

**RESULTS:** The interruption of structured and supervised exercise sessions for 15-days resulted in declines in PhA (5.5%; p-value=0.037). No differences were found for weight (p=0.662), body mass index (p=0.631), %FM (p=0.953), %FFM (p=0.455), %AM (p=0.138), %GM (p=0.300), and CRF (p=0.618).

**CONCLUSIONS:** A short-term detraining period of 2-weeks resulted in detrimental changes in PhA, suggesting a decline in the integrity of body cells, but no changes in the remaining body composition outcomes or CRF. These results highlight the importance of maintaining structured exercise sessions in older adults in order to preserve body cell integrity.

**Abstracts were prepared by the authors and printed as submitted.**
Fatigue-related impairments in the nursing workforce contribute to a multitude of health, safety, and economic consequences at the individual, organizational and societal levels. Long and compressed work schedules are commonly worked in the healthcare industry, but more research is needed to understand the cumulative effects of multiple work shifts on performance outcomes in nurses. PURPOSE: To examine the effects of a single nursing work shift compared to three successive (one every 24-hours) 12-hour shifts on outcome measures of fatigue, sleep, and job satisfaction. METHODS: Twenty-six fulltime hospital working nurses and aides (age = 36.1 ± 13.3 years) reported to the lab for testing before, immediately after a single 12 hour shift, and after working three 12-hour shifts in a 72-hour period. Outcome measures included vigilance-based reaction time and muscle function assessments (lower and upper body maximal strength, rate of torque development and vertical jump performance). RESULTS: All performance variables except hand grip strength showed a significant (P < 0.05) decline following the three work shifts. The psychomotor vigilance reaction time variable significantly declined from the end of the shift one to the end of the three shifts (8% more impaired following shift 3 versus shift 1), indicating an accumulation of fatigue with increasing number of shifts worked. Muscle function variables responded early in the shift cycle, showing a significant decline following shift one (P < 0.05 for all but hand grip) and remained reduced but did not further decline by the end of the third shift (performance reductions ranged from 6 – 18% from baseline to post shift three). CONCLUSION: This study used objective measures to substantiate that fatigue impairments occur from working a single 12-hour shift and in several instances, increases further with increased number of successive work shifts. Nurse personnel and administrators should view work schedules involving multiple successive shifts with caution. Fatigue management strategies may reduce consequences from fatigue-related mishaps, and this study reports several variables – namely lower body strength and power and psychomotor vigilance reaction time – that appear to be sensitive for identifying and tracking fatigue in a full time working nurse population.
Reductions in %body fat and markers of obesity-related disorders have been reported following obesity treatments; however, this short-term success is regained after the termination of treatments. **PURPOSE:** The purpose of this study was to evaluate whether telephone follow-up intervention is effective in preventing long-term regression of %body fat and inflammation after primary intervention in obese children. **METHODS:** 56 obese children (aged 10-14yrs) completed this study (19 PITI: primary intervention and telephone follow-up intervention, 18 PI: primary intervention only, and 19 CON: no intervention). Anthropometric data and blood samples were obtained before (PRE), after 2 weeks of primary intervention (POST), and 10month telephone follow-up intervention (1YEAR) to measure levels of %body fat, tumor necrosis factor-alpha (TNF-α), C-reactive protein (CRP), and TNF-α. **RESULTS:** Levels of primary intervention in PITI and PI significantly reduced %body fat (PITI:29.2±1.1%→25.8±1.3%, Mean±SE, P=0.003; PL89.91:0.6→26.1±1.4%, P=0.008), TNF-α (PITI:1.48±0.40μg/mL→3.24±0.62, P=0.02; P45.65:0.38→3.19±0.56, P=0.016), and CRP (PITI:9.5±3.3μg/L→2.31±0.47, P=0.035; P12.87±3.6→2.82±0.49, P=0.031) and elevated levels of adiponectin (PITII6.68±69μg/mL→8.5±8.8, P=0.019; TNF:6.48±0.6→8.18±0.85, P=0.024), while CON showed an increase in %body fat (29.3±1.0%→30.7±1.1%, P=0.028) with no differences in inflammatory cytokines. Results of 10month follow-up measurement (1YEAR) were reverted back to PRE for the PI (1YEAR value and P value for PRE vs. 1YEAR: %body fat: 28.3±1.2, P=0.89; TNF-α:4.14±1.51, P=0.60; CRP:2.66±0.55, P=0.75; adiponectin: 6.98±.79, P=0.47) whereas those in PITI at 1YEAR remained statistically significant to PRE (1YEAR value and P value for PRE vs. 1YEAR: %body fat: 27.1±1.3, P=0.016; TNF-α: 3.68±.52, P=0.035; CRP:2.48±.47, P=0.043; adiponectin: 8.03±0.8, P=0.038). **CONCLUSIONS:** Results of this study confirm that levels of inflammation are correlated to changes in %body fat, indicating that fat loss is effective in preventing and managing obesity-associated disorders. It is suggested that a telephone intervention is an effective follow-up tool for stabilizing reductions in %body fat, and levels of inflammation obtained from an intensive primary intervention in obese children.
The maximum force recorded from each muscle group during a session was used for analysis. A paired sample t-test was conducted to compare pre and post road march strength measurements.

RESULTS: No significant change in lumbar extension strength was identified between the pre and post conditions. Significant decreases in strength performance were observed in the hip flexion (8.3%; p<0.003), knee extension (7.8%; p=0.02), and lumbar flexion (9.9%; p<0.009) measurements between the pre and post conditions.

CONCLUSION: While lumbar extension strength did not change following the road march, the decreases identified for hip flexion, knee extension, and lumbar flexion followed the hypothesized trend. This study provides novel insight into the effects of field activities on soldier muscle strength that were not quantifiable prior to the portable HHD fixation system, and presents a range of new opportunities to understand the impact of military exercises on strength.

3582 Board #270
Jun. 1 9:30 AM - 11:00 AM
Effects of High-Intensity Interval Training on Fitness during Initial Military Training
John R. Borman, United States Military Academy, West Point, NY.
Email: john.borman@westpoint.edu

(No relationships reported)

Effects of High-Intensity Interval Training on Fitness during Initial Military Training

Author Block
John R. Borman, Brittany R. Hotaling, Kevin A. Bigelman, Dan A. Jaffe, Jesse L. German, Richard B. Westrick, Nicholas H. Gist
United States Military Academy, West Point, NY. United States Army Research Institute of Environmental Medicine, Natick, MA.ABSTRACT
High-Intensity Interval Training (HIIT) may confer rapid aerobic and anaerobic physiological adaptations. While several studies have compared HIIT and Moderate-Intensity Continuous Training (MICT), none have compared the United States Army’s doctrinal interval training work-to-rest ratios to examine its effects on aerobic capacity, anaerobic power and physical performance. We hypothesize that HIIT will improve aerobic and anaerobic fitness as well as MICT.

PURPOSE: To investigate the effects of a 5 -week low volume HIIT intervention on selected laboratory and field-based assessments [maximal oxygen uptake (VO2max); Running Anaerobic Sprint Test (RAST) performance] compared to MICT protocol in Initial Military Training Soldiers.

METHODS: 30 college-aged males at the United States Military Academy Preparatory School participated in an 11-week (1 week of pre-testing, 9 weeks of exercise training, 1 week of post-testing) research study examining the effects of HIIT on components of aerobic and anaerobic endurance, anaerobic power and performance time.

RESULTS: After training, HIIT experienced a 4.3% increase in peak power as measured by RAST performance. MICT had a statistically significant decrease in VO2max. Both groups had a non-significant increase in average power.

CONCLUSIONS: Using the United States Army’s interval training work-to-rest ratios, the HIIT protocol was more effective for improving peak power and maintaining both aerobic and anaerobic endurance when compared to MICT protocol. The MICT protocol enabled the maintenance of peak power but decreased overall aerobic endurance.

DISCLAIMER: The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government. Supported by the U.S. Army Medical Research and Materiel Command.

3583 Board #271
Jun. 1 9:30 AM - 11:00 AM
Individual Muscle Hypertrophy and Strength Responses to Traditional Resistance Training vs Drop Set System
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(No relationships reported)

Abstract category: Fitness Assessment, Exercise Training, and Performance of Athletes and Healthy People - 102 Exercise Intervention Interventions in Healthy People Cléton Augusto Libardi, Vitor Angleri, Carlos Ugrinowitsch. Federal University of São Carlos, SP, Brazil; University of São Paulo, SP, Brazil. To maximize, or to prevent the stagnation of gains in muscle strength and mass, coaches have used resistance training (RT) systems. It has been shown that traditional RT (TRAD) and drop-set systems (DS) result in similar gains in muscle hypertrophy and strength. However, a large variability has been reported for muscle strength and hypertrophy outcomes even when subjects perform RT programs.

PURPOSE: The aim of this study was to compare the individual muscle mass and strength gains to TRAD vs DS in well trained young men.

METHODS: We used a within-subjects design in which 14 participants had one leg randomly assigned to TRAD (3-5 sets of 6-12 repetitions at 75% 1RM) and the other to DS [3-5 sets of ~50-75% 1RM to muscle failure]). Participants had one leg fixed in the TRAD while the contralateral leg performed either DS to allow for total training volume (TTV) equalization. Muscle cross-sectional area (CSA) and one repetition maximum (1RM) were assessed at baseline and after 12-wks of RT. For group analyses, the accumulated TTV and changes in muscle CSA and 1RM values were compared between TRAD and DS using paired t-tests. For individual analyses, if an individual that showed a difference in the response (for CSA or 1RM) from TRAD or DS (or vice-versa) within 2 typical errors (CSA typical error [TE] = 2.20%, 1RM TE = 2.62%), no difference in the response between RT schemes was considered.

RESULTS: No significant differences in TTV (P > 0.05) were detected between protocols TRAD and DS. Muscle CSA and 1RM values increased significantly and similarly for TRAD and DS (P < 0.0001). This study highlights that some individuals showed greater muscle strength gains following TRAD (35.7% of individuals), and other show similar responses between TRAD and DS (64.3% of individuals). For muscle CSA, individuals showed similar responses to TRAD and DS. CONCLUSION: Despite the analysis groups show similar gains in strength and muscle hypertrophy, some individuals show greater strength gains for TRAD compared to the DS.

3584 Board #272
Jun. 1 9:30 AM - 11:00 AM
Wearable Positive-End-Expiratory Pressure Valve Increases Aerobic Capacity and Performance

STEPHEN F. CROUSE, FACS1, Sean Boutrous2, William B. Benton1, Michael Moreno1, Patrick McCulloch3, Bradley S. Lambert1, Texas A&M University, College Station, TX. 1HOUSTON PLASTIC AND CRANIOFACIAL SURGERY, Houston, TX. 2PEEP Performance, LLC, Houston, TX. 3Houston Methodist Hospital, Houston, TX. 4Methodist Research Institute, Houston, TX.

Reported Relationships: S. Crouse: Other (please describe); Member, Board of Directors, PEEP Performance LLC.

PURPOSE: We report testing results of wearing a positive end-expiratory pressure (PEEP) valve mouthpiece during exercise on VO2max and cycling time to exhaustion.

METHODS: 4 women & 5 men (Age 31±2 yrs, Ht 172.2±3.8 cm, WT 72.1±3.7 kg) were assigned at random on two separate occasions (time of day controlled, at least 48 hr between each test) to wear our PEEP mouthpiece or a Battle Oxygen Mouthguard® during cycle ergometer (Corival) testing to maximal voluntary exhaustion (MVE) at each condition. Participants were encouraged to self-regulate their power output (W) between each test) to wear our PEEP mouthpiece or a Battle Oxygen Mouthguard® during cycle ergometer (Corival) testing to maximal voluntary exhaustion (MVE) at each condition. Participants were encouraged to self-regulate their power output (W) between each test to allow for total training volume (TTV) equalization. VO2 was measured continuously (MGC Ultima®), and heart rate (HR, bpm) and blood pressure (BP, mmHg) were recorded at the end of each stage. There followed approximately one week later a timed endurance ride to exhaustion with the assigned mouthpiece at a power (W) equivalent to each subject’s ventilatory threshold (VT) measured during the VO2 test. RESULTS: Table (all p<0.05, paired t-test). Notably, time to exhaustion at VT was 13% greater with PEEP, but this did not reach statistical significance. Ratings of perceived exertion recorded during exercise did not differ between mouthpiece conditions.

Variable

<table>
<thead>
<tr>
<th>Condition</th>
<th>VO2max (ml/min·kg)</th>
<th>VO2max Test Time to Exhaustion (sec)</th>
<th>Max Systolic Blood Pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4.42 ± 0.33</td>
<td>495.3 ± 72.8</td>
<td>193 ± 7.5</td>
</tr>
<tr>
<td>PEEP</td>
<td>4.53 ± 0.21</td>
<td>521.8 ± 73.4</td>
<td>193 ± 6.5</td>
</tr>
<tr>
<td>Change from Control</td>
<td>+6.7%</td>
<td>+5.8%</td>
<td>-3.6%</td>
</tr>
</tbody>
</table>

CONCLUSION: The wearable PEEP-valve mouthpiece significantly improves cycling maximal aerobic capacity, reduces peak exercise systolic blood pressure, and may improve cycling performance. The PEEP mouthpiece technology appears to confer a benefit to cyclists performing high intensity exercise.

3585 Board #273
Jun. 1 9:30 AM - 11:00 AM
Muscle, Blood and Performance Responses to Ice Hockey Match-play in Elite Male Players
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(No relationships reported)

Competitive ice hockey is a high-intensity intermittent sport with an activity pattern characterized by short fast-paced bouts of skating repeated continuously. The course of the game interspersed by passive recovery intervals. However, no previous studies have yet examined the physiological response and degree of fatigue during an elite game. PURPOSE: To examine muscle, blood and performance responses to match-play in elite male ice hockey players in relation to physiologically mediated
fatigue. METHODS: Thirty players from the Danish U20 national team participated and completed one experimental game. The game was modified so each period consisted of 8 shifts of 1 minute duration preceded by 2 minutes of recovery resulting in a total playing time of 24 min for each participant. During the game each player was monitored continuously using heart rate monitors and a local positioning system assessing the activity pattern. Muscle biopsies were taken before and after the game (n=7) as well as instantly following shifts during the game (n=6). Blood sampling was performed before the game and at the end of each period. In addition, players performed a repeated sprint test consisting of three maximal 30 m sprints interspersed by 25 s recovery before the game and following each result. RESULTS: Players covered on average 6015±199 m reaching peak speeds of 29.2 km/h including 109±14 intense accelerating or decelerating actions and 2701±251 m high-intensity- and sprint skating resulting in an average and peak heart rate of 143.9 and 182.8 beats per min, respectively. Muscle lactate rose from 6.9±3 before the game to 38.2±0 and 20.1±12 mmol/kg d.w during the first and third period, while blood lactate increased from 0.8±0.3 at baseline to 4.7±3 and 4.9±3 mM following the first and third period (p<0.05). Muscle glycogen decreased from 400±22 to 188±43 mmol/kg d.w. over the course of the game (p<0.05). Compared to pre-game values mean sprint time declined following the first (p<0.05) and third (p=0.01), but not after the second period.

CONCLUSIONS: Ice hockey is a high-intensity team sport with a large anaerobic contribution resulting in significant glycogen utilization and fatigue development especially at the end of the game. The latter finding may at least partly be explained by lowered muscle glycogen levels.

Many potential benefits of altering bicycle crank length (CL) have been proposed from reducing injury to increasing aerodynamics and consequently, performance. Submaximal cycling bouts are often used to simulate various riding efforts to determine how CL can impact race performance in various cycling disciplines. These studies either used a set wattage for all participants or an intensity relative to VO_{2max} or Ventilatory Threshold (VT) based on a Cardiopulmonary Exercise Test (CPET) performed on one CL. However, it is unknown whether CL impacts VO_{2max} and/or VT, thus altering the prescribed submaximal intensity when CL is changed. This is crucial prior to future work in the area and for interpreting previous studies. PURPOSE: The purpose of this study was to determine the influence of crank length on VO_{2max} and VT in trained cyclists and multisport athletes. METHODS: A familiarization session 10 subjects performed three separate trials using different crank lengths (162.5, 172.5 and 182.5 mm) in randomized, counter-balanced order. The trials consisted of a maximal CPET to determine VO_{2max} and VT, a supramaximal effort to verify VO_{2max} and two 10-min submaximal efforts at a low intensity (70% of VT) and a high intensity (95% of VT). Individual repeated measures analysis of variance (ANOVA) were used to compare differences in VO_{2max} and VT across the three crank lengths. To achieve a power of 0.80 with a difference of 3 mL/kg/min and a standard deviation of 1.5, nine subjects were required. RESULTS: VO_{2max} and VT at values were not significantly different across the three crank lengths (162.5, 172.5 and 182.5 mm): 4.35, 4.39 and 4.36 L/min, p=0.65 and 3.08, 3.04 and 3.08 L/min, p=0.64, respectively. CONCLUSION: Mean differences in the VO_{2max} and VT values between crank lengths were not statistically significant; however, several individual differences were of clinical relevance (5/10 subjects for VO_{2max} and 6/10 for VT) for between ±3 mL/kg/min or more between at least two CLs). Factors including explosive power capacity, preferred cadence, leg length, body composition, and submaximal cycling economy contribute to this variability and warrant further evaluation.

Purpose: This mixed methods, experiential learning research project incorporated multiple teaching methodologies to assess improvements in knowledge and self-efficacy in exercise physiology (EXPH) human performance testing. METHODS: Six undergraduate EXPH students completed a pre-intervention quiz which assessed knowledge of blood lactate production and lactate threshold. Participants received a lecture on lactate production and lactate threshold from an expert in the field of human performance and discussed peer-reviewed research readings. Supervised training and practice were held prior to conducting lactate threshold testing on the varsity women’s rowing team. Following, participants met to review physiological concepts, data collection procedures, discuss research readings, and reflect on the service component of the project. At the end of the project, participants completed the same lactate threshold quiz as well as an anonymous, online, 15-question self-efficacy and satisfaction survey with answer choices on a 7-point Likert scale. A focus group discussion moderated by trained researchers captured participants’ perceptions of the experiential service learning project. Data were content analyzed to identify common themes using independent data reviewers and a tiebreaker when necessary. RESULTS: All participants agreed or strongly agreed that participation in this project would allow them to make a difference in their community, enable them to interact with relevant professionals in ways that are meaningful and effective, and apply [their] knowledge in ways that solve real-life problems. All students strongly agreed they would recommend this experience to their friends. Compared with a pre-assessment, participants scored 10% higher on the lactate knowledge quiz at the end of the experiential learning project. Students reported improved self-efficacy, knowledge, communication, and confidence in exercise physiology related content as well as professional skills.

Conclusion: An experiential learning project incorporating multiple teaching methodologies successfully improved knowledge, self-efficacy, and professional skills in human performance testing.

Prolonged strenuous endurance exercise is associated with altered cardiac physiology that often manifests as both transient cardiac dysfunction and detectable cardiac troponin (cTn) in peripheral circulation. The extent of a possible relationship between cTn release and cardiac function is unclear, as many studies do not report significant correlations. The influence of exercise intensity, mode and duration on EICF and cTn release is also unknown due to large methodological variation. PURPOSE: We performed a systematic review, meta-analysis and meta-regression of studies that sought to determine the relationship between cTn and left ventricular (LV) function. The second objective was to determine how study-level and exercise factors influenced the variation in the body of literature.

Methods: A systematic search of Pubmed Central, Science Direct, SPORTDISCUS, and MEDLINE databases for original research articles published between 1997-2018 involving ≥30mins of continuous exercise, measures of cTn event rates, LV ejection fraction and E/A ratio. Random-effects meta-analyses and meta-regressions with four a priori determined covariates (age, exercise heart rate [HR], duration, mass) were performed.

Results: Pooled cTn event rates were evident in 45.6% of participants (95% CI = 33.6 – 58.2%); however, the overall effect was non-significant (P>0.05). There were significant (P<0.05) reductions in E/A ratio: –0.38 (SMD = –1.25, 95% CI [-1.4, -1.0]), and LVFE: 0.202% (SMD = –0.38, 95%CI [-0.7, -0.1]) pre to post-exercise. Exercise HR predicted cTn release and E/A ratio. Participant age was negatively associated with cTn release. There was a significant negative association between E/A ratio and cTn event rate (P<0.05).

Conclusions: High levels of statistical heterogeneity and methodological variability exist in the majority of EICF studies. Exercise intensity and age are the most powerful determinants of cTn release. E/A ratio is influenced by exercise HR and cTn release, implying exercise bouts at high intensities are unable to elicit LV dysfunction and cTn release. Future EICF studies should consider sex and mode: A Systematic Review and Meta-Analysis

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immediately after, and one hour post an acute bout of BFR exercise. RESULTS: %FMD was unaltered immediately (0.95±2.33) and 1 h post (0.43±3.05) BFR exercise compared to baseline (9.62±1.63) (p<0.05). CONCLUSION: An acute bout of BFR exercise does not alter endothelial function in healthy males. Future studies are aimed at determining if females display a similar response when controlling for the impact of the menstrual cycle on vascular function.

3592 Board #280 Jun. 1 9:30 AM - 11:00 AM The Effects of Simultaneous Upper and Lower Body Cycling on Cardiorespiratory Responses.

Jessica Royen, Brandi N. Guillotte, Kierstin Marshall, Kimberly Billiot, Robert R. Kraser, FACSM. Southeastern Louisiana University, Hammond, LA.

(No relationships reported)

Some forms of physical activity require greater amounts of upper body activity combined with lower body activity. Arm ergometry has been shown to elicit larger increases in blood pressure and heart rate when compared to lower body ergometry. Arm ergometry, in workloads up to 125 W, has been shown to illicit greater increases in VO2 due to extra stabilization of the torso and mechanical efficiency. The effects of a combined lower and upper body ergometry simultaneously, with identical workloads, on the cardiorespiratory system has not yet been studied. Previous studies have evaluated cardiorespiratory responses to elliptical ergometry, which utilizes both upper and lower body extremities. However, an elliptical does not allow for precise regulation and measurement of work performed by both upper and lower body.

PURPOSE: The aim of this study was to examine the effects graded upper body ergometry, lower body ergometry, and combined upper and lower body ergometry on oxygen consumption, heart rate, minute ventilation, respiratory exchange ratio, and blood pressure. METHODS: Eight males, ages 18-28y, participated in three trials over seven days. Subjects were divided into two groups. Session one included one trial of graded leg ergometry and one trial of graded arm ergometry. The two groups completed each of these trials in a counterbalanced fashion with 20min rest between trials. Session two included a trial of graded leg ergometry combined with graded arm ergometry, performed simultaneously, at identical workloads. Each trial began with a warmup at 60% and maintained a 60rpm cadence. Workload for each trial increased by 0.5kg every 2 min peaking at 95W. RESULTS: Combined body ergometry produced significantly (p<0.001) greater peak oxygen consumption (36.14± 4.95 ml/kg/min) compared lower body ergometry (19.41± 3.88 ml/kg/min) and upper body ergometry (21.58 ± 7.08 ml/kg/min). Combined elicited a significantly higher peak blood pressure (p < .005) and heart rate (p < .005), respectively (180mmHg ± 10) (168± 16 BPM), than lower body (156± 13 mmHg) (126± 12 BPM), but not upper body. CONCLUSIONS: These data could be helpful in considering cardiorespiratory stress in healthy and clinical populations from manual tasks involving both upper and lower body extremities.

3593 Board #281 Jun. 1 9:30 AM - 11:00 AM Bone Density and Cross-Sectional Area are Inversely Related in the Young Adult Distal Tibia.

Nathaniel I. Smith1, Paul M. Bartlett2, Katelyn I. Guerriere2, Kathryin M. Taylor1, Mary L. Bouxsein1, Stephen A. Fouls1, Julie M. Hughes1, 2USARIEM, Natick, MA. 2Massachusetts General Hospital; Beth Israel Deaconess Medical Center; Harvard University, Boston, MA.

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(No relationships reported)

Bone is posited to develop and adapt to loads by satisfying the competing demands for achieving sufficient stiffness and minimizing mass. This compromise has been demonstrated at the midshaft of the tibia by an inverse relationship between cross-sectional area and thickness of the cortical shell. The requirement for minimizing mass is likely greater at the distal tibia where inertial properties cause bone mass to be more metabolically expensive. Whether there is a similar tradeoff between bone size and the amount of bone tissue at the distal tibia remains to be determined. PURPOSE: Determine whether cross-sectional area of bone is inversely related to bone density at the distal tibia. METHODS: Six hundred seventy-three (476M, 197F) Army trainees (20.4±3.4 yrs; 1.71±0.09m; 72.5±13.3kg) underwent low resolution peripheral quantitative computed tomography (HP-μCT, XTEX, ZEISS, Inc.). Scans of their non-dominant distal tibias at 4% bone density from the distal growth plate, at the start of their initial military training. Generalized linear models adjusted for sex were used to test the significance and directionality of relationships between total cross-sectional area (CSA) normalized to body mass and total volumetric bone mineral density (vBMD). RESULTS: Normalized CSA was significantly and inversely related to vBMD (p < 0.001) whereas length of one-unit increase in normalized CSA (mm/mg) resulted in a 5.856% HA/cm3 reduction in vBMD. Specifically, the lowest compared to the highest quintile of normalized CSA had 13% higher vBMD, per unit body mass. CONCLUSION: These findings support the hypothesis that bone in the distal tibia

3591 Board #279 Jun. 1 9:30 AM - 11:00 AM The Impact of Blood Flow Restriction Exercise on Endothelial Function.

Leryn Reynolds, Robbie Pittman, Hannah Twiddy. Old Dominion University, Norfolk, VA.

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(No relationships reported)

Research has shown low intensity resistance training done with blood flow restriction (BFR) to be an effective means at increasing skeletal muscle strength. However, research is lacking examining the effects of BFR exercise on brachial artery endothelial function, which is closely linked to coronary artery endothelial function and thus predisposition to developing atherosclerosis. Given the important role of blood flow (i.e., shear stress) on maintaining endothelial function, BFR exercise may have negative consequences on vascular health. PURPOSE: The purpose of this study was to examine the effects of blood flow restriction training on endothelial function in healthy men. METHODS: Subjects were 9 healthy males, 23.9±1.2 years, 27.7±1.2 kg. Participants were moved into a sitting or standing position at least 2 times per week. Participants performed 3 sets of bicep curls at 30% of their 1 repetition maximum to failure with a blood pressure cuff at 80% arterial occlusion pressure. Endothelial function was assessed by percent flow mediated dilation (%FMD) performed before, immediately after, and one hour post an acute bout of BFR exercise. RESULTS: %FMD was unaltered immediately (0.95±2.33) and 1 h post (0.43±3.05) BFR exercise compared to baseline (9.62±1.63) (p<0.05). CONCLUSION: An acute bout of BFR exercise does not alter endothelial function in healthy males. Future studies are aimed at determining if females display a similar response when controlling for the impact of the menstrual cycle on vascular function.

3590 Board #278 Jun. 1 9:30 AM - 11:00 AM Association Of Mid-pregnancy And Current Exercise With Arterial Stiffness 6 Months-3 Years After Delivery In Women.

Abby J. Heinichen, Catherine A. O’Byrne, PaigeWilbanks, Nicole Hoffner, William Tucker, Abbi D. Lane-Cordova. University of South Carolina, Columbia, SC.

Email: lanecord@mailbox.sc.edu

(No relationships reported)

PURPOSE: Regular exercise is associated with lower cardiovascular disease (CVD) risk. Pregnancy influences longer-term CVD risk for women, regardless of their previous prenatal risk level. Our purpose was to assess whether prenatal and/or current physical exercise levels were associated with arterial stiffness in women 6 months-3 years after a singleton delivery.

METHODS: We performed gold-standard measurement of central arterial stiffness (aortic pulse wave velocity; PWV) in 19 women (mean age 34±1 yrs; mean BMI=27.0±2 kg/m2; 15 white/3 black/1 Asian). Participants were asked to recall leisure-time exercise performed during mid-pregnancy, as well as current exercise habits, and reported both using a validated survey (Godin Leisure-time Exercise Questionnaire). We used linear regression to determine associations of mid-pregnancy and current exercise with PWV, adjusted for age.

RESULTS: Average exercise units were 39±6 (mid-pregnancy) and 43±7 (current). Mean systolic and diastolic blood pressures were 111±3 and 70±2 mmHg, respectively; average PWV was 6.4±0.3 m/s. Mid-pregnancy exercise score (b=-0.02±0.01, p=0.051), overall exercise score (b=-0.02±0.01, p=0.051), and exercise score (b=-0.02±0.01, p=0.051) were associated with PWV 6 months-3 years after delivery. The findings suggest that exercise during pregnancy may be important for influencing longer-term maternal vascular function.

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Tendinopathy represents 30 to 50% of sports-related injuries. Yet, a significant proportion of patients do not respond to the first-line conservative management with progressive loading and strengthening exercises program. Recently, Mesenchymal Stem Cells (MSC) have emerged as a potential regenerative treatment in tendinopathy. **Purpose:** The aim of the present study is to determine whether the injection of MSC conditioned with celastrol, a HSP90 inhibitor, and/or MSC conditioned with celastrol and a HSP90 inhibitor and antioxidant. The outcome measurements were histopathological changes assessed after anesthetic administration, before scraping is begun.

**RESULTS:** There were no statistically significant differences between groups, both at 4 weeks and 12 weeks (α > 0.05). However, at 12 weeks, there was a trend towards more improvement and better Modified Bonar Scores in the tendons treated with Confidant-MSC (0.48 ± 0.46) and conditioned-MSC (1.51 ± 0.81) compared to tendons injected with vehicle (2.26 ± 1.90).

**Conclusion:** No difference was found in Modified Bonar Scores in tendon specimens injected with PB-saline compared to MSC and celastrol-conditioned MSC at 4 weeks. The number of rats per group that was observed until 12 weeks for pathologic analysis was insufficient to draw any conclusion. Nevertheless, these results underline that we need to host rats for a longer period for pathologic analysis. We are currently expanding this experiment with a larger number of rats to be assessed at 12 weeks.

**Abstracts were prepared by the authors and printed as submitted.**
of 1.3 years. The extent to which PAM users share their data should be considered when using this technology as a behavior change tool. Encouraging users to share data publicly may lead to longer device engagement.

Background: Purpose: Arab Americans account for almost 3.7 million people in the United States (Arab American Institute, 2014). However, limited health data is available on youth populations. Additionally, very few interventions have been designed to increase the physical activity levels of Arab American youth. Therefore, the purpose of this study is two-fold: evaluate Arab American children’s physical activity (PA) levels during physical education (PE) class and understand how the implementation of PAM can influence the PA of Arab American youth in the PE context.

Methods: System for Observing Fitness Instruction Time (SOFIT) was used to assess activity levels, lesson context, and teacher involvement during PE class. A total of 66 PE classes in one urban, primarily Arab American, district, were observed in grades 3-8, involving 18 PE teachers. Data collection took place over two time points, with one professional development of the SPARK PE curriculum occurring in-between.

Results: MANCOVA’s were run to better understand the effect grade level has on physical activity minutes, lesson context, and teacher involvement while controlling for teacher, total lesson minutes, and type of activity. In general results showed that students were not meeting suggested PA guidelines during PE class $M_{ \text{activity}} = 18.6 \text{ min}, M_{ \text{context}} = 13.6 \text{ min}, M_{ \text{teacher}} = 12.3 \text{ min}$. Overall, participants did not have a significant effect on level of PA ($p > .05$). MVPA did not increase between T1 and T2 ($p > .05$), but there were significant changes across timepoints in lesson context ($p < .01$) and teacher involvement ($p < .01$).

Conclusions: The results show that youth were not meeting recommended amounts of daily PA during PE class at either timepoint. A one-time SPARK professional development did not significantly change student behavior as measured by MVPA, but did show improvements in teacher knowledge as measured by lesson context and teacher involvement. Implications for using SOFIT data gathered to inform the ongoing SPARK and Dearborn SHINES intervention and importance of prolonged professional development to transition from increases in knowledge to behavior change will be discussed.

Assessing Safety, Ease of Use, and Productivity While Using Treadmill Desks: A Pilot and Feasibility Study

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(No relationships reported)

PURPOSE: The purpose of this study was to evaluate the safety, ease of use, and productivity associated with using treadmill desks (TD) during the work day.

METHODS: Sedentary office workers ($n=14$; 86% female, $40 \pm 12$ yrs) took part in a within-person, 4-week randomized crossover study comparing group usage of a TD to a usual desk condition. During the TD condition, participants were asked to use the treadmill for a minimum of 30 minutes each workday. In-person study visits were conducted at baseline and during the final week of each condition, and electronic surveys were administered via an email link. Treadmill use and physical activity bouts were tracked with logs and the activPAL accelerometer worn on the thigh.

RESULTS: During the TD period, participants spent an average of 33±25 minutes at an Active Station (Hopkins, Minn.) each day; the range of the walking bout durations, when the TD was used, was 15-120 minutes. All participants reported feeling safe while using the TD. 12 people reported it was ‘easy’ to use, with one person reporting it was ‘somewhat easy’. Productivity results were mixed; 4 reported they were somewhat or much more productive, 4 were neutral, and 5 reported they were somewhat less productive. All participants endorsed a desire to continue using the treadmill desks.

CONCLUSIONS: Results suggest that, over the short term, treadmill desks are safe and easy to use and appear to have mixed effects on productivity. Further research should include full-scale long-term efficacy trials of treadmill desks that include measures of productivity, adherence, and cardiometabolic health outcomes.

Does Post-diagnosis Physical Activity Prolong the Duration of Active Surveillance in Men With Prostate Cancer?

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(No relationships reported)

PURPOSE: In this retrospective cohort study, we examined the effect of post-diagnosis physical activity on active surveillance (AS) termination in men with low-risk prostate cancer.

METHODS: 630 participants on AS were included in the analysis. Post-diagnosis physical activity was measured using the Godin Leisure-Time Exercise Questionnaire and expressed in metabolic equivalent-minutes per week (MET-min/wk). Four physical activity categories were created to classify participants throughout the study: inactive (<210 MET-min/wk), insufficiently active (210-500 MET-min/wk), active (500-1000 MET-min/wk), or highly active (>1000 MET-min/wk). Using Cox regression models, we evaluated the relationship between post-diagnosis physical activity and risk of terminating AS, adjusting for age, prostate-specific antigen (PSA) and number of positive cores most proximal to AS initiation.

RESULTS: Of the 630 participants, 198 underwent active treatment and 432 were censored. The earliest and latest events of AS termination, indicated by active treatment initiation occurred at 5 and 116 months, respectively. In this cohort, post-diagnosis physical activity was not significantly associated with time to AS termination. PSA (HR, 1.11; 95% CI, 1.03 to 1.20) and the number of positive cores post-diagnosis physical activity was not significantly associated with time to AS treatment initiation occurred at 5 and 116 months, respectively. In this cohort, post-diagnosis physical activity was not significantly associated with time to AS termination. PSA (HR, 1.11; 95% CI, 1.03 to 1.20) and the number of positive cores post-diagnosis physical activity was not significantly associated with time to AS termination. PSA (HR, 1.11; 95% CI, 1.03 to 1.20) and the number of positive cores most proximal to AS initiation.

CONCLUSIONS: Results suggest that, over the short term, treadmill desks are safe and may lead to longer device engagement.
is highly accurate. Since the average American spends 46 min/day in the car, there is a need to develop new methods that correctly classify driving time for hip- and wrist-worn devices.

3602 Board #290 Jun. 1 9:30 AM - 11:00 AM Comparing Estimates Of Sedentary, Light And Moderate-vigorous Physical Activity Between Activity Monitors Cami Christopher, Rachel Barnett, Mami Takeda, Julian Martinez, Matt Nelson, Sarah Keable. California Polytechnic State University, San Luis Obispo, San Luis Obispo, CA. Email: cchris17@calpoly.edu (No relationships reported)

Accelerometers are widely used in research, but studies use different monitors, attachment sites, and/or data processing methods, making it difficult to compare results across studies.

**PURPOSE:** Therefore, the purpose of our study is to compare data collected at the hip, wrist, and thigh to determine if estimates of sedentary time (ST), light physical activity (LPA) and moderate-vigorous physical activity (MVPA) are comparable over a 7-day wearing period. 

**METHODS:** Participants wore an ActiGraph (AG) on the hip and non-dominant wrist, and activPal on the thigh 24 hours/day for 7 days. Intensity was categorized using the following methods: AG-Hip 3x, Freedson, Sasaki, Matthews, and Crouter; AG-wrist random forest (RF), linear model (LM) and GGIR; and activPal software. Across the different methods, we compared mean estimates and pearson correlations for ST, LPA and MVPA.

**RESULTS:** Average ST ranged from 461 min/day (Hip-Crouter) to 610 min/day (Hip-Freedson), the lowest correlation was between Hip-3x and Wrist-GGIR (R= 0.14) and the highest was between Hip-Freedson and Hip-Sasaki (R=0.94). Average LPA ranged from 201 min/day (Hip-Matthews) to 338 min/day (Hip-Sasaki), the lowest correlation was between Hip-3x and Wrist-LM (R=0.46) and the highest was between Hip-Freedson and Hip-Matthews (R=0.94). Average time in MVPAA ranged from 53 min/ day (Hip-Freedson) to 186 min/day (Wrist-LM), the lowest correlation was between Wrist-LM and Wrist-GGIR (R= 0.30) and the highest was between Hip-3x and Hip-Matthews (R= 0.93).

**CONCLUSIONS:** Estimates of ST, LPA and MVPA are heterogeneous across different processing methods and attachment sites, particularly when comparing hip and wrist attachment sites. There is a need to identify which procedures will result in equivalent methods to facilitate data pooling and ensure coherent public health translation of prospective cohorts that are using accelerometers.

3603 Board #291 Jun. 1 9:30 AM - 11:00 AM High-active Mice Have Elevated Clearance Rate Of Bcaas Compared To Low-active Mice Jorge Z. Granados, Gabriella A. M. Ten Have, Aylaid C. Letsinger, John J. Thaden, J. Timothy Lightfoot, FACSM, Nicolea E. P. Deutz. Texas A&M University, College Station, TX. Email: jgranos@tamu.edu (No relationships reported)

Physical activity (PA) is associated with a diminished prevalence of hypokinetic related diseases and its worldwide economic burden on health care cost. For several decades, branched-chain amino acids (BCAAs; leucine [LEU], isoleucine [ILE], valine [VAL]) have been studied for muscle wasting disorders. However, little is known about the metabolic interactions between BCAAs and regulation of PA levels.

**PURPOSE:** To assess BCAA metabolism by measuring plasma clearance rates in mice previously classified as either low-active (LA; CHF/HeJ) or high-active (HA; C57/J). 

**METHODS:** 12-week-old male LA (n=23) mice (body weight: 25.8 ± 1.2g; lean body mass: 21.0 ± 1.1g; fat mass: 2.5 ± 0.5g) and HA (n=20) mice (27.5 ± 1.2; 22.5 ± 1.3; 4.3 ± 1.3g; 4.5 ± 1.4g) were used. Under anesthesia, a pulse of stable tracers (L-LEU[13C6], L-ILE) and HA (n=20) mice (27.5 ± 1.2; 22.5 ± 1.3; 4.3 ± 1.3g; 4.5 ± 1.4g) were used. Under anesthesia, a pulse of stable tracers (L-LEU[13C6], L-ILE) and HA (n=20) mice (27.5 ± 1.2; 22.5 ± 1.3; 4.3 ± 1.3g; 4.5 ± 1.4g) were used. Under anesthesia, a pulse of stable tracers (L-ILE[13C6]) and HA (n=20) mice (27.5 ± 1.2; 22.5 ± 1.3; 4.3 ± 1.3g; 4.5 ± 1.4g) were used. Under anesthesia, a pulse of stable tracers (L-ILE[13C6], L-VAL [13C5]) was administered via the right jugular vein catheter. Subsequently, blood samples were taken (Time: 1, 3, 5, 7, 10, 15, 20, 25, 30, and 40 mins). Plasma enrichments and concentrations of LEU, ILE, and VAL were determined by LC-MS/MS. Whole-body production (WBP) was calculated from fitted area under the curve (AUC) as pulse/AUC, and clearance of stable tracers was calculated as WBP/plasma concentrations. Fitting and statistical analysis (unpaired student t-tests) were performed using GraphPad Prism 8 software. Data are expressed as mean ± SE.

**RESULTS:** HA mice had significantly lower plasma concentrations for LEU (125.2 ± 48 vs 144.8 ± 6.4 µmol/l, p< 0.02), ILE (48.5 ± 19 vs 57.7 ± 2.3 µmol/l, p< 0.01) and VAL (156.8 ± 4.9 vs 187.9 ± 7.1 µmol/l, p< 0.01) and significantly higher WBP values for ILE (11.6 ± 0.6 vs 8.3 ± 1.1 mmol/g/lbm, p< 0.02) and VAL (111.4 ± 5.4 vs 92.8 ± 2.8 mmol/g/lbm, p< 0.01) compared to LA mice. No significant WBP differences were observed for LEU (75.5 ± 3.3 vs 72.7 ± 3.2 mmol/g/lbm, p= 0.56).

HA mice demonstrated higher percent clearance for LEU (40%), ILE (76%), and VAL (29%) compared to LA mice. **CONCLUSIONS:** The observed changes in plasma concentration, WBP, and clearance of BCAAs suggest modified metabolic pathways of LEU, VAL, and ILE in HA mice, compared to LA mice. FUNDING SOURCES: Texas AM Vice President of Research Office, TACSM Student Research Development Award, College of Education & Human Development Student Research Grant, and funds from the Omar Smith Endowment.

3604 Board #292 Jun. 1 9:30 AM - 11:00 AM Ghrerin and PYY are Differentially Altered Following an Acute Bout of Aerobic vs Resistance Exercise Tanya M. Halliday, Mollie H. White, Davis M. Bitton, Allison K. Hild, Jonathan R. Miller, Edward L. Melanson, FACSM, Marc-Andre Cornier. University of Utah, Salt Lake City, UT. University of Colorado Anschutz Medical Campus, Aurora, CO. Email: tanya.halliday@utah.edu (No relationships reported)

**PURPOSE:** The purpose of our ongoing trial is to determine if aerobic exercise (AEx) and resistance exercise (REx) differentially influence acute energy intake and appetite regulation.

**METHODS:** Physically inactive adults with overweight/obesity (n=19, 35 ± 1.7 yrs, BMI: 28.7 ± 1.1 kg/m2) completed 2 conditions; 1) AEx (treadmill walking at 65-70% of age-predicted maximum heart rate for 45 minutes) and 2) REx (1 set to failure of 12 resistance exercises). Each condition was initiated in the post-prandial state (35 minutes post breakfast). Appetite (visual analog scale [VAS] for hunger and satiety) and hormones (ghrelin and PYY) were measured every 30 minutes for 3 hours following consumption of the standardized breakfast meal. Post exercise food cravings (following 90 min VAS and blood draw via Food Cravings Inventory [FCI] questionnaire) and ad libitum energy intake at the lunch meal were also measured.

**RESULTS:** There was no difference in post-exercise ad libitum energy intake between conditions (AEx: 932±75 kcal vs. REx: 910±81 kcal). There were also no differences in post exercise food cravings, nor area under the curve (AUC) for hunger, satiety, ghrelin, and PYY. However immediately following exercise (90 minutes post breakfast), ghrelin (AEx: 7848±66 pg/ml vs. REx: 64±41 pg/ml, p<0.08) and PYY (AEx: 166±12 pg/ml vs. REx: 124±11 pg/ml, p<0.05) were both higher in the AEx condition. Across conditions, higher scores on the FCI (p=0.49, p=0.01), increased hunger AUC (p=0.62, p=0.001), and decreased satiety AUC (p=0.43, p=0.013) were associated with increased ad libitum energy intake.

**CONCLUSIONS:** The data suggest that an acute bout of aerobic exercise appears to transiently increase both ghrelin and PYY, which are orexigenic and anorectic gut peptides, respectively, compared to resistance exercise. However, ad libitum energy intake was not different between conditions. Future work is needed to confirm these findings and uncover mechanisms by which exercise influences appetite indices and energy intake.
CONCLUSIONS: In this pilot study, consumption of a high concentration polyphenol produced significant improvements in neurological function specifically related to visual components, balance and reaction time in this older age group in a relatively short time period. Further investigation in other age groups attempting to regain and maintain function in domains related to vision and reaction time is warranted in response to polyphenol compounds.

3606 Board #294 Jun. 1 9:30 AM - 11:00 AM Metabolic Flexibility is Impaired in Response to Acute Exercise in the Young Offspring of Mothers with Type 2 Diabetes
Cullen Vincellette, Timothy Allerton, Brian Irving, FACSMM, Guillaume Spielmann, Neil Johannsen. Louisiana State University, Baton Rouge, LA. Email: cvincl19@lsu.edu
(No relationships reported)

Metabolic Flexibility is Impaired in Response to Acute Exercise in the Young Offspring of Mothers with Type 2 Diabetes.

1Louisiana State University, Baton Rouge, LA. 2Pennington Biomedical Research Center, Baton Rouge, LA. Healthy adults with a family history (first degree relative) of T2D demonstrate impairments in metabolic flexibility (MF), which is considered to be a factor in the development of T2D. Insulin sensitivity has been shown to improve in the first 48 hours in response to exercise. Whether, a single bout of high intensity interval exercise (HIIE) improves MF in men and women with a family history of T2D remains to be resolved. PURPOSE: The purpose of this study was to assess MF in a group of young, seemingly healthy adults with a positive family history of maternal T2D (FH+) and those without. METHODS: Subjects were 72 healthy adults (36 FH+, 21 FH-, 15 controls) of similar age (30.0±9.7 years; BMI=25.0±4.0; % fat=34.0±7.3) and those without a family history of maternal T2D (FH-) in response to a single bout of HIIE and 1 hour (1H) and 48 hours (48H) after exercise. RESULTS: Seventeen participants (9 FH+: 26±6F/ 74±11M) consumed a liquid mixed meal with 3-hour post-prandial resting metabolic assessments (RMR) taken at baseline (BL, no prior exercise), and at 1H and 48H after a bout of HIIE (10 ±6 kcal/ 100 max watt max). RESULTS: 

3607 Board #295 Jun. 1 9:30 AM - 11:00 AM Relationship Of Leptin,Body Composition And Resting Metabolic Rate In Chinese Overweight And Obese Adults
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(No relationships reported)

PURPOSE: Resting metabolic rate (RMR) and substrate utilization are important factors in maintaining energy balance and leptin is postulated to be involved in the regulation of RMR. However, in overweight and obese individuals, excess fat mass has a significant impact on metabolic function both directly through altered regulation of body weight. However, in overweight and obese individuals, excess fat mass has a significant impact on metabolic function both directly through altered regulation of body weight and indirectly, through chronic changes in hormonal concentrations. This study determined the relationship of body composition and leptin with RMR and substrate utilization (carbohydrate, fat and protein oxidation rates) in Chinese overweight and obese adults.

METHODS: The subjects were 33 women (age = 44.0±12.1 years; BMI = 27.3±3.2 kg/m²; percent body fat (%fat) = 38.7± 4.0%) and 34 men (age = 30.0±9.7 years; BMI = 27.4±1.7 kg/m²; percent body fat (%fat) = 27.5± 4.3%). RMR and substrate utilization were measured by indirect calorimetry (Metamax 3B® Metabolic Measurement System, Germany) and body composition by the bioelectrical impedance method. Serum leptin levels were determined by radioimmunossay.

RESULTS: In men and women, RMR significantly correlated with Skeletal Muscle Mass (Men: R=0.556, p=0.001; Women: R=0.493, p=0.004), but both not significantly correlated with leptin(both p=0.05). In stepwise multiple regression analysis, BMI was the main predictor of RMR, explaining 42.5% and 28.5% of the variance of RMR in men and women respectively. In women, but not men, leptin significantly correlated with RER (R=0.581, p=0.029) and carbohydrate, fat, and protein oxidation rates respectively (R=0.558, 0.689, 0.690; all p<0.01). Furthermore, in stepwise multiple regression analysis, leptin explained 33.7% of the variance of RMR in women.

CONCLUSIONS: Skeletal Muscle Mass is a significant predictor of RMR in Chinese overweight and obese adults, evaluation of body composition may be an effective and efficient way to evaluate metabolic status. Serum leptin concentrations in female subjects showed a negative association with respiratory quotient and carbohydrate oxidation rate and positive association with fat and protein oxidation rates. We suggest that sex-specific evaluations are also necessary. Acknowledgements: This work was supported by National science and technology program of China (Grants No.2013FY114700).

3608 Board #296 Jun. 1 9:30 AM - 11:00 AM Exercise, Estradiol, And Specific Estrogen Receptor Activation For The Prevention Of Type 2 Diabetes
Brittany Gorres-Martens1, Janelle Shiffer1, Teresa Binkley2. 1Augustana University, Sioux Falls, SD. 2South Dakota State University, Brookings. Email: brittany.gorres-martens@augie.edu
(No relationships reported)

Postmenopausal women have an increased risk for type 2 diabetes (T2D), and hormone replacement therapy (HRT) decreases this risk. However, HRT increases the risk of breast cancer and stroke, and thus, the US Preventive Services Task Force does not recommend HRT to prevent or manage T2D. Moreover, exercise is an effective means to prevent and treat T2D. PURPOSE: To compare exercise treatment with drug-induced estrogen receptor (ER) activation in overweight and obese postmenopausal women. METHODS: VOX females were fed a high-fat diet (HFD). METHODS: VOX females were fed a HFD for 10 weeks. One group of rats ran on a treadmill for 25 minutes/day at 40 cm/s for 5 days/week (Ex), while the other rats were treated with estradiol (E2, 1.4 g/kg/day) separately. The specific ERα activator PPT (18 g/kg/day), or the specific ERβ activator DPN (18 g/kg/day) was administered to the group and the amount of food consumed and the amount of food remaining at the end of the week, and voluntary cage activity was measured using Optom-M4 cage monitors. At the end of the study dual energy X-ray absorptiometry (DXA) determined the body composition. Normalized distributed data were analyzed using a one-way ANOVA and an LSD post-hoc test. Non-normally distributed data were analyzed using Kruskal-Wallis testing. RESULTS: At the end of the study, the Ex and E2 groups gained 125.2 ± 48.4 and 125.9 ± 48.4 g of body weight, which was significantly less than the PPT and DPN groups (165.2 ± 48.4 and 160.2 ± 48.4 g, respectively, p<0.05). Although the Ex and E2 groups gained the same amount of total body weight, the Ex group had a significantly lower abdominal fat % compared to the E2 group (30.1% ± 17.2% and 37.2% ± 17.2%, respectively). Although the food intake (kcal/day) did not differ between the groups, both Ex and E2 groups had significantly greater (p<0.005) than the E2 group (30.1% ± 17.2% and 37.2% ± 17.2%, respectively). The food intake (kcal/day) did not differ between the groups, although voluntary cage activity of the Ex group (498 ±27 counts/hr) was significantly greater (p<0.05) than the PPT and DPN groups (387 ±34, 397 ±27, and 370 ±27 counts/hr, respectively).

CONCLUSION: The prescribed exercise in the Ex group contributed to a lower body weight and lower % abdominal fat, and the voluntary cage activity in the Ex group contributed to a lower body weight, but not lower % abdominal fat, which is the greatest risk factor for T2D Supported by NIH Grant P20GM103443 and NSF Grant IIA-1355423.

3609 Board #297 Jun. 1 9:30 AM - 11:00 AM The Effect Of Gestational Physical Activity On The Psychological Health Of Their Offspring
Jung eun Byun1, Da-ae Kim1, Yong-Chul Jung2, Sung-Hun Park1, Tayler S. Thurston1, Eun-Young Kim1, Hyun-Chul Cho1, Joon-Yong Cho1, Jung-Hoon Koo2. 1Korea Incubator Laboratory of group exercise, Seoul, Korea, Republic of; 2University of West Florida, Pensacola, FL. 3University of Utah, Salt Lake City, UT. 4Preventive Medicine, , Chungbuk, Korea, Republic of; 5Yongin University, Gyeonggi, Korea, Republic of; 6Korea National Sport University, Seoul, Korea, Republic of.
(No relationships reported)

PURPOSE: Gestational physical activity (GPA) has been associated with improved fetal outcomes. The purpose of this study was to examine whether exercise during pregnancy contributes positively to the psychological health of their offspring. METHODS: A survey was administered to 1509 children (ages 11-13) to identify psychological health factors such as mental stress, depression, and self-esteem using a modified Daily Hassles Questionnaire, Children’s Depression Inventory, and Rosenberg’s self-esteem, respectively. Mothers of the participants were retrospectively categorized into three groups based on GPA: non-exercisers (CON), low-intensity aerobic exercise (AE), and body-weight strength training (BWWT). RESULTS: After excluding questionnaires due to incomplete data sets, 855 surveys were analyzed. Their results indicated significantly lower levels of depression with concomitant increased self-esteem among children of exercising mothers compared to the non-exercisers.
Former professional football players have considerable cardiovascular disease risk. Studies have shown that psychosocial factors and depression are also strongly associated with CVD morbidity and mortality. **PURPOSE:** To better understand the association of cardiovascular disease and psychosocial factors such as depression in a population of retired NFL players. **METHODS:** Blood pressure, anthropometry, and laboratory blood analyses were collected from former NFL athletes (n = 648) between October 2016 and February 2018 during cardiovascular screenings held throughout the U.S. Questionnaires were used to collect demographic information, exercise frequency and Patient Health Questionnaire 2 (PHQ-2) scores. Means were analyzed via one-way ANOVA and associations between variables assessed using GLM. Chi-square analysis or t-test was used to assess differences between categorical variables, as appropriate. **RESULTS:** Variables of race (p=0.0007), log of systolic blood pressure (SBP) (β=0.5258, p=0.0404), log of waist circumference (β=-0.9366, p=0.0218), log of hip circumference (β=17.2927, p=0.0196) and waist to hip ratio (β=8.2430, p=0.0171) were significantly associated with positive screen for depression on the PHQ-2. Variables race (p=0.0002), log of SBP (β=3.8318, p=0.0009), diastolic blood pressure (DBP) (β=0.0168, p=0.0035), log of hip circumference (β=46.3330, p=0.0101), log of hip circumference (β=46.5107, p=0.0100), and waist to hip ratio (β=22.3890, p=0.0078) were significantly associated with higher score on the little interest in doing things question of the PHQ-2. Variables race (p = 0.0048), log of SBP (β=2.2832, p=0.0122), and DBP (β=0.0141, p=0.0059) were significantly associated with higher score on the feeling depressed question of the PHQ-2. There were significant differences in prevalence between racial groups for positive screen for depression on the PHQ-2 (p<0.0006). **CONCLUSIONS:** Factors reflecting body composition were found to be significantly associated with a positive screen for depression and depressive symptoms. Measures for abdominal obesity may be a better indicator for the association of body composition and depression in retired athletes. Accounting for racial differences in clinical practice may also help improve overall health outcomes.

**References:**

1. Kessler, Jocelyn N. Simons, Genevieve E. Smith, Mark M. Cassidy, Gregory W. Stewart, FACSM. Tulane University School of Medicine, New Orleans, LA. (No relationships reported)
ball carrier and a defender that were initiated by at least one of the players’ helmets. Regional or national championship level games—films from 2016 and later were obtained, from each division, via open-source locations on the internet or a private subscriptions service for film review (NFL Network, Indianapolis, IN). This study received IRB waiver of consent, as an prior power analysis was done to detect a 5% difference between age divisions, and data analyzed by assessing relative risk of each division as compared with the NFL and utilizing tests of trends. RESULTS: A total of 1,812 hits were watched over 7 age groups. Nearly 1 in 6 (16% [95% CI 15-17]) hits involved IHC. 18.9% [95% CI 15.8-22.31] of hits were IHC at the NFL level. Most lower age levels demonstrated significantly lower relative risks of IHC (range 0.55-0.92) as compared with the NFL and there was a trend toward increased risk of IHC with increasing age division of play (p=0.09). IHC was twice as common amongst defensive participants as offensive (RR 2.0, p=0.01). CONCLUSIONS: The exercise mediated increase in activity in the cerebellum was abolished by an intraperitoneal injection of naltrexone. Further study is necessary to identify the relationship with quantitative forces of impact and potential cognitive sequelae.

### 3614 Board #302
Jun. 1 9:30 AM - 11:00 AM
Head Trauma Biomarkers In NCAA Men's Soccer Athletes Over The Course Of A Season
Andreas Kreutzer1, Javier A. Zaragoza2, Jonathan M. Oliver1, Amy Veltkamp1, Trenton Tona2, Tori Como5, David Juovich5, James Hall1, Sid O’Bryant1, Stacie L. Urbina1, Lennu W. Taylor, IV, FACSM2, 1Texas Christian University, Fort Worth, TX. 2University of Mary Hardin-Baylor, Belton, TX. 1United States Military Academy, West Point, NY. 4Wake Forest School of Medicine, Winston-Salem, NC. 5University of North Texas Health Science Center, Fort Worth, TX. Email: a.kreutzer@tcu.edu

### 3615 Board #303
Jun. 1 9:30 AM - 11:00 AM
The Role of Endogenous Opioids in Cerebral Glucose Uptake Following Acute Exercise
Quadratullah Qadir2, Candance Longoria2, Harlee York1, Kelly A. Davis1, A total of 37 games (2012 hits), 7 age groups, across all levels of American tackle football. There is a higher rate amongst defensive participants and a trend toward an increased relative risk at higher age divisions. Further study is necessary to identify the relationship with quantitative forces of impact and potential cognitive sequelae.

### 3616 Board #304
Jun. 1 9:30 AM - 11:00 AM
Diminished Cardiovascular Performance That Persists Up To 3 Days After Completion Of Repeated 6-hour Hypoxic Resting Dives At 1.35 ATA Is Associated With Reduced Oxygen Consumption
Elizabeth R. Bergeron, John P. Florian. Naval Experimental Diving Unit, Panama City Beach, FL. (No relationships reported)

### 3617 Board #305
Jun. 1 9:30 AM - 11:00 AM
The Combined Impact Of Altitude And Heat On Heat Shock Protein 70 And Hypoxia-inducible Factor-1 Alpha
Roy M. Salgado, Katherine M. Mitchell, Karleigh E. Bradbury, Adam J. Luippold, Charles S. Fulco, Jermaine A. Ward, Roy M. Salgado, Katherine M. Mitchell, Karleigh E. Bradbury, Adam J. Luippold, Charles S. Fulco, Jermaine A. Ward, Robert W. Kenefick, FACSM. US Army Research Institute of Environmental Medicine, Natick, MA. Email: roy.m.salgado.civ@mail.mil (No relationships reported)

There are areas in the world where elevated temperatures occur at relatively high altitudes. Exposure to heat and altitude typically induces an increase in heat shock protein 70 (HSP70) and hypoxia-inducible factor-1a (HIF-1α), which...
have beneficial down-stream physiological effects. However, the responses to the combination of these environments are unclear. Purpose: To determine the impact of combined acute exposure to heat and altitude on iHSP70 and iHIF-1α.

Methods: Using a randomized, cross-over study design, 10 men (mean ± SD; age: 25 ± 7 yr; weight: 88 ± 13 kg; height: 180 ± 6 cm; sea level (SL) VO2peak: 42 ± 5 ml kg⁻¹ min⁻¹) were exposed to four environmental conditions separated by at least one week: (1) SL thermoneutral (SLTN; 250m, 20°C, 30%-50% rh); (2) SL hot (SLH; 250m, 35°C, 30% rh); (3) altitude thermoneutral (ATN; 3000m, 20°C, 30%-50% rh); and (4) altitude hot (AH; 3000m, 35°C, 30% rh). Blood samples were collected at SL (baseline, BL) prior to ~1.5 hour environmental equilibration period and again immediately Pre- and Post- 30 minute of steady state (SS) exercise (cycling, 50% of SL VO2peak). iHSP70 and iHIF-1α were measured from peripheral blood mononuclear cells. The percent change (Δ%) from BL to Post-SS was calculated with x 2 (ΔBL to Pre- and Post-SS x environment) RM ANOVA. Results: iHSP70 there was an effect of exercise (Pre-SS: 4.4 ± 7.6% vs Post-SS: 17.5 ± 9.6%, p < 0.05), but no effect of environment (p>0.05) or an exercise x environment interaction (p>0.05). iHIF-1α: there was no effect for exercise (p>0.05), environment (p>0.05), or an exercise x environment interaction (p>0.05).

Conclusion: Our results indicate that iHSP70 increased in response to SS exercise while iHIF-1α was unaltered in these testing conditions. The combination of heat and altitude did not result in an even greater protein expression when compared to exercise alone. However, it is plausible that a more severe environmental stress and/ or higher exercise intensity (> 50% SL VO2peak) would result in elevated cellular response compared to a single environment. Funded by USAMRMC; authors views not official US Army or DOD policy.

RESULTS: The athletes were 30.9 year old (SD: 7.1), they trained 14.5 (SD: 7.7) hours a week and averaged 5.4 years of experience in sports. They had 29.5% Fat Mass (FM) (SD: 7.3) and 48.5 (SD: 6.5) kilograms of Free Fat Mass (FFM) measured with DEXA scan. There was no difference between FM and FFM results determined by DEXA scan and those estimated by Kerr Ross Method (p<0.001). There was a significant difference between DEXA scan results and estimations by Durran Womersley equation (p<0.001).

No difference was found when comparing anthropometric results with the athlete in the supine/prone position and seating in their wheel chair. The correlation between FM and FFM measured with DEXA scan and the estimated By anthropometric equation where superior for Kerr Ross method (r=0.75 and r = 0.86 respectively). The average difference between DEXA scan results and Kerr Ross method estimation for FM and FFM was 0.14% (SD = 0.04) and -0.39 kilograms (SD= 0.15) respectively.

CONCLUSIONS: While using anthropometric evaluation to estimate body composition in athletes with SCI, Kerr Ross method is superior to Durran Womersley equation. But this method does not have acceptable agreement with DEXA scan for clinical purposes. Anthropometric evaluations are easily performable in the field and affordable, but more research is needed to determine the best method to estimate body composition in athletes with SCI.
Purpose: The purpose of this study was to identify relevant content for the development and structure of a pediatric cardiac rehabilitation curriculum for young patients with CHD using a consensus approach.

Methods: A three-round e-Delphi study among CHD and pediatric exercise physiology (EP) experts was conducted. In the first round, experts provided opinions in a closed- and open-ended electronic questionnaire to identify specific elements necessary for inclusion in a Pediatric Cardiac Rehab Program. In the second round, experts were asked to re-rate the same items after feedback and summary data was provided from round one. In the third round, the same experts were asked to re-rate items that did not reach consensus from round two.

Results: 47 experts were contacted via e-mail to participate on the Delphi panel. 37 consented, 35 completed round one, 29 completed round two and 28 completed the final round. After the third round, consensus was reached in 55 of 60 (92%) questionnaire items. Experts identified specific elements across four domains: exercise training, education, outcome metrics and self-confidence to be included in a Pediatric Cardiac Rehab Curriculum.

Conclusion: This study established consensus toward the ideal program structure, exercise training principles, educational content, patient outcome measures and self-confidence components. By identifying the key components within each domain, there is potential to benchmark recommended standards and practice guidelines for the development of a Pediatric Cardiac Rehab curriculum to be used healthcare team members for optimizing the health and wellness of pediatric CHD patients.

3622 Board #310 Jun. 1 9:30 AM - 11:00 AM Consequences Of Physical Inactivity In Older People: An Umbrella Review Of Meta-analyses

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Low physical activity (PA) levels are implicated in the aetiology of many non-communicable diseases. However research often fails to specifically focus on the impact of physical inactivity on the health of older adults, despite the fact that PA declines and worsens with age.

PURPOSE: An umbrella review of the epidemiological evidence for the effects of physical inactivity on physical and mental health in older adults (≥60yrs) for the 2019 Copenhagen Consensus Statement on PA and Ageing.

METHODS: Systematic database search for meta-analyses (MA) of longitudinal observational studies. Titles and abstracts were reviewed independently by two researchers. Duplicates were removed and data from included MAs extracted, including relative risk (RR) for health outcomes, characteristics and risk of bias (AMSTAR Scale) of included reviews.

RESULTS: 4,434 citations were identified. 17 full text MA were included. Key findings of high quality reviews (≥8/11 on AMSTAR scale): All-cause mortality: 34% RR reduction with highest vs lowest level of PA (≥70yrs, RR=0.66, 95% CI 0.50-0.88) (Samit et al., 2011); Healthy ageing was significantly associated with PA (n=174,114, ≥65yrs, ES=−1.14 95% CI 1.07-1.22) (Daskalopoulou et al., 2017); Cognitive decline: Moderate vs lowest level of PA:RR reduction ranged from 26% (RR=0.74, 95% CI 0.60-0.90) (Guerre et al., 2017) to 35% (RR=0.65, 95% CI 0.57-0.75) (Sofi et al., 2011); Dementia: Highest vs lowest level of PA=14% RR reduction (n=40,384, RR=0.86, 95% CI 1.76-0.97) (Blondell et al., 2014); Alzheimer’s disease: Highest vs lowest level of PA=35% RR reduction (n=23,345, 70-80yrs, RR=0.65, 95% CI 0.56-0.74) (Santos-Louzado et al., 2016). Incident depression: Highest vs lowest level of PA=17% RR reduction (adjusted OR=0.83, 95% CI 0.79-0.88) (Schuch et al., 2018); Musculoskeletal health: RR reduction in hip fracture=6% (n=96,966 women, RR=0.94, 95% CI 0.93-0.96) (Rong et al., 2016) and 29% RR reduction in total fractures for highest vs lowest level of PA (RR=0.71, 95% CI 0.63-0.80) (Qu et al., 2012).

Adverse risks were not reported.

CONCLUSION: PA confers contemporaneous and wide ranging health benefits in later life. These findings make a compelling case for further investment in preventive services that promote PA in older adults.

3623 Board #311 Jun. 1 9:30 AM - 11:00 AM How Does Circadian Rhythmicity Relate to Neuropsychological and Neuroimaging Markers in Older People at Risk for Dementia?

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(No relationships reported)

Background: Changes in the circadian regulation of the sleep-wake cycle occur with ageing and may be linked to neurodegeneration. It is unclear the extent to which such changes are evident in mild cognitive impairment (MCI), and how they may relate to neuropsychological functioning, the integrity of key temporal lobe structures and longitudinal decline. Method: 334 older individuals (mean age=66.1, SD=8.9) with subjective cognitive impairment (SCI) and MCI (mean MMSE=28.1, SD=1.4) received a detailed neuropsychological assessment including Logical Memory, Rey Auditory Verbal Learning Test, Rey Figure and Boston Naming Test. They also received clinical and wrist-worn actigraphic assessment, and a subset of 60 individuals underwent neuroimaging. Circadian rhythm analysis was performed using non-parametric methods to obtain intraday variability, interdaily stability, and activity during the least and most active 5-hour periods and 10-hours of the day, respectively. Cosinor methods were also used to derive amplitude, mean, and variability of the rest-activity rhythm. For the neuroimaging subset, cortical thickness of the entorhinal cortex and hippocampal volume were derived using Freesurfer. A subset of 90 individuals had 2-year longitudinal follow-up data from which memory decline scores were computed.

Results: Compared to SCI, after controlling for age, participants with MCI showed significantly greater intraday variability as well as lower amplitude of activity across the circadian period, and lower activity during the most active 10-hour period. Across both groups, circadian disruption was associated with poorer performance on tests of verbal memory (p<0.05), visuospatial memory (p<0.001) and confrontation naming (p<0.001). Lower activity amplitude was associated with reduced cortical thickness in the entorhinal cortex. For those with follow-up data, greater activity during the least active 5-hours of the day was associated with memory decline longitudinally (p<0.05).

Conclusion: Disruptions to the rest-activity cycle relate to both memory and language decline cross-sectionally and memory decline longitudinally as well as to degeneration of key temporal brain regions. Alternations in this cycle may represent a preclinical or prognostic marker for dementia and may warrant intervention.

3624 Board #312 Jun. 1 9:30 AM - 11:00 AM Exercise Intervention Reduces Circadian Clock Suppressor, CRY2, in Adults with Obesity

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PURPOSE: Exercise improves skeletal muscle insulin sensitivity, and also resets physiological circadian clocks. CRY2, a circadian clock suppressor, reduces exercise capacity in mouse models. Whether exercise impacts CRY2 in humans is unknown.

Thus, we tested the effects of 12 weeks of exercise training on circulating CRY2 concentrations in adults with obesity. Secondarily, we assessed whether these changes were related to improvements in insulin sensitivity.

METHODS: Thirteen adults (Age: 64.4 ± 13.7, BMI: 35.9 ± 5.1) participated in 12 weeks of exercise training (5 day/wk, 60 min/session, 85% HRmax) combined with a eucaloric diet. Body composition (abdominal adiposity using computed tomography), insulin sensitivity (glucose disposal rate from euglycemic-hyperinsulinenic clamp), exercise capacity (VO2max), and circulating CRY2 levels measured by ELISA were assessed before and after intervention.

RESULTS: After intervention, CRY2 levels decreased after intervention (Pre: 122.2 ± 2.1; Post: 101.1 ± 2.3 mg/mL, P<0.001). Baseline CRY2 inversely correlated with baseline fat-free mass (r=0.56, P<0.046) and baseline insulin sensitivity (r=−0.61, P=0.038).

CONCLUSION: We show for the first time that exercise training reduces circulating levels of CRY2, a circadian clock suppressor, in adults with obesity, which was accompanied by increased insulin sensitivity and improved body composition. Direct links between exercise-induced changes in circadian clock function and parallel systemic metabolic improvements are worthy of further investigation.

Funding: Supported by NIH grant R01 AG12834, and in part by CTSA UL1RR024989 and U54 GM104940.

3625 Board #313 Jun. 1 9:30 AM - 11:00 AM The Effects Of Different Resistance Training Zones With Equalized Volumes On Muscular Adaptations

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(No relationships reported)

PURPOSE: To investigate the effects of different resistance training (RT) zones with equalized volumes on muscular adaptations. METHODS: Thirty-one volunteers underwent 8 weeks of RT and were distributed in two groups: ten sets of three maximal
repetitions (10x3, n=14) and three sets of ten maximal repetitions (3x10, n=17). The biceps curl, squat and elbow extension exercise were performed twice a week. The maximum strength (one repetition maximum test-1RM) was tested before and after the study for these exercises. Muscle thickness (MT) was also measured (pre x post) for biceps braquii (BB), triceps braquii (TB) and vastus lateralis (VL). RESULTS: As showed in Table 1, a significant main effect (p=0.001) on time in 1RM biceps curl, 1RM squat and 1RM elbow extension was observed for both groups. There was no significant difference in time x group interaction for 1RM biceps curl, 1RM squat and 1RM elbow extension (all p>0.05). A significant main effect (p=0.001) in time was observed in MT for BB, TB and VL. There was no significant difference in time x group interaction for BB, TB and VL (all p>0.05). CONCLUSION: The present study suggests that, regardless of the number of sets and maximum repetition zone, the improvement of maximum strength in squatting, elbow flexion and extension, as well as biceps, triceps and vastus lateralis muscle thickness occurs similarly when volume of repetitions is equalized.

KEY WORDS: Resistance training; Muscular adaptations; Volume of training

Table 1. Muscle strength and muscle thickness measures after 8 weeks of training.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Before</th>
<th>After</th>
<th>∆%</th>
<th>Cohen</th>
<th>ANOVA 3x2</th>
<th>time</th>
<th>time*group</th>
<th>ES</th>
<th>p value</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td>1RM biceps curl</td>
<td>29±15</td>
<td>38±17</td>
<td>33.2</td>
<td>0.60</td>
<td>0.001</td>
<td>0.973</td>
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<tr>
<td>1RM squat</td>
<td>152±73</td>
<td>206±85</td>
<td>35.3</td>
<td>0.68</td>
<td>0.001</td>
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<tr>
<td>1RM elbow</td>
<td>54±20</td>
<td>66±23</td>
<td>20.8</td>
<td>0.52</td>
<td>0.001</td>
<td></td>
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<tr>
<td>BB (mm)</td>
<td>34.9±6.5</td>
<td>39.3±6.8</td>
<td>13.7</td>
<td>0.69</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
<td>0.226</td>
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<tr>
<td>TB (mm)</td>
<td>35.0±5.5</td>
<td>40.1±4.7</td>
<td>14.4</td>
<td>0.98</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
<td>0.775</td>
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<tr>
<td>VL (mm)</td>
<td>40.9±4.7</td>
<td>45.7±4.9</td>
<td>11.8</td>
<td>1.01</td>
<td>0.001</td>
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</table>

Values expressed in mean±SD of 3x10 group and 10x3 group One maximal repetition test (1RM). Muscle thickness (mm) of the biceps brachii and brachialis (BB), triceps brachii (TB) and vastus lateralis (VL). Effect size (ES). *significant (p<0.05) differences to before.