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 sports. However, the time course of the recovery of mechanical competence of 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 bone in male and female recruits as a result of 8 weeks of BCT. **RESULTS:** Changes in bone microarchitecture and estimated bone strength over 12 months following tibial SF diagnosis. **CONCLUSION:** Persistent decrements in bone microarchitecture and estimated bone strength suggest bone mechanical integrity does not return to baseline for 3-6 months after tibial SF diagnosis. This, coupled with the high rate of recurrent SFs, suggests more conservative return to sport guidelines may be in order.
Vitamin D was 46.8ng/mL (95% CI: 39.6-54.6ng/mL). approximately 28% (95% CI: 25-33%), and dietary protein was 1.5g/kg/d (95% CI: 1.3-1.7g/kg/d). Dietary carbohydrate was 4.2g/kg/d (95% CI: 3.4-5.0g/kg/d), dietary fat was 1.5g/kg/d (95% CI: 1.3-1.6g/kg/d) of the diet. Serum ferritin was 28.1ng/mL (95% CI: 14.3-35.1ng/mL) and Vitamin D was 46.8ng/mL (95% CI: 39.6-54.6ng/mL). CONCLUSION: Despite the demanding training volume mid-season, collegiate women’s cross country runners were able to maintain adequate calories and recommended intake for dietary fat and dietary protein. Circulating markers commonly associated with female athlete triad were also within the recommended ranges for optimal health. A nutrition education program may help bring awareness and knowledge on how adequate energy is vital to health and performance.

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 (LBM). 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 hydrodensitometry were used to compute body mass index (BMI), LBM, and percent body fat (BF). RESULTS: The volleyball players reported total calorie consumption 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 sample t-tests showed increases in LBM, 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: Examining 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 yrs.; weight: 70.6 ± 6 kg; height: 179.5 ± 4.3 cm, BMI: 21.9 ± 1.8, Body Fat% (BF): 13.2 ± 1.7). RESULTS: To determine 1) if collegiate women cross country runners consumed adequate energy mid-season after receiving nutrition education, and 2) to observe how mid-season nutrition affected serum Iron and serum Vitamin D values. METHODS: Five women from a NCAA Division I cross-country team (age: 20.8±1.5 years, height: 169.6±5.7 cm, weight: 58.3±3.4 kg) received nutrition education starting at pre-season and continuing on throughout the season. Three diet records were collected and analyzed by a registered dietician. After an overnight fast, blood samples were collected and measured for total ferritin and circulating vitamin D by immunoassay. RESULTS: Athletes consumed an average (95% CI) of 1980 kcal/d (1740-2220kcal/day). Dietary carbohydrate was 42g/kg/d (95% CI: 3.4-5.0g/kg/d), dietary fat was approximately 28% (95% CI: 25.3%-33%) and dietary protein was 1.5g/kg/d (95% CI: 1.3-1.6g/kg/d) of the diet. Serum ferritin was 28.1ng/mL (95% CI: 14.3-35.1ng/mL) and Vitamin D was 46.8ng/mL (95% CI: 39.6-54.6ng/mL).
**Board #5**
**June 1 9:00 AM - 11:00 AM**
**Sources Of Nutrition Information And Knowledge For Ultra-runners**

Sara E. Mahoney, FACSM, Thomas R. Wójcicki, Andrew J. Carnes, Nigel Ouslan. Bellarmine University, Louisville, KY.

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(No relevant relationships reported)

**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 (GNKO-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 GNKO-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<.001), credible (3.02, p<.001), and interesting (2.62, p<.002). Social media was the most accessible (2.81, p<.001), but the least credible (1.87, p<.001). A modest, significant correlation (r=0.185, p<.001) 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.

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**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**

Brian P. Reagan¹, Darby Culp¹, Christa Parkes¹, David Pierce². ¹University of Indianapolis, Indianapolis, IN; ²Indiana University - Purdue University, Indianapolis, Indianapolis, IN.

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(No relevant relationships reported)

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-emphasized sports (LES) such as gymnastics and tennis, primary contributor to ED in LES 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 Dwyer’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 day prior to test date. The criterion for “Adequate Knowledge” (AK) was set at 87% 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). All athletes scored significantly higher on CHO and WM domains (p<.001). The majority (28.6%) reported a double-answer, or the “I don’t know” option. The maximum possible 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 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.

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**Board #7**
**June 1 9:00 AM - 11:00 AM**
**Evidence Of A Relationship Between Dietary Fat Intake And Inflammation Among Professional Soccer Players**

Diarmuid Daniels¹, Nathan Lewis², Paul Catterson¹, John Newell¹, Georgie Bruinvels³, Micheal Newell¹, Andrew Simpkin¹, Andrew Barr³, Charles R. Pedlar³. ¹National University of Ireland Galway, Galway, Ireland. ²St Mary’s University, Twickenham, United Kingdom. ³Newcastle United Football Club, Newcastle, United Kingdom. ⁴Orreco, Business Innovation Centre, National University of Ireland, Galway, Ireland.

(No relevant relationships reported)

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 test. **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 fatty acid index (AIFAI: 0.495, p<0.001, and -0.466, p<0.015) exists between use of peer-reviewed literature and nutrition knowledge. **Conclusion:** There is a relationship between inflammation and 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 AIFAI 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 soccer players. The relationship appears to depend on the sampling occasion. Future research should explore augmenting EMFA as an anti-inflammatory strategy.

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**Board #8**
**June 1 9:00 AM - 11:00 AM**
**Sex Differences in Nutrition Knowledge of Division I College Athletes**

Alyssa J. Guadagni, Emily N. Werner, James M. Pivarnik, FACSM. Michigan State University, EAST LANSING, MI.

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(No relevant relationships reported)

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 (Callella et al., 2017) that contained both general- and sport nutrition-specific 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. Knowledge 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 females were 64.5±18, 31.1±11.0, and 21.4±5.5 for the total survey, general nutrition, and sport nutrition sections, respectively. On average, males scored significantly lower, with scores of 43.6±15.9, 27.6±11.0, 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.
Thematic Poster - Behavioral Aspects of Exercise

Saturday, June 1, 2019, 9:00 AM - 11:00 AM
Room: CC-102A

3257 Chair: Erica M. Taylor, FACSM. Columbus State University, Columbus, GA.

(No relevant relationships reported)

PURPOSE: Healthy-mind exercise is an exercise of a low-medium intensity and benefit to both physically and mentally. The exercise is composed of Tai Chi, Healthy Qi Gong and Yoga. The hypothesis of this experiment was that the healthy-mind exercise intervention is superior to the control intervention in terms of cardiovascular risk factors in Shanghai compulsory detoxification and rehabilitation centers on the effect of fitness and quality of life.

METHODS: A total of 100 male individuals of illicit drug dependent who met the inclusion criteria were recruited and randomly assigned to two groups. In the experimental group (n=50), subjects practiced three times of healthy-mind exercise in the morning, noon and evening for 20 minutes for each exercise session. The total time of the exercise was 60 minutes, 5 times a week. The control group was treated with the conventional rehabilitation method (n=50). The contents of the exercises in control group included recreational gymnastics, gesture exercise, the times of daily practice, duration of each session, total duration of a day and the repetitions per week were the same as those of the experimental group. Outcomes of fitness, quality of life for drug addiction questionnaire (QOL-DA) were measured at the baseline, 3 month and 6 month. Data analysis was applied with SPSS 19.0. A two-way repeated measures analysis of variance (ANOVA) was applied to test whether the treatments were different after 6 months.

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 physical function (F (2,170)=9.71), symptom function (F (2,170)=6.42), social function (F (2,170)=14.91) and total score (F (2,170) =15.95). CONCLUSIONS: This study proved that the healthy-mind exercise was suitable for substance dependent individuals.

3258 Board #1 June 1 9:00 AM - 11:00 AM
The Physical and Mental Rehabilitation Effect of Healthy-mind Exercise Intervention on Individuals of Illicit Drug Dependent
Dong Zhu1, Mei Jiang2, Ding Xu3, 1Shanghai University of Sport, Shanghai, China. 2Shanghai Drug Administration, Shanghai, China. Email: zhudong@hotmail.com
(No relevant relationships reported)

3259 Board #2 June 1 9:00 AM - 11:00 AM
Confirmation of Self-Reported Ambulatory Exercise Bouts During Ecological Momentary Assessment
Lindsay P. Toth, Lucas F. Sheridan, Kelley Strohacker, FACSM. The University of Tennessee, Knoxville, TN.
(No relevant relationships reported)

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±6y) completed four mobile surveys/d for 14-d (82% response rate). For all sessions, knee extension torque was recorded during the isometric muscle maximal muscle activation, endurance, and motor control/precision. These exercises were conducted with a commercially available EMG biofeedback unit (Pathway MR-20, Promethius Group, Dover, NH). During the second session, participants used the KneeBRIGHT game that was designed to match the exercise sets in the first session. For all sessions, knee extension torque was recorded during the isometric muscle activation exercises using a dynamometer, and patient engagement was assessed using the technology acceptance model (TAM) questionnaire. Peak torque and TAM scores obtained during the KneeBRIGHT and traditional biofeedback sessions were compared using paired t-tests.

RESULTS: Knee extension torque generated during KneeBRIGHT game exercise sessions was increased by an average of 25% compared to the torque generated during conventional EMA biofeedback sessions (2.14 Nm/kg vs. 1.77 Nm/kg, p<0.02). There was no significant difference in TAM scores between the sessions (3.42±0.4 vs 3.2±0.5, p=0.25).

CONCLUSIONS: Patients exercising with the KneeBRIGHT game produced greater knee torque than patients exercising with the conventional system, and demonstrated positive levels of engagement.

3261 Board #4 June 1 9:00 AM - 11:00 AM
Exploring Qualitative Determinants of Regular Group Indoor Cycling Participation in a Diverse Sample of Adults
Alvin L. Morton3,4, Lyndsey M. Hornbuckle3, Miguel Aranda3, Derrick T. Yates1,4, Courtney L. Anderson1,4. 1University of Tennessee, Knoxville, Knoxville, TN. 2Georgia State University, Atlanta, GA.
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(No relevant relationships reported)

While U.S. adults generally do not acquire adequate amounts of physical activity, non-Hispanic Blacks (NHB) obtain less physical activity than non-Hispanic Whites (NHW). Identifying reasons why NHB regularly participate in a given exercise modality may help tailor future recommendations in this population. Group indoor cycling (GIC) classes have gained popularity and are offered widely in fitness facilities. PURPOSE: To qualitatively investigate the motivation for regular GIC class participation in a racially diverse sample.

METHODS: Women and men attending GIC classes at a rhythm-based cycling studio ≥1 day/week for the preceding three consecutive months were recruited. Participants completed a questionnaire that included two open-ended questions: 1) Why do you continue to regularly choose GIC classes for exercise? and 2) ‘How does the environment at this cycling studio motivate you to continue to choose GIC for exercise?’ Three investigators independently analyzed data using established procedures for thematic analysis. Data from the two questions were reported in continuous and step counts were above 5 steps per 10s epoch for the approximate SR duration. Descriptive statistics and frequency analyses were conducted. 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 size.

3260 Board #3 June 1 9:00 AM - 11:00 AM
Feasibility Of A Novel Video Game-based EMG Biofeedback System In Patients With Knee Osteoarthritis
Eileen Krepkovich1, Colby Magnum2, Susan Saliba2, Matthew Lichter1, Aaron Olowin1, Neil Richardson1, Joseph Hart, FACSM1, 1Barron Associates, Inc., Charlottesville, VA. 2University of Virginia, Charlottesville, VA. (Sponsor: Joseph Hart, FACSM)
(No relevant relationships reported)
the relationship extends beyond American college students.

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 parametrically compared the acute effects of aerobic exercise and tDCS over left prefrontal regions on cognitive control. RESULTS: Models revealed a main effect of Condition on n-back sensitivity (nonparametric signal detection A’ = 2.45, p = 0.014), but no significant 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.

Humans ascending to high altitude are susceptible to debilitating psychological alterations which include severe mood changes, cognitive fatigue, and neurocognitive impairments. The combination of environmental stressors that occur at both physiologic and psychological levels. PURPOSE: Music has ergogenic effects on physical performance through enhancing psychological factors such as mood, emotion and cognition. This study aimed to explore the impact of music as a tool for mitigating the performance decrements observed at altitude. METHODS: 32 participants (23.9 ± 4.01 years old) completed one familiarisation session and four counterbalanced experimental trials: 1) normoxia (0.209 FiO2), 2) normoxia (0.209 FiO2) with music; 3) normobaric hypoxia (0.13 FiO2) and no music; 2) normobaric hypoxia (0.13 FiO2) with music; 3) normobaric hypoxia (0.13 FiO2) and no music; 4) normobaric hypoxia (0.13 FiO2) with music. All conditions were completed at 21°C with 50% relative humidity. Music was self-selected by each participant prior to the familiarisation session. The songs were assessed for their motivational qualities using the Brunel Music Scale Inventory (BMSI). Each experimental trial included a 15-min self-paced time trial on an arm bike, followed by a 60-s isometric maximal voluntary contraction (MVC) of the biceps brachii. Supramaximal nerve stimulation was used to quantify central and peripheral influences of the music. All efforts were made to control external confounders. RESULTS:音乐选择 (83和80%)，工作室气氛 (67和80%)，身体健康 (58和100%)，和享受/乐趣 (42和60%)。

CONCLUSIONS: The music (majority hip-hop and rap) in this study may have played an integral role in attracting NHW to participate in GIC classes at this studio on a regular basis. Low cardiorespiratory fitness and accumulated fat mass have been widely associated with impaired cognitive performance in children, however, their influence on creativity remains unclear. The creativity is a component of cognition, it is defined as the process of identifying the difficulty, formulating hypotheses about the deficiencies and solving the problems. Actually, the creativity has become an element key to cognition because contribute to personal and professional success of the subject. PURPOSE: Here, we compare creativity in children with different levels of cardiorespiratory fitness (CF) and fat mass (FM), as well as their relationship. METHODS: In this cross-sectional study, 73 children with age ranging from 10.1 to 11.5 participated while attending two testing sessions. On the first testing session, all children had general anthropometric assessments and completed a graded shuttle run test to estimate cardiorespiratory fitness (VO2 max). On the second session, they perform the Children’s Figural Creativity Test, scholastic performance test and have the fat mass (FM) measured by the Dual-energy X-ray Absorptiometry. Children were divided in two groups (Lower x Higher) separated by the median value of CF and FM. Creativity was compared between groups by a paired t test and unpaired Mann-Whitney (p<0.005). Pearson or Spearman correlations were used to compare the associations between the variables. RESULTS: The results demonstrate no significant differences on creativity between VO2 max (p = 0.75) and FM (p = 0.56) levels. In addition, no correlation was identified between creativity with CF (r = -0.031; p = 0.828) and FM (r = 0.174; p = 0.218). No significant differences were observed at altitude.

CONCLUSIONS: In conclusion, creativity is similar in children with different VO2 max and FM level and there is no relationship between these variables. However, are necessary more studies with a robust creativity measurement technique, based in neurobiological markers (NIRS, fMRI).

The relationships between cell phone use and sedentary behavior in samples of Japanese and American college students. Jacob E. Barkley1, Andrew Lepp1, Takahiro Sato1, Koji Yamatsu2, Ellen L. Glickman, FACSM1, 1Kent State University, Kent, OH; 2Saga University, Saga, Japan. (Sponsor: Ellen Glickman, FACSM) Email: jbarkle1@kent.edu (No relevant relationships reported) Previous work from our research group has indicated a significant, positive relationship between cellular telephone (cell phone) use and sitting or sedentary behavior in college students. However, this work has been limited to only a single, large, public university in the Midwestern United States. Therefore, it remains unknown if this relationship would be present in groups of college students from different geographic regions and/or cultural backgrounds. PURPOSE: To compare the relationship between daily cell phone use and sedentary behavior in samples of college students from Japan and the United States. METHODS: A sample of college students (N = 808, 20.2 ± 1.8 years old) from either a university in Japan (n = 534, 19.8 ± 1.1 years old) or the United States (n = 274, 21.71 ± 2.4 years old) completed validated surveys assessing daily, cell phone use (min) and daily total sedentary behavior (min). Surveys were administered in English for American students and Japanese for students from Japan. RESULTS: Independent samples t-tests revealed that Japanese students reported greater daily sitting (420 ± 264 min/day) and less daily cell phone use (215 ± 125 min/day) than American students (360 ± 198 min/day sitting, 274 ± 150 min/day cell phone use). Because of these differences, Pearson’s correlation analyses assessing the relationship between cell phone use and sedentary behavior were performed for Japanese and American students separately. There were significant, positive relationships between cell phone use and sedentary behavior in both Japanese (r = 0.132, p = 0.002) and American (r = 0.160, p = 0.006) college students. CONCLUSION: While there were differences in sedentary behavior and cell phone use in Japanese versus American college students, the relationships between these variables was positive and significant regardless of group. This finding supports previous data indicating that elevated cell phone use is predictive of greater daily sedentary behavior in college students. Furthermore, present results indicate that this relationship extends beyond American college students.

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 parametrically compared the acute effects of aerobic exercise and tDCS over left prefrontal regions on cognitive control. RESULTS: Models revealed a main effect of Condition on n-back sensitivity (nonparametric signal detection A’ = 2.45, p = 0.014), but no significant 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.

Humans ascending to high altitude are susceptible to debilitating psychological alterations which include severe mood changes, cognitive fatigue, and neurocognitive impairments. The combination of environmental stressors that occur at both physiologic and psychological levels. PURPOSE: Music has ergogenic effects on physical performance through enhancing psychological factors such as mood, emotion and cognition. This study aimed to explore the impact of music as a tool for mitigating the performance decrements observed at altitude. METHODS: Following ethical approval from Loughborough University, 13 healthy males (23.9 ± 4.01 years old) completed one familiarisation session and four counterbalanced experimental trials: 1) normoxia (0.209 FiO2) and no music; 2) normoxia (0.209 FiO2) with music; 3) normobaric hypoxia (0.13 FiO2) and no music; 4) normobaric hypoxia (0.13 FiO2) with music. All conditions were completed at 21°C with 50% relative humidity. Music was self-selected by each participant prior to the familiarisation session. The songs were assessed for their motivational qualities using the Brunel Music Scale Inventory (BMSI). Each experimental trial included a 15-min self-paced time trial on an arm bike, followed by a 60-s isometric maximal voluntary contraction (MVC) of the biceps brachii. Supramaximal nerve stimulation was used to quantify central and peripheral
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 Stresses 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)

3267 Board #1 June 1 9:00 AM - 11:00 AM 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) Email: matthew.r.schoenherr.ctr@mail.mil (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 last 3 months. Coupling hypotheses (associations between CORT, DHEA, and TESTO summary parameters) were tested with Pearson product-moment correlation analyses.

RESULTS: DHEA was positively coupled with TESTO (r range: .28-.61, r < .05) and also with CORT (r range: .50-.57, p < .05) throughout the day. Positive coupling between CORT and TESTO was only observed in the evening (r = .32, p = .014). 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 TESTO and CORT 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 = 49 ± 6.8%), followed by a swift recovery at Wake + 60 min. Approximately 17.4% (n = 12) were classified as negative-reactors (i.e., <0% 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 < 0.05; a 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 redefined 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.

**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 = 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 cycle number, self-reported pre-diagnosis minutes/day of MVPA, weekend v. weekdays, and self-reported health status on days of MVPA.

**RESULTS:** On average, breast cancer patients engaged in 20.8 minutes/day (95%CI:17.4,24.1) 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: 1.3,3.2) 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.

**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.

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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 (0.11 m/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.

Prostate cancer is the most commonly neoplastic disease that affects men in the world. Androgen deprivation therapy (ADT) is the treatment regimen most used in advanced disease stages. Whereas the occurrence of late side effects induced by ADT seems well documented, the long-term consequences of ADT in muscle function and fatigue have not been well documented.

Purpose: The purpose of this study was to assess fatigue, muscle strength, muscle thickness, and muscle quality in prostate cancer survivors undergoing to ADT.

Methods: Ten prostate cancer patients on ADT (ADT group) (74.40 ± 5.76 years, 77.44 ± 14.75 kg and 1.63 ± 0.07 m), 8 patients not undergoing ADT (N-ADT) (69.75 ± 5.92 years, 82.25 ± 9.20 kg and 1.70 ± 0.07 m) and 18 healthy control subjects (CON) (72.17 ± 6.54 years, 77.94 ± 9.47 kg and 1.69 ± 0.07 m) participated in this study. Perceived fatigue was assessed through 20-item Multidimensional Fatigue Inventory. Muscle thickness and quality (e.g., echo intensity) were assessed through B-mode ultrasound. Muscle strength and work capacity were assessed using an isokinetic dynamometer. One-way ANOVAs with Bonferroni post-hoc were used for comparisons between groups adjustment.

Results: Muscle thickness was lower in ADT than CON (21.32 ± 3.20 vs. 26.49 ± 5.10 respectively, p < 0.001). Peak torque was lower in ADT than CON (109.78 ± 30.36 vs. 154.67 ± 33.92 respectively, p = 0.005). Work capacity was lower in ADT than CON (1964.40 ± 571.71 vs. 2923.67 ± 604.39 respectively, p < 0.001). AT-HIIT significantly improved fatigue, muscle thickness, peak torque, work capacity, and echo intensity (p < 0.05). General fatigue was greater on both ADT (11.01 ± 3.41 vs. 7.83 ± 2.60, p = 0.030) and N-ADT (11.13 ± 3.48 vs. 7.83 ± 2.60, p = 0.047) compared to CON. Physical fatigue was greater on ADT than CON (13.20 ± 3.42 vs. 7.83 ± 2.60, p = 0.030).

Conclusions: Therefore, it appears that the nature of ADT treatment has a deeply negative effect on muscle function and fatigue when compared to patients not undergoing ADT. Therefore, further research is needed to confirm these preliminary findings, in order to attenuate the decline of muscle function and fatigue in men undergoing ADT treatment.

Purpose: The randomized controlled OptiTrain trial showed beneficial effects on fatigue after a 16-week exercise program in patients with breast cancer undergoing adjuvant chemotherapy. Hypothesized underlying mechanisms include the involvement of inflammatory pathways. Here, we investigated the effects of exercise on inflammation markers and whether the positive effects on fatigue were mediated by changes in inflammation.

Methods: 240 women scheduled for chemotherapy were randomized to 16-weeks of resistance and high-intensity interval training (RT-HIIT), moderate-intensity aerobic and high-intensity interval training (AT-HIIT) or usual care (UC). In the current mechanistic analyses, we included participants with ≥60% attendance and a random selection of controls (RT-HIIT = 30, AT-HIIT = 27, UC = 29). Ninety-two blood markers (e.g. IL-6, TNFα, soluble CD8A) were quantified at baseline and post-intervention. The Piper Fatigue Scale was used to assess general and physical fatigue. Mediation analyses were conducted to explore whether changes in inflammation markers mediated the effect of exercise on general and physical fatigue. ANCOVA adjusted for menopausal status, chemotherapy treatment (taxanes/no taxanes) and baseline values of the inflammation marker and fatigue, was used to identify between-group differences in the outcome.

Results: In general, chemotherapy led to an increase in inflammation. The increase in IL-6 (pleiotropic cytokine) and CD8A (T-cell surface glycoprotein) was, however, less pronounced following RT-HIIT compared to UC (-0.45 [95% CI -0.85; -0.05], p=0.03) and -0.28 (95% CI -0.57; 0.004), p=0.05 respectively). The changes in IL-6 and CD8A significantly mediated the effects of exercise on both general and physical fatigue by 32.0% and 27.7%, and by 31.2% and 26.4%, respectively. No significant between-group differences in inflammation markers at 16 weeks (post-intervention) were found between AT-HIIT and UC.

Conclusions: This study is the first showing that supervised RT-HIIT partially counteracted the increase in inflammation during chemotherapy, i.e. IL-6 and soluble CD8A, which resulted in lower fatigue levels post-intervention. Exercise might be put forward as an effective treatment to reduce chemotherapy-induced inflammation and subsequent fatigue.

Purpose: This study examined how barriers and benefits of exercise differ between breast cancer survivors who are not engaging in any moderate or vigorous physical activity, those doing physical activity but not meeting physical activity guidelines, and those meeting recommended physical activity guidelines. Methods: 392 breast cancer survivors were recruited through the Susan Love/Army of Women, a national non-profit breast cancer organization, and completed the Exercise Barriers and Benefits Survey, the International Physical Activity Questionnaire and questions on resistance exercise activities. Results: Multivariate ANOVAs examined whether exercise groups differed in types of exercise benefits and barriers they reported. 267 of the women (69.6%) did not meet recommended guidelines (150 minutes/week of aerobic activity and twice per week resistance exercise). The greatest perceived benefits were for physical performance and the lowest were for social interaction. There were significant differences between groups on benefits (F= 18.981; df = 2, 16; p<0.000; n2= 0.90). Exercise benefits were not significantly different between the same exercise and exercise guidelines groups. The greatest perceived barriers were for physical exertion and the lowest were for the exercise milieu. There were significant differences between groups on barriers (F= 54.807; df = 2, p<0.000; n2= 0.222). The same exercise group had significantly higher barriers than the exercise guidelines group (p=0.047).

Conclusions: Despite recommendations, the majority of breast cancer survivors do not meet physical activity guidelines. Understanding which barriers and benefits are relevant to different groups of exercisers is an important avenue to prescribing exercise in an at risk population. Personalized approaches may promote exercise initiation in those not currently exercising; while targeting different barriers may help those already exercising to meet recommended physical activity guidelines.
PURPOSE: Meta-analyses have shown beneficial effects of exercise on quality of life (QoL) and fatigued 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), thus making the exercise in trial is not possible. TWCs (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 TWCs 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 asked to be active for 30 min/day supported by a physical 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. TWCs 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 the effect of the intervention compared to a control group. Comparisons to a control group may further identify benefits; however, based on these data, a larger, multi-site trial of Exercising Together© in the radiological oncology setting is warranted.

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

3280 Board #8 June 1 9:00 AM - 11:00 AM
Exercising Together©for Couples during Radiation Therapy for Prostate Cancer: A Pilot Feasibility Study
Mary E. Medyska, Jessica C. Sitemba, Kimi Daniel, Arthur Hung, Kerri M. Winters-Stone, FACSM. Oregon Health & Science University, Portland, OR. (Sponsor: Kerri Winters-Stone, FACSM)

We developed Exercising Together©, a partner-based strength training program, as an exercise-based approach to improve physical 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 signed rank tests were used to assess changes in the measures over the intervention period and post-treatment. 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 PIP scores (p=0.023) and chair stand time (p=0.024) post-treatment. 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.

3282 Board #1 June 1 9:00 AM - 11:00 AM
The Role of T Cells in Muscle Damage Protective Adaptation
Michael R. Deyhle1, Meghan Carlisle2, Chad Hancock2, Robert Hyldahl2. 1University of Florida, Gainesville, FL. 2Birmingham Young Medical School, Provo, UT.

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

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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 central nervous system activity 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 following LC-induced 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.

Rapamycin has been shown to have a dose-dependent effect on multiple signaling proteins in skeletal muscle cells that influence protein synthesis and calcium handling. However, it has yet to be determined if a low dose of rapamycin impacts skeletal muscle during recovery from an exercise-induced injury. PURPOSE: To determine if low-dose rapamycin affects the rate of isometric strength recovery, muscle ubiquitination levels and markers of autophagy compared to saline control 14 days after exercise induced injury. METHODS: Mice were injected with either saline (SAL; 0.9%) or low-dose rapamycin (RAP; 10 mg/kg body weight) every other day for 2 weeks before and after a single bout of 150 eccentric contractions of the left anterior crural muscles. The recovery of strength of the anterior crural muscles was measured in vivo immediately, 7 days, and 14 days after injury induction. RESULTS: Isometric twitch torque values did not differ between groups at any time point. No group differences in peak isometric tetanic torque were observed pre-injury, post-injury or 7 days following injury. However at 14 days, RAP mice recovered to pre-injury peak isometric torque values (P< 0.001). Beclin-1 and free ubiquitin expression in TA muscles were significantly increased for the DOM group at 24 and 48 hours post exercise (P<0.001) with no change following EIMD. These findings suggest the loss in torque production following EIMD is a factor of EIMD’s effect on muscular function and not the central and peripheral mechanisms of fatigue.

Exercise-induced muscle damage (EIMD) is a result of high-force eccentric contractions and can lead to significant alterations in the structure and function of skeletal muscles. Critical torque (CT) and the impulse above critical torque (IACT) have been reported to decrease following EIMD. PURPOSE: The purpose of this study was to observe the time course of change in CT and IACT up to 7-days following EIMD, and 2) to assess the extent to which central and peripheral factors contribute to changes in CT and IACT following EIMD METHODS: Participants (males = 6, females = 4) completed 2 familiarizations and 5 experimental visits. Fatigue patterns were assessed, and CT and IACT were derived at the 1st experimental visit. The 2nd experimental visit included an EIMD protocol consisting of 100 back squats. The 3rd, 4th, and 5th experimental visits were identical to the 1st CT visit. Images were acquired through a voluntary isometric contraction protocol. RESULTS: The participant’s ratings of muscle soreness were significantly elevated up to 4-days following EIMD (p<0.05). Dominant leg MVIC was reduced up to 2-days (p<0.05) while non-dominant leg MVIC was reduced up to 4-days (p<0.05) following EIMD. Mean CT was decreased up to 4-days following EIMD in the voluntary 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). Not only was the magnitude of damage different 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.

Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume. Images were analyzed at the end of the study with ImageJ software to quantify vastus muscle volume.
The Effects of Betalain Supplementation on Indices of Muscle Damage
Steven Viti, Headley, FACSFM, Susan Sotiri, Elizabeth O'Neill, University of Illinois Springfield, Springfield, IL, Springfield College, Springfield, MA. (Sponsor: Samuel Headley, FACSFM) Email: svit2@uis.edu

**Purpose:** Immediately following eccentric exercise, a pro-inflammatory and pro-oxidative state ensues to initiate the remodeling phase and subsequent repair of damaged tissue. A continued pro-inflammatory and pro-oxidative state can lead to secondary muscle damage thereby prolonging the repair and regenerative process. Betalains are bioactive pigments that are reported to have anti-inflammatory and antioxidant properties. We therefore examined the effects of a betalain-rich concentrate (BRC) on indices of muscle damage following eccentric exercise in an effort to assess muscle recovery following supplementation.

**Methods:** In this counterbalanced repeated measures design, a total of 11 recreationally active males consumed 50 mg of BRC, containing 12.5 mg of betalains, 3 times per day for 3 days (initial testing day, 24 and 48 hr post-exercise), or nothing at all (control). The exercise protocol consisted of 30 maximal eccentric contractions of the elbow flexors. Each condition was separated by 2 weeks and the contralateral arm was used for the second testing session. Maximal voluntary isometric contraction (MVIC), arm circumference (AC), muscle soreness (MS), and range of motion (ROM) were measured pre, post, 24, 48, and 72 hr following the eccentric exercise. Creatine kinase (CK) was measured pre, 24, 48, and 72 hr following the eccentric exercise.

**Results:** No significant differences or interactions were observed for any of the variables (p > .05). There was, however, a p-value approaching significance with a corresponding large effect size for the main effect of MVIC (p = .07, d = 0.28).**Conclusion:** Betalain supplementation did not enhance skeletal muscle recovery following eccentric damage. However, we feel the large effect size may provide practical significance. Therefore, future studies should expand upon ours to include larger samples of recreationally active individuals using a more intense damage protocol.

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. The 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 dairy 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 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 paired-samples t-test revealed a significant difference (0.041 kg/m²; p = 0.0003) between all the sports. Additionally, the influence of BMI, %BF, and FFMI on gender differences for FFMI_adj during a TST was determined using stepwise linear regression analysis. RESULTS: Males produced significantly higher FFMI_adj (p = 0.001) and FFMI_adj (p = 0.008), compared to females. However, when adjusted for measures of body composition, FFMI was significant for FFMI_adj (p = 0.002) and FFMI (p = 0.001), and gender was not significant (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 balance that is required to achieve optimal force production and sprint swimming performance.

Female body image is an important component of both sexual function and overall well-being. 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 (BSIQ) 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 kg/m² were classified as “normal” (NW); values ≥25 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 = 0.0154); not surprisingly, there was also a main effect in FE for BMI (p = 0.0139; NW>OW). A main effect for BMI existed in OAE (p = 0.0001; NW > OW; II (p = 0.039; normal > overweight); HFE (p = 0.001; Nor>OW); and NA (p = 0.003; OW>Nor). A gender-BMI interaction existed in HFI (p = 0.009) indicating that OW males felt that health and fitness influenced feelings about their bodies more so than OW females; in NOR students, 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.

There is an assumption among competitive swimmers that certain body types are predisposed to perform better. This assumption may be in part due to research on young swimmers that suggests that greater standing (SH) and seated height (SH), arm span (AS), and the surface areas of the arm and foot increase swimming speed. However, literature on these variables in adult swimmers does not exist. Further, despite literature supporting the negative correlation between body fat percentage (BF) and performance in a variety of sports, the literature on swimmers suggests BF
The researchers of the current study hypothesized runners with less appendicular fat would have a biomechanical advantage over runners predisposed to appendicular fat storage. PURPOSE: To determine the predictive power of traditional skinfold sites including chest, midaxillary, triceps, subscapular, abdomen, suprailiac, thigh, calf, and biceps, on performance in a 3200m time trial for trained male distance runners.

METHODS: Participants were 22 members of a NCAA Division 3 men's cross country team. Skinfold measurements were recorded for each of the nine sites on each of the athletes using a skin caliper. The athletes then completed a 3200m time trial. This data was then used to run a multiple-regression to determine the importance of each site to time trial performance. RESULTS: The subjects had an average body fat percentage of 12.8%, ±4.5%, and an average 3200m time of 10:48 ±48s. The regression analysis revealed that 58.1% of the variance in 3200m time trial performance was predicted by the model using the nine sites (biceps, suprailiac, thigh, chest, subscapular, calf, midaxillary, abdomen, and triceps) as predictors (p=0.05). When co-varied out, chest, midaxillary, and abdomen were significant (p=0.05) predictors of 3200m performance. Increased chest and abdomen fat storage significantly predicted increased finish time (p=0.037, B=0.206 min) and (p=0.023, B=0.317 min). Increased midaxillary fat storage significantly predicted decreased finish time (p=0.023, B=0.166 min). When co-varied out, triceps, calf, biceps, subscapular, suprailiac and thigh fat storage were not significant predictors (p>0.05). CONCLUSIONS: Skinfold thickness in the chest, midaxillary, and abdomen were significant predictors of 3200m performance in trained college males, while skinfold thickness in the triceps, subscapular, suprailiac, thigh, calf, and biceps were not. Appendicular fat storage may not be as important to performance as hypothesized in homogeneous well trained male endurance runners.

Skinfold thickness have been used as a proxy for adiposity, as they are positively correlated with body fat percentage. PURPOSE: To determine the effect of 6-weeks of resistance training program of different lengths designed to prepare athletes for NFL combine and pro-day performance.

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 participating in this program were also provided dietary counseling by a registered dietitian to improve dietary habits. Pre- and Post- training, body mass (BM), body fat percentage (BF%), fat free mass (FFM), 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 that completed 4-6 weeks of training (n=7). Data were analyzed by separate repeated measures analysis of variance (ANOVA) for each variable. RESULTS: Regardless of 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 being selected in the third round. Data suggests that 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%.

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 (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 participating in this program were also provided dietary counseling by a registered dietitian to improve dietary habits. Pre- and Post- training, body mass (BM), body fat percentage (BF%), fat free mass (FFM), 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 that completed 4-6 weeks of training (n=7). Data were analyzed by separate repeated measures analysis of variance (ANOVA) for each variable. RESULTS: Regardless of 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 being selected in the third round. Data suggests that 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%.

Introduction: LATENESS or LATERNAL 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 sports' 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>n</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
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<tbody>
<tr>
<td>Sport</td>
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<td>185.8 ± 5.7</td>
<td>106.8 ± 18.1</td>
</tr>
<tr>
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<td>177.8 ± 8.2</td>
<td>74.5 ± 9.2</td>
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</table>
RESULTS: The WCs were correlated significantly with FM, %BF, FM in abdominal, and %BF in abdominal (p < 0.001).

Individuals, such as collegiate athletes, that engage in increased levels of strenuous exercise often possess a lower body fat percentage (BF%) and increased fat-free mass (FFM). Additionally, repetitive progressive resistance training and participation in high-impact sports has been demonstrated to increase bone mineral density (BMD). Because collegiate athletes experience a high amount of repetitive loading, it may be expected that BMD would yield a relation to body composition. PURPOSE: The purpose of this study was to examine the relationship between body composition and BMD in elite college athletes. METHODS: Male (n = 45) and female (n = 33) athletes (ages 18-21 years) from a range of sports, including baseball, football, softball, and volleyball, participated in the study. Total BMD and body composition (i.e., BF% and FFM) were measured using dual-energy x-ray absorptiometry. Pearson’s product-moment correlations were used to assess all relationships between BMD, BF%, and FFM. RESULTS: In terms of males, Pearson’s product correlation demonstrated a significant moderate-to-strong positive association between FFM and BMD (r = 0.79, p < 0.01). BF% showed a significant positive low-to-moderate correlation with BMD (r = 0.35, p = 0.02). For females, FFM showed a moderately positive association with BMD (r = 0.58, p < 0.01), while BF% provided a non-significant inverse correlation with BMD (r = -0.21, p = 0.23). CONCLUSION: FFM in both male and female collegiate athletes was positively associated with BMD. However, males displayed a positive BMD and BF% relationship, while females a non-significant, inverse association. These findings may reflect the diversity of female athletes (i.e., various sports) that were included within the analysis. For instance, sports that require a greater body mass to enhance performance and those that require a leaner physique were both included within one group which may have affected the BMD and BF% relationship.
Multi-compartment models are emerging as a criterion method of analyzing body composition, thereby reducing the error associated with standalone laboratory measures. **PURPOSE:** The purpose of this study was to compare a 3-compartment model (3-C) with two gold standard lab measures (i.e., air displacement plethysmography (ADP) and dual-energy x-ray absorptiometry (DEXA)). **METHODS:** Sixty-nine male and forty-eight female athletes completed three body composition measures (i.e., DEXA, ADP, and bioelectrical impedance spectroscopy (BIS)). Body fat percentage (BF%) was calculated using a 3-compartment (3C) model, consisting of total body water (via BIS), body volume (via ADP), and body weight. For statistical analysis, a repeated measures ANOVA was used to compare ADP and DEXA against a 3-C model for all within gender comparisons. **RESULTS:** For males, results showed a significant mean difference when comparing 3-C (13.2±7.0%) and DXA (16.5±5.9%; p<0.01), but no difference between 3-C and ADP (12.0±8.0%; p=0.09). For females, a significant mean difference was seen with 3-C (23.5±7.2%) and DXA (26.5±6.6%; p=0.01); however, there was no difference between 3-C and ADP (22.2±7.1%; p=0.34). **CONCLUSION:** DEXA may provide overestimates of BF% for both male and female athletes, while ADP provided no significant differences when compared to a multi-compartment model.

**PURPOSE:** The purpose of this study was to compare a 3-compartment model to criterion measures for estimating body composition in athletes. **METHODS:** Ninety college athletes (33 male; 66 female) from Georgia Southern University, Statesboro, GA were selected in CrossFit boxes and divided into two groups: CrossFit athletes (GA) and CrossFit beginners (GI). 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 ADP. Statistical analyses used: Kolmogorov-Smirnov and T of Student. **RESULTS:** Females and males demonstrated a non-significant, moderate correlation (rs=0.45, p=0.05) was observed, with no differences in others parameters. Among male groups, male GA showed higher REE (1656.0±78.7 vs 1455.7±157.8, P<0.02) and higher VO2 (240.4±11.6 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±236.7 vs 1656.0±157.8, P<0.03) and a significant decrease in baseline body fat percentage (26.4±1.7 vs 25.2±2.2, P=0.05) between baseline and 4 weeks. In female GI, a significant increase in 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±286.5 vs 1843.3±336.8, P<0.03) and greater VO2 (330.0±41.2 vs 267.2±48.6, P=0.03) 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 professional levels. 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-I 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 incline 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 with FFM and UBP for the entire group and genders. **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 measurements 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], fat free mass [FFM], percent body fat [%BF], lean mass [LM], bone mineral content [BMC], and armLM, legLM) was assessed using dual-energy x-ray absorptiometry. RESULTS: A total of 102 males (mean age = 20.35 ± 1.38 years) were included in the analyses. Intra-class correlations between the two BIA determined fat free mass (FFM) of total body, right arm, left arm, trunk, right leg and left leg were .974, .961, .965, .963, .954, and .994, respectively. Two-tailed paired samples t-tests showed all comparisons of DXA FFM (bone mineral content [BMC] + lean mass) compared to the average of the two BIA FFM (comparable to DXA BMC + lean mass) to be significantly different (p < .001) except for the trunk (p = .242). Segmental BIA FFM underestimated segmental DXA FFM by ≤ 1.05kg, while total body BIA FFM overestimated total body DXA FFM by 2.2kg. CONCLUSIONS: Multi-frequency BIA is reliable in determining total and segmental FFM. The significant differences between DXA and BIA in determining segmental FFM may be due to body composition derived from DXA is based on attenuation of x-ray to determine BMC, lean tissue, and fat mass while; body composition derived from BIA is based on impedance of body water content.

No previous studies, to our knowledge, have examined the reliability of multi-frequency bioimpedance spectroscopy (BIS) for the evaluation of body composition. PURPOSE: To evaluate the test-retest reliability of BIS for the assessment of total body water (TBW), extracellular water (ECW), and intracellular water (ICW) content, as well as fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%) in physically active males. METHODS: Sixteen males (Mean ± SD, 25 ± 3 y, 90 ± 11 kg, 176 ± 6 cm) were assessed at 2–5 visits, separated by 2–7 days. During each visit, participants rested quietly for 3–5 min in a supine position with their arms abducted ≥ 30° away from their torso and legs separated prior to their assessment. Two single-tap electrodes were placed on the right side of the body 5 cm apart on both the dorsal surface of the wrist and dorsal surface of the ankle, respectively. The BIS device was used to estimate TBW, ECW, and ICW (liters; L) based on Cole modelling with Hanai mixture theory, which were then used to calculate FM (kg), FFM (kg), and BF%. Reliability was examined by calculating the intra-class correlation coefficient (ICC; model 2,1) and standard error of measurement (SEM). The coefficient of variation (CV) was calculated by expressing the SEM relative to the grand mean (%). The 95% confidence interval (CI) for each ICC was calculated and used to test the null hypothesis that each ICC was equal to zero. Systematic variability was assessed for each variable via a paired t-test. RESULTS: Reliability statistics are displayed in Table 1. None of the dependent variables displayed significant systematic variability (p = .05). ‘Excellent’ relative and absolute reliability was observed among all body water (ICC = 0.91 – 0.99; CVs = 1.08 – 3.50%) and body mass (ICC = 0.95 – 0.99; CVs = 1.10 – 6.99%) measurements. CONCLUSION: These results indicate that the BIS device used in this study allows for the reliable assessment of TBW, ECW, ICW, FM, FFM, and BF% in physically active men.

Table 1.
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 components at different times in the training cycle. Question remains concerning the accuracy of these devices to track body composition changes over the yearlong training and competitive cycle compared to a standard laboratory procedure.

**PURPOSE:** To compare the accuracy of selected BIA devices compared to dual-energy X-ray absorptiometry (DEXA) for tracking body composition across a college women’s basketball season. **METHODS:** Twelve NCAA Division-II women basketball athletes (age = 20.1 ± 1.2 y, height = 1.75 ± 0.56 m, weight = 70.2 ± 4.4 kg, %fat = 27.8 ± 2.8%) were measured prior to the season (T1), after pre-season conditioning (T2), at mid-season (T3), and at the end of the season (T4) using 7 single-frequency BIA devices and DEXA.

**RESULTS:** Repeated-measures ANOVA indicated that body mass (p = 0.19) and DEXA %fat (p = 0.08) did not change significantly over the course of the season. A method x trial ANOVA of %fat and fat-free mass (FFM) assessed 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 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.

**A Matter Of Fat? Body Composition In Relation To Vo2max Improvements In Division II Female Athletes**

Kallie LaVelle, Joseph D. Ostrem. Concordia University - St. Paul, St. Paul, MN.

(No relevant relationships reported)

**PURPOSE:** Body composition is a significant factor in the determination of relative maximal oxygen consumption (VO2max). Kenney, Wilmore, & Costill, 2015). Historically, O2 consumption reported in ml/kg/min considers O2 consumption related to fat free mass (FFM). A training program that facilitates an increase in FFM and/or a decrease in fat mass (FM) and body fat percentage (BF%) would inherently increase relative aerobic capacity and may optimize performance throughout the competitive season (Castagna, et al., 2013).

The purpose of the study was to determine the relative aerobic capacity response via Graded Exercise Testing (GXT) in relation to body composition changes in female Division II collegiate athletes following a preseason conditioning program. **METHODS:** Nine female college athletes (age = 20.1 ± 1 yrs) participated in the study. Subjects performed a modified Balke GXT assessment on a treadmill to failure. Prior to performing the modified Balke GXT, subjects had their body composition assessed utilizing a Bod Pod (COSMED, Rome, Italy). All laboratory assessments were performed in the kinesiology lab at Concordia University – St. Paul, MN. Aerobic fitness and body composition were assessed before and after an 8-week preseason interval training program. Paired t-tests evaluated mean differences for pre- and post-training variables within body composition and GXT assessments.

**RESULTS:** The measured VO2max via GXT (43.7 vs. 44.0 ml/kg/min, P=0.57) was not significantly increased and body composition components (FFM: 51.3 vs. 51.8 kg, P=0.49; FM: 16.0 vs. 15.9 kg, P=0.93; BF%: 23.9 vs. 23.5%, P=0.78) were also not significantly affected over the 8-week preseason training period. **CONCLUSIONS:** The 8-week preseason conditioning program showed improvements, although not significant, among VO2, FFM, FM, and BF%. Further studies with a greater number of participants could provide appropriate power to accurately determine the anthropometric and physiological changes experienced throughout the program.
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 total body mass (r = 0.95) than when sex was held constant. 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.
players combined (n=60) demonstrated the following body composition characteristics: total body FM (15.2± 4.8 kg), total body LM (46.96 ± 4.7 kg), and BMC (27.2± 4.3). There were significant differences between sports and segmental LM (LIM and RLM). Lacrosse athletes had higher %fat compared to soccer athletes: (mean difference [MD] = SD: 2.5 ± 2.3%; p=0.034). Segmental leg LM (LIM, RLM) was higher in both legs of soccer athletes (LIM MD: 0.08 ± 0.5 kg; p<0.004, RLM MD: 0.89 ± 5.2 kg; p<0.001). In the full sample, there was no significant difference (p=0.139) between RLM and LLM. When evaluating injured vs. non injured athletes in the full sample, 45% of athletes reported a knee injury; %fat was significantly higher for athletes with no injury history (MD: 2.5±2.4%; p=0.046).

CONCLUSIONS: These finding suggest that Division I soccer and lacrosse players who have returned to play following a lower extremity injury do not experience differences in segmental leg lean mass between the left and right leg. Based on the elite level of these teams, these data could portray optimal characteristics of successful athletes returned to play.

3344 Board #32 June 1 8:00 AM - 9:30 AM
The Relationship Between Body Composition with Peak Force and Anaerobic Power in Collegiate Baseball Players
Jeremy R. Pearson, Tanaj Wadhri, Jacob T. Rauch, Justin Thiel, Jody C. Andersen, Jay O’Sullivan, Eduardo O. De Souza. The University of Tampa, Tampa, FL.
Email: jeremy.pearson@spartans.ut.edu

(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine the association between parental socioeconomic status and skeletal muscle mass in college students. METHODS: A cross-sectional study including 2194 college freshmen (537 males; 1657 females) was conducted in Shenyang, China. Data on body composition, health check-up, and self-reported questionnaire were available from all participants. Skeletal muscle mass assessment was performed by bioelectrical impedance analyzer (Tanita BC-420 MA). Information on parental socioeconomic status (educational levels, annual income, occupational status) was collected via questionnaires. Educational levels were divided into 4 categories: primary school, middle school, high school, and ≥ college. Annual income was divided as <15000, 15000-29999, 30000-49999, and ≥50000 CNY. Occupational status was classified into 4 groups: non-employment, blue-collar workers, and white-collar workers. Analysis of covariance was used to adjust the confounding effect of age, sex, ethnicity, hometown location, smoking status, alcohol use, sleep duration, and body mass index.

RESULTS: Mean (standard deviation) body mass of college freshmen was 54.9 (7.8) kg in male students and 39.2 (4.3) kg in female students. Multivariate analysis showed that college freshmen with higher paternal (mean [95% confidence interval]: primary school, 42.2 [41.7, 42.7]; middle school, 42.9 [42.6, 43.2]; high school, 43.6 [43.2, 43.9]; ≥ college, 43.2 [42.8, 43.5]) had higher % fat mass, including bone, with anaerobic power but only a moderate relationship with CMJ (PP: r=0.777; p<0.001, AP: r=0.713; p<0.001) but only moderately correlated to CMJ (PP: r=0.488; p<0.001). LBM was also strongly correlated to WIN (PP: r=0.660; p<0.001, AP: r=0.738; p<0.001) but only moderately correlated to CMJ (PP: r=0.467; p<0.001). 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 (CMJPP: r=0.076; p≥0.001) and moderately correlated to CMJ (CMJPP: 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, BF was strongly correlated to performance probably because athletes with more LBM 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 Puertorriquen wrestler Preparación for the National Championship

(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 Puertorriquen wrestlers to prepare for the National Wrestling Championship. 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 measurement times. Independent sample t-test was used to detect differences between sex.

RESULTS: Body weight decreased from 68.9±14.0 to 66.95±13.5 kgs from the week
before the competition to the day of the weigh-in, and then increased to 68.2±13.8 kgs from weight-in to the day of the competition (F= 27.33, p<.001). UYG increased significantly from 1 week before to the weigh-in (1.024±006 vs. 1.028 ±0.07 g/ml) and decreased on the competition day (1.025±0.077) (F=4.32, p<.019). No differences were found between sex in relative weight change (%) and UYG. 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. CONCLUSION: The results indicate that wrestlers of the national adult pre-competition 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.

3346 Board #34 June 1 8:00 AM - 9:30 AM Predicting Percent Body Fat from Waist-to-Height Ratio Using a Regression Model Stephanie Gerlach, Ann Gibson, FACSM. University of New Mexico, Albuquerque, NM. (No relevant relationships reported)

Relative body fat (%BF) is a health status indicator. 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 (20-80 yrs, 71 adults; 30:10:yr; 79.6±6.5 kg, 2.8±1.5 kg) volunteered for the wet body weight and WHR was measured prior to the study. 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 a significant relationship. 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. Wt and WHR were negatively correlated with sex (r = .145 men; r = .434 women, p<.05); %BF and WHR were positively correlated with age (r= .461 men; r=.389 women, p<.05). For the sample, %BF = 19.415 + 0.544* WHtR + 0.259*age. For the women, %BF = 20.85 + 0.55*WHtR + 0.08*wt + 0.27*age. For the men, wt is a lower and age a stronger predictor of %BF. The resulting sex-specific equation for WHR, weight, and sex was significant predictors of %BF (p<.001). For each sex, %BF increased with each unit increase in WHR, kg body wt, and yr of age. Wt and WHR were negatively correlated with sex (r = .145 men; r = .434 women, p<.05); %BF and WHR were positively correlated with age (r= .461 men; r=.389 women, p<.05). For the sample, %BF = 19.415 + 0.544* WHtR + 0.259*age. For the women, %BF = 20.85 + 0.55*WHtR + 0.08*wt + 0.27*age. For the men, %BF = 20.85 + 0.55*WHtR + 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.

3347 Board #35 June 1 8:00 AM - 9:30 AM The Relationship Between BMI, Lean Mass, and Body Fat Percentage with Balance in Collegiate Archers Branden Ziebel, Jared Feister, Andy Bosak, Russel Lowell, Madeline Phillips, Hannah Nelson, Taylor Sanders, Liberty University, Lynchburg, VA. (Sponsor: Dr. James Schoffstall, FACSM) (No relevant relationships reported)

For shooting sports, static balance and stability can have a dramatic impact on performance. Archery requires the balance and stability required for precision shooting. To investigate the relationship between balance and body composition and other factors that may affect balance, 40 female collegiate archers were evaluated. Archery is considered a sport that requires low-level skill and physical demands, thus it was hypothesized that there would be no relationship between body composition (eg. %BF, LLM, TLM, and BMI) and trunk lean mass (TLM) with balance in archers. PURPOSE: To investigate the potential relationship between BMI, %BF, LLM, and TLM on balance in collegiate archers in order to determine if archers should consider incorporating training to improve body mass or segment lean mass. METHODS: After having height (170.73 ± 7.48 cm), weight (71.02 ± 13.31 kg), and age (20.2 ± 1.55 years) recorded, 11 (7 males, 4 females) collegiate archers had their body composition (eg. %BF, LLM, TLM, and BMI) assessed. Then, after the completion of a general dynamic warm-up and a series of flexibility tests (ie. sit and reach, back scratch test, and trunk extension), subjects had their balance, with a balance system, evaluated via an athletic single leg assessment feature. During that assessment, the individual performed a single leg stance on a platform that decreased the amount of friction underneath the platform over 30 seconds and scoring was determined by how much movement occurred with the leg. Body composition was determined using hydrostatic weighing (HW). CONCLUSIONS: There was no relationship between balance and %BF (p = .790 r = .091) and a low correlation occurred with balance and BMI (p = .387 r = .290). However, there was a moderately high correlation between balance and TLM (p = .028 r = .656) and a high correlation between balance and LLM (p = .003 r = .801). CONCLUSIONS: %BF appears to have no relationship with balance, while BMI has very little impact. Yet, LLM and TLM may influence static balance. Future research may be required to evaluate LLM and TLM with balance using a larger population in order to further explore this potential relationship and perhaps further understand the factors that affect balance.

3348 Board #36 June 1 8:00 AM - 9:30 AM Relationship Between Physical Activity Level With Body Composition And Physical Fitness Of Students From Ilhabela, Brazil José Matheus O. Estivaleti, Carolina Gonzalez, Tatiana Figueiredo, Mauricio dos Santos, Luis Oliveira, José D.S. Guedes, Victor K. R. Matsudo. Nove de Julho University (UNINOVE), São Paulo, SP, Brazil. 1Center of Studies of the Physical Fitness Research Laboratory from Sao Caetano do Sul (CELAFITSCS), Sao Caetano do Sul, SP, Brazil. 2School of Medical Sciences of Santa Casa de Sao Paulo (FCMSCSP), Sao Paulo, SP, Brazil. (No relevant relationships reported)

Low level of physical activity in children and adolescents has several negative implications for health, such as overweight and decreased physical fitness. PURPOSE: Describe and compare the body composition and physical fitness of schoolchildren according to the recommendation of physical activity, measured by accelerometer. METHODS: The sample consisted of 73 schoolchildren, 37 boys and 36 girls, from 9 to 11 years of age, participating in the Mixed-Longitudinal Project of Growth, Development and Physical Fitness from Ilhabela. The variables analyzed were: body weight (kg), height (cm), BMI (kg/m²), skinfolds (mm), circumference (cm), agility (shuffle run/sec), flexibility (sit and reach), speed (50 meters/sec) and upper (hand grip/kg), lower limb (vertical jump/cm) strength, and abdominal strength (rep). The measures followed the CELAFITS CS standardization. Physical activity was measured objectively by means of an accelerometer (Actigraph, GT3X). Schoolchildren were divided into two groups: a- reached the PA recommendation (≥60min/day), b- not reached the PA recommendation (< 60min/day). To verify data normality, Shapiro-Wilk test was used. Comparison of the schoolchildren who did or did not reach the physical activity recommendation was made by t-test and Mann-Whitney U test. The level of significance was set at p < .05. RESULTS: Schoolchildren who reached the recommendation had significantly lower values compared to those who did not meet, respectively for adiposity (sum of 7 skinfolds) 66.1 cm vs 100.4 cm; body weight 34.3 kg vs. 40.5 kg; height 141.1 cm vs. 144.1 cm; speed 10.1 secs. vs. 10.4 secs. and agility 12.6 secs. vs. 13.5 sec. A significant difference was found in lower limb strength and abdominal strength. CONCLUSION: Children who fulfilled the recommendation of physical activity presented a better body composition, speed, and agility than the children who were insufficenty active.
Anthropometry Among Non-sedentary Elderly: Tendency Analysis Of Adiposity Over Three Decades

João da Silva Junior, Rafael Benito Mancini, Carolina Gonzalez Beltran, Tatiane Cosmenko Ferrari, Timoteo Leandro Araújo, Sandra M. Matsudo, José da Silva Guedes, Victor K. Matsudo, CELAFBSCS, São Paulo, Brazil. 1Universidade de São Paulo-USP, São Paulo, Brazil. 2UNIFMU Faculdades Metropolitanas Unidas, São Paulo, Brazil. 3Universidade Federal do ABC, Santo André, São Paulo, Brazil.

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 subscapular, 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.

Statistical 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 (r2) 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 0.01 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. The age group that showed the highest values for the mean values analyzed. As 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 suprailiacal 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 centripetal fat redistribution occurs with aging.

Vo2max 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 Vo2max 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 1.83.6 ± 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 Vo2max test. Vo2max 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 VO2max 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 VO2max, 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 VO2max average would be ranked in the 95th percentile and deemed excellent for VO2max based on the ACSM guidelines. The highest recorded VO2max from the study is ranked in the 95th percentile and deemed superior. Based off the ACSM guidelines, the average for the body fat percentage falls in the 95th percentile and is deemed fair. The leanest player of the group is in the 80th percentile and deemed excellent.

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

Brian Tyo, Kate Early, Clayton Nicks, Janes Davis, Cory Gibson, Columbus State University. Columbus, GA.

Email: tyo_brian@columbusstate.edu

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 (WBA), upper body bioelectrical impedance (UBIA), and lower body bioelectrical impedance (LBIA). Methods: Seventeen male participants (33.1 ± 9.3; 23.0±9.0% 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 (60PE) 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 (17.4 ± 6.5%), and LBIA (15.6 ± 8.0%). There was no effect of 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 WBIA, 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 PE15. WBIA and UBIA 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.
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. All participants were in a euhydrated state (Usg < 1.020). %BF was determined after exercise (without water; n=11), and a third group served as the control group (n=10). Participants then performed 30 min. of exercise at 70% VO2max on the treadmill (n=10). Participants reported in a euhydrated state (Usg < 1.020). %BF was determined a second time. Water equal to the BM lost during exercise was reconstituted (n=11). Participants then reported for a single visit following exercise and after fluid consumption. RESULTS: %BF 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 the water group (79.4±9.5; 78.5±9.7 kg; p=0.001). CONCLUSIONS: These results suggest that a difference in body fat up to 7.3% can be observed between the different methods assessed. However, the relationship between the different methods is fairly strong. Due to the large variability observed in the different body composition methods assessed, it would suggest the need for developing recommended standard ranges based on the body composition assessment utilized.

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

Xiong Qin, Weimo Zhu, FACSFM, Zexhao Chen. University of Illinois at Urbana and Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSFM)

Email: xiongq2@illinois.edu

(No relevant relationships reported)

PURPOSE: Aerobic capacities, specifically VO2max, 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 VO2max prediction, this study was to examine the impact of changed BMI on the declined VO2max.

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 VO2max using the equation of Cureton et al. (1995): VO2max (ml/kg/min) = (8.41*Time) + (0.34*Time^2) + (0.21*Age*Sex) - (0.84*BMI) + 108.94. Second, BMI in the prediction were replaced by the BMI 50th percentiles of 8-11 yr. boys and girls in 2015-16 NIANES. Finally, the difference between 1987 and 2015-16 estimated VO2max were computed and compared.

RESULTS: Impact of BMI changes on the estimated VO2max 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 VO2max of 8-11 children and youth, indicating that weight management should be a part of fitness and health promotion in children and youth.
(t_{min}), and total hip BMD were computed. The mean BMD of both sides was computed for each sub-region, and a ratio between BMD of each respective sub-region and the ribs was computed. Participants were then divided into quintiles by whole body Z-score. A linear mixed effect model was used to determine whether the sub-regional BMD parameters and ratios differed between quintile groups. Pairwise comparisons were used to determine differences between quintile groups if a main effect was significant (p<0.05). RESULTS: There were significant main effects for BMD to differ by each sub-region, with the lowest quintile group always having significantly lower BMD than that of each of the upper three quintiles. However, the only significant ratios were that of F2c (p<0.019) and F4c (p<0.019). Pairwise comparisons revealed the upper quintile group had significantly lower ratios for these two parameters than all other quintile groups. CONCLUSION: Decreased BMD in RIB and all sub-regions of the legs, combined with elevated F2c and F4c ratios, suggest that BMD is lost from the ribs at a greater rate than it from specific regions of the legs in athletes with the lowest whole body Z-scores. Future research should explore the clinical implications of this finding for stress fracture risk and long-term bone health in athletes.

Observer 1 data were combined from each center for both female and male athletes to form single data files. Observer 2 and 3 data, each sampled from a different center, were used to determine differences between quintile groups if a main effect was significant (p<0.05).

There were significant main effects for BMD to differ by each sub-region, with the lowest quintile group always having significantly lower BMD than that of each of the upper three quintiles. However, the only significant ratios were that of F2c (p<0.019) and F4c (p<0.019). Pairwise comparisons revealed the upper quintile group had significantly lower ratios for these two parameters than all other quintile groups. CONCLUSION: Decreased BMD in RIB and all sub-regions of the legs, combined with elevated F2c and F4c ratios, suggest that BMD is lost from the ribs at a greater rate than it from specific regions of the legs in athletes with the lowest whole body Z-scores. Future research should explore the clinical implications of this finding for stress fracture risk and long-term bone health in athletes.

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

PURPOSE: To compare the body fat estimated with a commercial EIM mobile device with body fat measured with DXA.

METHODS: We evaluated the body fat percentage (%BF) of 28 professional male soccer players (19 - 34 years old, BF% 14.95 ±2.43) 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). CONCLUSIONS: The EIM mobile device was useful to accurately estimate %BF, even evaluating a single anatomical site when compared with DXA in professional soccer players. This device may be helpful for body composition assessment on the field. However, its accuracy in other athletic populations and its applicability for follow-up warrants further research.

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<td>7.89</td>
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<td>10.29</td>
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<td>-10.88</td>
<td>0.25</td>
<td>0.005</td>
<td>11.13</td>
</tr>
</tbody>
</table>

ICC: Intraclass correlation coefficient; Range LA: Absolute range on limits of agreement (95%); SD: Standard deviation. * Significant differences with DXA (p<0.05).

Table. Body fat percentage analysis from DXA and electrical impedance myography.

Abstracts were prepared by the authors and printed as submitted.
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, p = 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) - 0.031(age) + 228.54(sex, M = 1, F = 0), R² = 0.68, SEE = 173 kcal/day. Cross-validation statistics were: R² = 0.54, p = 0.05, SEE = 199 kcal/day, and total error = 198 kcal/day. In published models, R² ranged from 0.47 to 0.57, SEE ranged from 192 to 213 kcal/day, and total error ranged from 212 to 1311 kcal/day. CONCLUSIONS: Cross-validation to published models estimated 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 overestimate 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 for weight management in clinical practice.

G-35 Free Communication/Poster - Fitness Assessment

Saturday, June 1, 2019, 3:30 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-Villanueva2, Luis E. Araya-Ortega3, Esmeralda de Valdivieso-Mora4, David K. Johnson5, Yamileth Chacón-Araya1, José Moncada-Jiménez1, N. National University, Heredia, Costa Rica. 2University of Costa Rica. 3University of Kansas, Lawrence, KS. 4University of California, Davis, CA.

Email: jose.moncada@uca.ucr.cr

(Coauthor 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 vs 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 = 62 ± 8.9 mmHg vs. Rural = 70 ± 2.3 mmHg, p < 0.001). Urban older adults showed better balance time than rural older adults (Urban = 22.7 ± 0.8 s vs. Rural = 18.4 ± 1.2 s; p = 0.003). Performance was similar between urban and rural older adults on the 6-MWT, 30-s Chair to-Stand, 30-s Arm Curl, TUG, and HGS tests (p > 0.05). CONCLUSION: In spite of having a higher chronic diseases health profile compared to rural older adults, balance was the only functional variable positively observed in urban older adults.
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 if 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. Tokyo University of Science, Tokyo, Japan. 1Gifu 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 each measured twice 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. Email: arney.blaine@uwlaux.edu  
(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 = .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.

3366  
**Board #54  June 1 9:30 AM - 11:00 AM**

**Reliability and Validity of Hip Rotation Strength Tests: Systematic Error Due to Tester Hand Dominance**

Connor Fedge1, Tim Tyler2. PRO Sports Physical Therapy of Westchester, Scarsdale, NY. Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, NY. (Sponsor: Malachy P McHugh, FACSM)  
Email: connorfedge@gmail.com  
(No relevant relationships reported)

**PURPOSE:** Manual muscle testing using hand held dynamometry (HHD) is commonly utilized and for a more objective measure. Deficits in hip rotation strength have been linked to lower extremity pathology, but measurement reliability is unknown. The purpose of this study was to assess the reliability and validity of hip internal (IR) and external (ER) rotation strength in three positions. **METHODS:** Right and Left Hip IR and ER strength was measured using HHD in 20 patients, (30 ± 12 years, 9 women, 11 men), using 3 tests (seated, supine, side-lying), at two different time points (Test 1, Test 2), by two different testers (A and B). *Results* were reported as torque (Nm/kg). Intratester and intertester relative reliability were assessed using intraclass correlation coefficients (ICC). Absolute reliability was assessed using 95% limits of agreement (LOA). **RESULTS:** Torque was highest for the seated tests, followed by the supine (13% lower than seated), and side-lying (25% lower than seated). There was a systematic difference between left and right legs for the seated and side-lying tests: the left side was stronger than right side for IR (Seated: 7% p=0.044, Side-lying: 9% p=0.04); right side 7% stronger than left side side-lying ER (p=0.008). Inter- and intratester ICCs are reported in Table 1. **CONCLUSIONS:** Hip ER and IR strength testing had poor intra- and intertester reliability. The right/left difference in seated and side-lying tests, suggest indicate tester hand dominance may be a confounding factor. These data highlight the need for more reliable hip rotation strength testing.

**Table 1.**
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 quantify any change in forearm girth over a 30-minute bout of climbing and compare it to the change in body size to the climber's ability to climb. METHODS: Ten intermediate rock climbers [Age; 26.7±6.7 years; Height: 174.5±16.12 cm; Mass: 68.1±18.21 kg; Body Fat %: 15.75±.63 %; Years Climbing: 7.3±4.69 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 height. Participants were measured in 120 senior Military students in the three military training schools (EMUSB-UCOIs and ESPRO-POIs). The 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 “Léger” 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), right time in the Squat Jump test (48.1s vs 451.1 vs 482.4 milliseconds, P = 0.001), right time in the Push Up test (404.6 vs 316.7 vs 375.5 milliseconds, p = 0.001), body mass index (23.5 vs 23.7 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 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-1 at 3% grade, 8 km·h-1 at 6% grade, 9 km·h-1 at 6% grade, 10 km·h-1 at 8% grade, 10 km·h-1 at 10% grade, 11 km·h-1 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 Vmax Encore medical software (Yorks Linda, CA, USA). 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 than SATST: 17.60 ± 7.55 vs 4.04 ±6.59 ml·kg-1·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). CONCLUSIONS: 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 National Firefighters Hyunjoo Kang1, Kyoungmin Noh1, Woock Song2, Chungkun Lee3, Seoyoung Park2, Jungjun Park1, Hanjoong Song1, Dongil Seo4, Yeonsoon Ahn5, Soonchunhyang University, Asan, Korea, Republic of. 2Seoul National University, Seoul, Korea, Republic of. 3Pusan National University, Pusan, Korea, Republic of. 4UlSAN University, UlSAN, Korea, Republic of. 5Dongguk University, Gyeongju, Korea, Republic of. 4Tosei University, Wonju, Korea, Republic of. Email: violiete@naver.com (No relevant relationships reported)

Firefighting is a physically demanding profession that requires optimal muscular fitness levels. Until now, there have been no studies investigating longitudinal changes and characteristics of the muscular fitness of firefighters. PURPOSE: To investigate the changes in the results of Korean firefighters’ muscular fitness test over 6 years for each gender. METHODS: Muscular 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, Ffemale = 10.856, both p < .001) every year. Records show that grip strength decreased as age increased (B = -.345); records also show that grip strength decreased 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, Ffemale = 246.373, both p <.001), and improved by T2 (1.1 ± 2.1; p = 0.003), but did not recover to pre-injury levels (p < 0.001).ACL-QOL increased from T2 (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 = 0.735, 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.

3373  Board #61 June 1 9:30 AM - 11:00 AM Convergent Validity and Relative Reliability of Hexoskin during a Maximal Field Test Manoorn Haddad, Feryel Dalans, Mariam Kharbach, Azam Mohamed, Zhehan Aganovic. Qatar University, Doha, Qatar. Email: mhaddad@qu.edu.qa (No relevant relationships reported)

PURPOSE: The aim of the study was to determine the convergent validity and relative reliability of a wearable metric Hexoskin “the smart shirt” 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 completely two trials of 400 m shuttle run test (10 shuttles) were conducted by 48th to 72h. RESULTS: Nearly perfect (r=0.93) and trivial (r=0.09) correlations have been observed in 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 MacDonald1. 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 994E) 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 33.7 ± 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 (11.1 ± 2.1; p=0.003), but did not recover to pre-injury levels (p=0.001). ACL-QOL increased from T2 (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 = 0.735, 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 Barbara N. Sanchez1, Matthew K. Beeler1, Carl M. Maresh1, FACSM2, William J. Kraemer3, FACSM4,5, Brett A. Cossack2,6, Dean M. Cordingley1, Sheila McRae1, Matthew K. Beeler1, Carl M. Maresh1, FACSM2, William J. Kraemer3, FACSM4,5, Brett A. Cossack2,6, Dean M. Cordingley1, Sheila McRae1. 1Ohio State University, Columbus, Ohio, OH. 2Bloomburg University, Bloomburg, PA. Email: sanchez.1094@osu.edu (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, squat, 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 exerting 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 maximum weight deadlifted. RESULTS: There was no significant difference (t(4) = -0.512, p > .05) between the self-selected psych-up technique (204.93 ± 48.78 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 exercise test protocol used. The nominal protocol started with a 3-minute warm-up (WU), 40 minutes of moderate-intensity (70% PHR) exercise, 3 minutes of cooldown (CD), and 10 minutes of rest. The MIT protocol was composed of a 3-minute warm-up (WU), 1 term of moderate-intensity (70% PHR) exercise, 3 min of cooldown (CD), and 10 min of rest. The MIT protocol was composed of a 3-minute warm-up (WU), 3 min of cooldown (CD), and 10 min of rest. The MIT protocol was composed of a 3-minute warm-up (WU), 4 term of moderate-intensity (70% PHR) exercise, 10 min of rest. The MIT protocol was composed of a 3-minute warm-up (WU), 1 term of high-intensity (90% PHR) exercise, 3 min of cooldown (CD), and 10 min of rest. The HIT protocol was composed of a 3-minute warm-up (WU), 1 term of high-intensity (90% PHR) exercise, 10 min of rest.

RESULTS: Relative VO\textsubscript{2peak} values did not differ between teams (WBB: 55.3 ± 8.1; WLAX: 53.8 ± 5.4 mL·kg\textsuperscript{-1}·min\textsuperscript{-1}). The percent of athletes that met each of the five criteria were: plateau (WBB: 55%: WLAX: 56%); HR\textsubscript{peak} (WBB: 27%: WLAX: 39%); RPE\textsubscript{peak} (WBB: 0%: WLAX: 1%); RPE (WBB: 55%: WLAX: 44%); LAC (WBB: 100%: WLAX: 83%). More WLAX attained VO\textsubscript{2peak} than VO\textsubscript{max} (55% vs. 45%). WBB was evenly distributed between VO\textsubscript{2peak} and VO\textsubscript{max} (50%). There was no statistical difference between WBB and WLAX in VO\textsubscript{2peak} or the number of athletes from each team who met each individual criterion. Significant differences between teams were observed for LAC (WBB 13.3 ± 1.7; WLAX 10.3 ± 2.3 mmol/L; p=0.001) and RER (WBB 0.96 ± 0.05; WLAX 1.04 ± 0.09; p=0.002).

CONCLUSION: These findings suggest physiological responses to a fixed VO\textsubscript{2peak} protocol may vary between sport teams of different metabolic demands. Consideration should be given to such variations when selecting test protocols and interpreting results.

INTRODUCTION: Astronauts complete maximal aerobic capacity (VO\textsubscript{2max}) testing as part of their annual fitness assessment (AFA) as well as several times once assigned to an International Space Station mission. Historically, the 2-Way T-Shape Non-Rebreathing valve with a mouthpiece and nose clip (mouthpiece) has been used in these tests. The testing procedure was updated to use the oro-nasal mask (mask) for the AFA starting in June 2017. Astronauts who used the mask during their AFA requested it be certified to be used for all mission associated tests. Considering the criticality of the data and the schedule constraints of astronauts, it is imperative that the requested hardware change provide data with equivalent reliability and repeatability as provided by the mouthpiece. PURPOSE: To assess the reliability of mask vs. mouthpiece by comparing submaximal and VO\textsubscript{2max} data within subjects (approximately 1 year apart).

METHODS: Each of 17 active astronauts completed a VO\textsubscript{2max} test with the mouthpiece (first) and the mask (second) for their AFA. The VO\textsubscript{2max} test was conducted on a cycle ergometer with a metabolic cart. The nominal protocol started with a 3-minute warm-up at 50 Watts (W) and increased 25W every minute until volitional fatigue (Light: 45W start; 15W increase). The VO\textsubscript{2max} were compared between tests and the expected day-to-day variation (±5%) was used as the threshold for determining agreement between tests. Submaximal values were plotted and evaluated visually for deviations between mask and mouthpiece. RESULTS: VO\textsubscript{2max} values were more than 5% different, despite similar test times, between mouthpiece and mask in 6 of 17 comparisons, 3 of which were higher with the mask (0.0±0.5%) while 3 were lower (-10.8±2.0%) with the mask. The submaximal data did not indicate a leak in either apparatus during these tests. An Astronaut Strength & Conditioning Rehabilitation specialist confirmed that the measured differences in VO\textsubscript{2max} of these 6 astronauts was consistent with observed changes in exercise habits during the year that separated the two tests.

CONCLUSION: The results of this data mining effort the mask was accepted for use in all tests, accepting that, if a leak is detected without resolve, the test will be repeated (if schedule allows) and remaining tests will be completed with the mouthpiece.

PURPOSE “Affective mind-set” is a mental frame or lens that selectively organizes. Previous reports proved that activation of the left anterior brain region is linked with the optimistic affective mind-set. Aerobic exercise such as moderate-intensity interval training (MIT) and moderate continuous training (MCT) activates the frontal area 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 brain. This study aimed to evaluate which exercise can activate the left brain more by using three different kinds of bicycle exercise. METHODS The participants performed six different data mining effort the mask was accepted for use in all tests, accepting that, if a leak is detected without resolve, the test will be repeated (if schedule allows) and remaining tests will be completed with the mouthpiece.
By performing muscular testing, such as an isokinetic fatigue test, it is possible to assess anaerobic capacity and measure how well isolated. 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 females, completed 2 separate sub-maximal repetition 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±6.5%; T2 43.7±6.9%), time to peak torque (T1 280.5±59.8ms; T2 284.1±69ms) average power (T1 99.0±19.4W; T2 100.5±20.6W), 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 females 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 and mobility. 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 yrs.; Body Mass Index [BMI] = 27.9 ± 7.4 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 Kinesiometry. 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 ± 2.3 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 < 0.001, 95% CI: 0.31, 0.75; r = 0.32, p < 0.01, 95% CI: 0.08, 0.62, r = 0.14). The ASM relative to height was unrelated to handgrip strength (r = 0.12, p = 0.45, 95% CI: -0.20, -0.42; r = 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 concluding 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 an underwater treadmill was performed by all participants to evaluate aerobic fitness (VO\textsubscript{2peak} defined as the highest 20 sec VO\textsubscript{2} attained during the test. Maximal heart rate (HR\textsubscript{max}) 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=33.6±5.7%, healthy=24.4±5.2%) (p<0.008) and significantly lower relative VO\textsubscript{2peak} (ACLR=21.5±5.6 ml/kg/min, healthy=36.0±4.4 ml/kg/min) (p<0.008). No differences were observed in absolute VO\textsubscript{2peak} (ACL=24:0±4:0 L/min, healthy=25:0±3:0 L/min) (p=0.61) or time to exhaustion (ACL=130:1±18 mins, healthy=142:2±23 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 VO\textsubscript{2peak} is typically evaluated in cycle protocols. Although individuals with ACLR displayed lower relative VO\textsubscript{2peak}, 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.

Healthy fitness components such as body composition, cardiorespiratory endurance, and muscle strength are associated with disease risk and premature mortality. Factors influencing health related fitness in college-aged students are unclear, and academic major has not been yet considered. PURPOSE: To assess and compare the achievement of healthy fitness zone (HFZ) by academic major in college students from Puerto Rico. METHODS: College students (331 females, 258 males, 18-25 years of age) enrolled in elective courses at the Physical Education Department of the University of Puerto Rico (PR), completed the Fitnessgram® assessment protocol. A Achievement of HFZ was determined for each component: strength-endurance fitness (SEF) with push-up, curl-up, and trunk lift; flexibility fitness (FLF) with back-saver sit and reach, and shoulder stretch; body composition fitness (BCF) with BMI, and %fat; and cardiorespiratory fitness (CFR) with the 20-m PACER test. Students were also classified according to their academic major: teacher education (TE), physical education (PE), natural sciences (NS), business administration (BA), and others (OP) including social sciences, humanities, communication, and general studies. Frequencies and percentages of students achieving the HFZ in each component were determined, and Chi-squares used to detect differences by academic major and sex. RESULTS: HFZ for the SEF component was achieved by 68% of participants, FLF by 52%, BCF by 61%, and CFR by 87%. More males than females were in the HFZ for SEF (p=0.05, 95% CI: 0.31, 0.75), BCF (p=0.001, 95% CI: 0.31, 0.75), and CFR (p=0.001, 95% CI: 0.31, 0.75); while more females than males were in the HFZ for BCF (65 vs. 52%, p=0.001). More PE majors were in the HFZ in SEF (82% vs 68, 59, 66 and 54% for TE, NS, BA and OP majors, respectively; p<0.01) and CFR (48% vs 27, 14, 34 and 19% for TE, NS, BA and OP majors, respectively).
majors, respectively, P<0.001). No differences were observed by academic major for FLF and BCF. CONCLUSION: Although a relatively high proportion of students achieved HFZ criterion in SEF, BCF and FLF, the standards proportion of achieving CRF, particularly females, is of concern. Results also suggest that academic major must be considered when developing strategies to promote the achievement of HFZ in critical health components such as CRF and SEF among college students in PR. Supported by FIP/DEGU/UPRP.

The physical demands of firefighting are evident, and a high level of physical fitness is required to perform the job safely. Despite the clear need for adequate physical fitness, the majority of firefighters (FF) remain unfit for duty. Regular exercise is an effective strategy to prevent/attenuate multiple health risks, as well as improve health and job performance. PURPOSE: To investigate the relationship between physical fitness (i.e., cardiovascular endurance and muscular endurance) and performance on the Academy FF Challenge (AFC). METHODS: During the first week (1) and last (week 7) weved of the FF set-up, FF recruits (men = 176 ± 4.1 yr; 100% male) physical fitness and FF ability were assessed. Physical fitness was assessed via cardiovascular endurance (estimated VO₂max via 1.5 mile run time) and muscular endurance (60-second sit-ups and push-ups and Young Men’s Christian Association (YMCA) bench press), while FF ability was assessed via total completion time on the AFC (Kesser Slid, Self-Contained Breathing Apparatus maze, victim drag, hose advance, equipment carry, and ladder set-up). RESULTS: Physical fitness predicted significant variance in FF ability at Week 1 (R²= 0.48, P<0.001) and Week 7 (R²=0.47, P<0.001) for accounting for age and BMI. Specifically, cardiovascular endurance accounted for 28.9% (F(3,50) =22.83) and 36.4% (F(3,50) =28.70) unique variance, while muscular endurance accounted for 11.4% (F(3, 6, 47) =3.45) and 10.2% (F(3, 6, 47) =3.02) unique variance on FF ability at week 1 and 7, respectively. CONCLUSIONS: Firefighting is a challenging occupation that requires these individuals to be in peak physical condition. Targeting FFs early in their careers and highlighting the importance of fitness is extremely vital to developing healthy, safe, and efficient FFs. By better understanding the relationship between physical fitness and firefighting ability, exercise specialists, researchers, and physicians may be able to better prescribe exercise in this population.

Purposes: To investigate the relationship between physical fitness and firefighting ability. PURPOSE: To investigate the relationship between physical fitness (i.e., cardiovascular endurance and muscular endurance) and performance on the Academy FF Challenge (AFC). METHODS: During the first week (1) and last (week 7) weved of the FF set-up, FF recruits (men = 176 ± 4.1 yr; 100% male) physical fitness and FF ability were assessed. Physical fitness was assessed via cardiovascular endurance (estimated VO₂max via 1.5 mile run time) and muscular endurance (60-second sit-ups and push-ups and Young Men’s Christian Association (YMCA) bench press), while FF ability was assessed via total completion time on the AFC (Kesser Slid, Self-Contained Breathing Apparatus maze, victim drag, hose advance, equipment carry, and ladder set-up). RESULTS: Physical fitness predicted significant variance in FF ability at Week 1 (R²= 0.48, P<0.001) and Week 7 (R²=0.47, P<0.001) for accounting for age and BMI. Specifically, cardiovascular endurance accounted for 28.9% (F(3,50) =22.83) and 36.4% (F(3,50) =28.70) unique variance, while muscular endurance accounted for 11.4% (F(3, 6, 47) =3.45) and 10.2% (F(3, 6, 47) =3.02) unique variance on FF ability at week 1 and 7, respectively. CONCLUSIONS: Firefighting is a challenging occupation that requires these individuals to be in peak physical condition. Targeting FFs early in their careers and highlighting the importance of fitness is extremely vital to developing healthy, safe, and efficient FFs. By better understanding the relationship between physical fitness and firefighting ability, exercise specialists, researchers, and physicians may be able to better prescribe exercise in this population.
Isometric pre-conditioning improves the physical fitness of athletes of different sports modalities. However, until now, there is no evidence of the effect of isometric pre-conditioning (IPC) on the performance of judo athletes. 

**PURPOSE:** Verify the acute effect of IPC on the Special Judo Fitness Test (SJFT) performed by judo athletes. 

**METHODS:** The study involved 17 judo athletes (age=21.35 ± 3.46 years, practice experience=8.94 ± 3.88 years, height = 1.73 ± 0.09m, body mass=69.34 ± 10.94kg). In the first session, they answered the questionnaires, underwent the anthropometric evaluation and the familiarization of the SJFT. The SJFT was used to evaluate the athletes’ physical fitness. In the second and third sessions, two experimental protocols were performed in a randomized and counterbalanced manner: a) IPC (3 cycles × 5 min isometric at 220 mmHg / 5 min reperfusion at 0 mmHg) + SJFT and b) SHAM (3 cycles × 5 min isometric at 20 mmHg / 5 min reperfusion at 0 mmHg) + SJFT. A 30 minute interval between the experimental protocols and the SJFT and 72 hours between the 2nd and 3rd sessions was observed. Statistical tests of variance homogeneity and Student’s t-test were performed to verify possible differences between the IPC and SHAM groups in the following measures: number of throws in the SJFT per series, total number of throw in the SJFT and SJFT index. The magnitude of the difference between IPC and SHAM conditions was assessed using the effect size (d=Cohen’s). 

**RESULTS:** The IPC performed a larger number of throws in the SJFT per series (p=0.004, d=0.50, moderate effect) compared to SHAM. When we analyzed the total number of throws we found a significant difference between the IPC and SHAM groups (p=0.001, d=0.37, small effect). The SJFT index showed a significant difference between IPC and SHAM (p=0.001, d=0.50, moderate effect). 

**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-second epochs and the Sasaki (2011) cutpoints were used to calculate the percent of game play spent in light, moderate and vigorous intensity activity. Participants also reported whether they performed a specific combination of physiotherapy exercises or stretches, such as hamstring stretches, knee bends, or other exercises.

RESULTS: Players reported playing pickleball 96-240 minutes per session for 2-6 days per week (537.5±381.3 mins/week). On average, 41.1±33.6% of game play was at moderate or higher intensities (47.1±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 the reported weekly physical activity participation is spent in actual game play, it is estimated that players typically engage in an average of 162.5±140.8 mins/week (range: 53.8-526.2 mins/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.
Physiological Responses of Arena Polo Players during Simulated Game Play

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(A no relevant relationships reported)

Arena polo is rising 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 (HR) (r² = 0.775 (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), respiration volume (VO₂), and respiratory exchange ratio (RER) of arena polo players during each time period.

<table>
<thead>
<tr>
<th>HR (bpm)</th>
<th>VE (L/min)</th>
<th>VO₂ (mL/min/kg)</th>
<th>RER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warmup</td>
<td>131 ± 1</td>
<td>37 ± 1</td>
<td>17.4 ± 0.3</td>
</tr>
<tr>
<td>Free Choice</td>
<td>164 ± 2</td>
<td>61 ± 2</td>
<td>23.3 ± 0.6</td>
</tr>
<tr>
<td>Chukker</td>
<td>169 ± 1</td>
<td>57 ± 1</td>
<td>24.9 ± 0.4</td>
</tr>
<tr>
<td>Recovery</td>
<td>136 ± 2</td>
<td>26 ± 1</td>
<td>10.8 ± 0.5</td>
</tr>
</tbody>
</table>

Values within a column lacking a superscript differ (P < 0.001).

The Upper-Quarter Y-Balance test (UQYBT) is frequently used to assess shoulder function and stability, and core stability. UQYBT consists three reaching tests in push-up position, Superior-Lateral Reach (SR), Inferior-Lateral Reach (IR), and Medial Reach (MR). Several studies identified differences between genders, sports, and pathologies. However, mechanical strategies during the UQYBT were not explored between the reaching tests. PURPOSE: To identify vertical ground reaction force (Fz) and center of pressure area (CPa) patterns globally between the three reaching tests and moderated by gender, and handedness. METHODS. Twenty college students participated, eight females (25±5 yrs; 65±11 kg; 164±5 cm) and 12 males (23±4 yrs; 83±17 kg; 179±7 cm). After 10 familiarization trials preceded testing by a minimum of 72 hrs. with balance performed first followed by strength tests. Results: 5 participants displayed an asymmetrical difference (1.2±1.8 kg), Pearson correlation statistical analysis revealed no significant relationship with overall balance performance (8.26±2.27 composite score, r = -0.151, p < 0.05) and no significant difference between right U1 (1.24±0.36 overall sway, r = -0.174, p = 0.05) and left U1 (1.34±0.60 overall sway, r = 0.085, p = 0.05). Conclusion: This small sample size of active seniors failed to provide a significant correlation between an asymmetrical deficit and balance performance. An asymmetrical deficit does not appear to increase the chance of falls in older adults in this cohort. A larger sample size and a comparison to a sedentary population may provide additional insight.

Exploring Upper Quarter Y-Balance Test Biomechanical Strategies in Active College Students

Kevin Masson, Tal Amasay, Alissa Bello, Parry Meredith, Jessica Aquino. Barry University, Miami, FL.

(A no relevant relationships reported)

The The Upper-Quarter Y-Balance test is frequently used to assess shoulder function and stability, and core stability. UQYBT consists three reaching tests in push-up position, Superior-Lateral Reach (SR), Inferior-Lateral Reach (IR), and Medial Reach (MR). Several studies identified differences between genders, sports, and pathologies. However, mechanical strategies during the UQYBT were not explored between the reaching tests. PURPOSE: To identify vertical ground reaction force (Fz) and center of pressure area (CPa) patterns globally between the three reaching tests and moderated by gender, and handedness. METHODS. Twenty college students participated, eight females (25±5 yrs; 65±11 kg; 164±5 cm) and 12 males (23±4 yrs; 83±17 kg; 179±7 cm). After 10 familiarization trials preceded testing by a minimum of 72 hrs. with balance performed first followed by strength tests. Results: 5 participants displayed an asymmetrical difference (1.2±1.8 kg), Pearson correlation statistical analysis revealed no significant relationship with overall balance performance (8.26±2.27 composite score, r = -0.151, p < 0.05) and no significant difference between right U1 (1.24±0.36 overall sway, r = -0.174, p = 0.05) and left U1 (1.34±0.60 overall sway, r = 0.085, p = 0.05). Conclusion: This small sample size of active seniors failed to provide a significant correlation between an asymmetrical deficit and balance performance. An asymmetrical deficit does not appear to increase the chance of falls in older adults in this cohort. A larger sample size and a comparison to a sedentary population may provide additional insight.

AlphAnd Beta Wave Eeg Activity During A Self-paced Vo2 Max Test In Middle-aged Adults

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(A no relevant relationships reported)

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 individuals. 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 VO₂ max (SPV) test was performed on a cycle ergometer, while subjects wore a wireless EEG electrode strip. This test consisted of five 2-min. stages using prescribed rating of perceived exertion (RPE) levels of 11, 13, 15, 17, and 20 (in that order). A ParvoMedics metabolic cart was used to analyze expired gases. Alpha (8-13 Hz) and beta (13-30 Hz) wave activity in the prefrontal and motor cortices (PFC and MC) were determined via PSD using Welch periodograms. Values were compared to an eyes open resting condition taken prior to exercise. Repeated-measures ANOVAs were used to determine the effect of test stage on EEG activity. RESULTS: The mean VO₂ max was 37±7±2.2 mL·kg⁻¹·min⁻¹. Relative PSD in both the alpha and beta frequency bands increased with corresponding increases in exercise intensity. In the PFC, there was a significant main effect of test stage in both the alpha and beta frequency bands (p < .013 and .034) respectively. In the MC, the main effect of time was significant in the alpha (p < .033), but not the beta (p > .08) frequency. Large increases in relative PSD in the transition from RPE17 to RPE20 (e.g. 7.6±2.0 µV²·Hz⁻¹ to 16±1.6±4·Hz 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
The functional movement screen (FMS) deep squat (DS) is used to identify movement deficiencies and potentially predict injury. While evidence does not support the predictive validity of FMS scores, useful information can still be obtained. Weight shifts are often observed in the FMS DS, but current literature lacks information about asymmetrical weight distribution. PURPOSE: To determine the amount of weight distribution asymmetry in physically active young adults during the FMS DS. METHODS: Nineteen physically active participants (11 F, 8 M; 20.2 ± 1.0 yo) were recruited and granted informed consent. Participants performed three trials of the FMS DS with feet flat (FF) followed by three trials with elevated heels (EH) elevated on a 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=0.031) 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 difference 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.

INTRODUCTION: There is limited research on the fitness benefits of certification courses offered in higher education. PURPOSE: To identify the fitness and functional movement effects from a 14-week, didactic, active learning suspension training certification course. METHODS: Forty-two participants (30 females; 12 males; Age = 25.6 ± 10.0 yrs; Height = 169.4 ± 9.8 cm; Body Mass = 69.7 ± 15.4 kg) in a suspension training curriculum experienced significant decrements in percent body fat and gains in flexibility, upper body muscular endurance, and functional movement screening scores.

Non-motorized treadmills (NMT) are designed to replicate overground exercise and are used in fitness testing, simulation of team sport exercise, and sprint training. Limited research describes differences in physiological responses between running on a curved NMT and motorized treadmill (MT) at the same speed. PURPOSE: Examine physiological differences between running on a NMT and a MT at the same speed and identify at which MT grade the physiological response to running on a MT is similar to a NMT at the same speed. METHODS: Ten active females ran at three speeds (2.68, 3.13, and 3.58 m/s) on a curved NMT and a standard MT. Five participants also ran at 3.13 m/s and 4%, 6%, and 8% grades on the MT. VO₂, blood lactate, heart rate, and rating of perceived exertion were compared between treadmills at each speed and grade using ANOVAs and paired samples t-tests. RESULTS: NMT VO₂ was significantly greater at 2.68 m/s (40.89 ± 2.13 vs. 35.73 ± 1.92 ml/kg/min; p < 0.01) and 3.13 m/s (47.7 ± 4.06 vs. 42.26 ± 1.14 ml/kg/min; p = 0.004), but not significantly different from MT at 3.58 m/s (50.30 ± 5.76 vs. 47.64 ± 2.73 ml/kg/min; p = 0.085). NMT blood lactate concentration was significantly greater at 3.13 m/s (88.83 ± 2.55 vs. 60.2 ± 2.75 mmol/L; p = 0.001) and 3.58 m/s (11.63 ± 2.25 vs. 8.10 ± 2.74 mmol/L; p = 0.001). At 3.13 m/s and a MT grade of 8%, VO₂ (̇O₂; p = 1.46, p = 0.22) and blood lactate (lactate; p = 0.06) were not significantly different from NMT at 3.13 m/s. CONCLUSIONS: The physiological response to running on a NMT was significantly greater than a MT at submaximal speeds. A greater non-oxidative contribution to running at 3.58 m/s on the NMT is likely due to runner position on the curved belt. Running on a MT at an 8% grade produces similar VO₂ and blood lactate responses to running on a NMT at the same speed. Practitioners prescribing NMT exercise should consider exercise intensity and effect of the NMT incline.

Accurate evaluation of arm strength and function is important to prevent injury, aid rehabilitation, and enhance performance. Traditional assessments involve isokinetic devices (e.g., Cybex) to determine post-injury abilities. However, this method is confined to a linear motion and fails to mimic normal isotonic movement patterns. Instruments that measure isotonic motions in three-dimensional space may be more appropriate. PURPOSE: Compare upper limb isokinetic force characteristics to those produced in isotonic actions. METHODS: Thirty healthy college students (12 men, 20 women, 23 men) performed biceps curls and triceps extensions of the dominant arm on one of two machines: Cybex HUMAC NORM isokinetic dynamometer (N=17) or Protes (N=18), which measures upper limb motion in three-dimensional space using magnetically-mediated resistance. Subjects performed practice trials to minimize learning effects. After completing testing, we used independent and paired-samples t-tests to compare peak force ratios of biceps and triceps generated by the different testing devices. RESULTS: Peak biceps torque on the Cybex was 25.9 ± 8.5 lb; peak triceps torque was 24.3 ± 6.3 lb. On average, it took the biceps approximately 62% longer to reach peak torque than it did the triceps (p<0.001). The isokinetic biceps-triceps strength ratio was 1.07:1 ± 0.22:1. This ratio was different between men and women (p<0.001). Among men, it was 1.28:1 ± 0.16:1. Among women, it was 0.99:1: ± 0.20:1. This ratio was also different when compared to peak power calculated by Protes (p=0.033). In our sample, isotonic, free-motion testing associated with a higher and more variable biceps-triceps strength ratio: 1.38:1 ± 0.99:1).

CONCLUSION: Performance prediction models and return-to-play testing batteries have traditionally captured functional profiles through isokinetic testing. Restricting movement to a limited range of isokinetic motion results in an inaccurate depiction of what a patient or an athlete does outside of the clinic. Isotonic resistance permitting three-dimensional assessment may be able to provide a more optimal analysis of upper limb function, which translates more directly to athletic and therapeutic contexts. More research is needed to understand how these values may help personalize training and rehabilitation programs.
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 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 0900 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, 10, men (8), 1, 9% bad, 1, 9% regular, 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").

Orienteering founded in north europe is now gradually popular worldwide. However, how to train focus on event specificity has not been established well. PURPOSE: The goal of this preliminary study is to explore physiological and psychological characteristics of elite orienteering players. METHODS: Ten elite orienteering athletes (OA) (age: 25.4 ± 8.9 yrs; BMI: 20.2 ± 1.7; training: 9.2 ± 2.8 hrs/wk; 5 males and 5 females; VO2max: 48.8 ml/kg/min) and ten elite running athlete (RA) (age: 21.0 ± 1.5 yrs; BMI: 20.8 ± 1.1; training: 12.8 ± 2.7 hrs/wk; 5 males and 5 females; VO2max: 52.7 ml/kg/min) were recruited to attend a time-trial and a distance-trial treadmill tests in balanced order. Athletic performance of participants were at least national level. Both tests were interspersed by 4 segments of mental games (named Peak in Apple Store) representing the capacity of problem solving, memory, concentration, and thinking agility in sequence. While playing mental games, participants kept on running with their effort. Performance indicators and ECG/EEG signals /game scores were analyzed using independent t test and mixed design of repeated measures respectively. Statistical significance was set at p < .05.

RESULTS: Better performance of time/distance trials (1084 min vs. 1100 min; 3338 m vs. 3211 m) in OA and most all indicators of OA were better than those of RA in main effect. Results indicated that attention index (55.6 vs. 44.3), game score (1092 vs. 8817) and %HRR (77.3 % vs. 67.6 %) of OA were significantly higher than those of RA during mental games in time-trial test (p < .05) in main effect.

CONCLUSIONS: We conclude that elite orienteering athletes own stronger power for mental management while keeping on higher intensity of running. Introducing mental challenges on running may enhance training effect of orienteering.
To establish a mechanical profile of baseball throwing and to test which kinematic domains associate with on-field performance. METHODS: 18 collegiate baseball players (11 fielders, 7 pitchers) were tested using Protes (Boston Biornotion, USA), which analyzes isotonic force production concurrently in all 3 planes. Players performed 5 consecutive throw motions against 3lb of magnetic resistance. PURPOSE: To design and validate a peak functional capacity test that is appropriate in time, intensity, and movement specificity to the dancer. METHODS: The Seifert Assessment of Functional Capacity for Dancers (SAFD) was developed using previous valid and reliable functional capacity protocols, published research in dance specific fitness tests, and consult with content experts. Final test parameters included 3 min. stages of increasing intensity utilizing both speed and difficulty of movements, continued until exhaustion. Followling pilot testing, a survey of content experts supported the validity of the SAFD. Female dancers (N = 13) completed a total of four separate sessions, a familiarization trial of the SAFD, SAFD trial 1, a peak treadmill test, and SAFD trial 2. Each test measured time to exhaustion, peak oxygen consumption (VO2peak), respiratory exchange ratio (RER), heart rate (HR), blood lactate (BLA+), and rate of perceived exertion (RPE). Tests were terminated upon volitional exhaustion or a total of three cues regarding poor movement quality or inability to keep pace with the metronome. Interclass Correlation Coefficients were used to assess reliability, while validity was analyzed using Pearson Product Moment Correlations. RESULTS: Strong correlations (r>0.7) were found between time to exhaustion, VO2peak, HR and RPE between SAFD trials. No significant (p > .05) differences existed in any of the physiological variables between the SAFD trials. Significant (p < .05) relationships were found between time to exhaustion, VO2peak, HR, BLA+ and RPE between the SAFD and the treadmill test. CONCLUSION: The strength of key physiological correlations of time to exhaustion, VO2peak, HR, and RPE provide strong evidence for the SAFD being both reliable and valid. Although the threshold value for correlation was not met in either RER nor BLA+, results do present a particularly meaningful set of values to the physiology practitioner and thus, further support the conclusion that the SAFD is both a reliable and valid method of assessing peak functional capacity in the dance population.

When performing repeated repetitions of a task, the body becomes familiar with the task and can become more efficient. This is known as the learning effect and can alter performance. PURPOSE: To examine the learning effect when fatigue testing without familiarization. METHODS: 22 masters-aged (53±5 years), competitive female cyclists completed 3 separate 50-repetition flexion/extension tests on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. RESULTS: No significant differences [Wilks’Lambda<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 60° (T1 50.7±10.4 N.m; T2 47.4±10.1 N.m; T3 50.1±9.0 N.m), e) relative total work completed (T1 50.2±9.7 kg.m; T2 50.5±9.0 kg.m; T3 51.5±10.9 kg.m), f) or combined total work (T1 2548.4±524.4 J; T2 2544.8±516.0 J; T3 2615.3±579.3 J). CONCLUSION: No learning effect was seen with the isokinetic knee flexion/extension 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.
The BodPod® (BP) is a standard, reliable tool for measuring body composition. A new body composition measurement tool called the Skulp® (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 compared to the BP. If the SK is determined to be accurate, the low cost and convenience of the SK would make measuring body composition more accessible and cost effective. For this reason, this study sought to determine the accuracy of the SK to the BP.

### RESULTS
A paired samples t-test showed a statistically significant increase in experimental CMJ scores from pre-test (M = 28.69, SD = 6.67) to posttest (M = 30.14, SD = 7.42), d(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), d(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.
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 ± 2.5 years old) volunteered for the study. Athlete injury history and sport performance level (international, national, regional, or recreational) were recorded. A lower limb functional screening tool was developed (the LoLFST), 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 symptom score. 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 LoLFST were significantly correlated with the injuries (ρ=0.290, P=0.035; ρ=0.390, P=0.004), and the two scores were significantly inter-correlated (ρ=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 0.666 (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: 0.636-0.890). 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 injured/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 LoLFST in determining low back and lower limb injury risk.

Purpose: The present study aimed to investigate the effect of strength endurance with higher intensity contractions on EMG activity and fatigue. Methods: Fifteen trained males (24.1±2.9 years old, 181.8±5.8 cm, 83.6±9.6 kg) performed four different strength training protocols in horizontal chest press (HCP) with different intensities of a load 1% 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; B) 30 sec of rest between blocks; B) 50% RM rest 30 sec between sets and 4 min between blocks. C) 3 sets x (3 reps of 90% RM) rest 30 sec between sets and 1 min rest after block and 4 X (15 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 (1227.5±184 vs 992±196 N; P<0.01) 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 0.876±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). Conclusion: 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 TB muscles.
**3419**  
**Board #107**  
**June 1 8:00 AM - 9:30 AM**  
**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 (ts>11.1), while the cerebellum and insular cortex were activated only in cyclists (ts>6.83). In addition, both groups had inhibition of prefrontal cortical areas (ts>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.

**3421**  
**Board #109**  
**June 1 8:00 AM - 9:30 AM**  
**Short-Term Back Squat Protocol Effect on 5km Run Performance**

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Purpose: Previous research indicates conflicting data on concurrent training. For instance, high intensity strength training, an uncommon training method for runners, has the potential to be beneficial as studies show it allows for enhanced fatigue resistance during high intensity endurance performance. Conversely, some evidence suggests high intensity strength training is harmful for endurance running performance and may alter fuel substrate utilization. Therefore, this study sought to determine the effects of a short-term, high repetition back squat training protocol on 5km run performance as well as on carbohydrate and fat oxidation rates. **METHODS:** Fifteen runners [4 men, 11 women; 150+ minutes of endurance exercise per week; age = 22 ± 5.1y; 20.4 ± 5.2 body mass index] completed two weeks of a high repetition back squat training protocol consisting of three sets of 15-24 repetitions at 60% of one-repetition max (1RM), three times per week. Pre- and post-tests included a 5km timed run on an outdoor track, respiratory exchange ratio (RER) through indirect calorimetry during two different intensities of steady-state treadmill exercise (60% and 70% heart rate max (HRmax)), and 1RM for back squats. **RESULTS:** Back squat 1RM significantly increased by 15% with training (48.0±27.9 to 56.7±30 kg, P < 0.001). However, no statistically significant differences were found in 5km times adjusted for heat-stress of outdoor conditions (Pre: 21.6 ± 9.8 vs. Post: 21.3 ± 9.0 minutes, P = 0.20). However, VO2max increased by 13% with training (3.8 ± 0.8 vs. 4.2 ± 0.6 liters.min⁻¹, P < 0.01). **Conclusions:** Performing a high repetition back squat protocol for two weeks does not appear to impact 5km running time or alter the body’s fuel utilization during exercise but is an effective way to increase lower body strength. Further studies are necessary in a temperature-regulated testing environment to determine whether high repetition strength training alters 5km running performance and fuel utilization.

**3422**  
**Board #110**  
**June 1 8:00 AM - 9:30 AM**  
**Proximity To Failure And Repetitions Per Set Effect Rpe Accuracy In The Squat, Bench Press, And Deadlift**

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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±4.0yrs, body mass: 84.1±14.3kg, training age: 6.9±4.0yrs) 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 (i.e. 4 and 1IRR). The RIR difference (RIRDIFF) was calculated by subtracting the predicted number of
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 RIRDFF 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 RIRDFF; significance was set at p<0.05. RESULTS: The RIRDFF 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 at the called 9RPE at the angle of 1.13 vs. 0.67, 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 their sternum 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 repetitions 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.

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 encounter in real-world conditions, can improve measures (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 yrs, 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 avoided 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 physiologic 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.

Muscular power is an essential component of numerous activities. Maximal throws and/or throws at a certain distance are often used in the sport of volleyball, 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 their sternum 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.

The ecological validity of findings can substantially be improved when laboratory-based research studies use elements similar to 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 stationary bicycle, has been extensively used 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 (VO₂ max). The criterion measure is closely related to functional capacity of the heart. Functional capacity of the heart has direct ties to risks associated with cardiovascular disease and cardiac mortality. CRF is traditionally measured using exercise protocols. Exercise protocols can be contraindicated for cardiac patients. In this case, participants filled a questionnaire to determine the level ofcardiorespiratory fitness. The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

### Cardiorespiratory Fitness

**PURPOSE:** The purpose of this study was to determine the level of cardiorespiratory fitness using a questionnaire. CRF was assessed using two prediction equations. The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

**CONCLUSIONS:** The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

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**Table 1:** Cardiorespiratory fitness (CRF) using two prediction equations. The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

- **Novice Clinicians**: 0.71, 0.50, 0.30
- **Expert Clinicians**: 0.60, 0.70, 0.30

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**RESULTS:** The correlation between the treadmill test and questionnaire was moderate (r = 0.75, r² = 0.56), whereas the observed MAPE values were large (18%). The 95% limits of agreement for the mean difference between the treadmill test and questionnaire were poor (−18.94 mL ∙ kg⁻¹ ∙ min⁻¹ to 10.99 mL ∙ kg⁻¹ ∙ min⁻¹).

**CONCLUSIONS:** Our findings suggest using the questionnaire to assess lower limb strength and control given its higher reliability in novice and experts. The questionnaire was based on knee movement, while LSD was based on trunk, arm, pelvis, knee, and foot. The higher reliability on SLS than LSD may be due to evaluating only one component rather than several simultaneously.

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**The single limb squat (SLS) and lateral step down test (LSD) are common lower extremity exercises used to assess gross lower extremity strength and power output generated by CT constant.**

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**Board #115 June 1 8:00 AM - 9:00 AM Exercise and Non-Exercise Methods for Determining Cardiorespiratory Fitness**

Kelley Phillips, Elizabeth Yost, Amelia Wagenknecht, Sarah Heesacker. *University of Minnesota Duluth, Duluth, MN.*

(Sponsor: Charles Foutaine, FACSM) (No relevant relationships reported)

**Abstract:**

Cardiorespiratory fitness (CRF) is a criterion measure expressed as maximal volume of oxygen consumption per unit of time (VO₂ max). The criterion measure is closely related to functional capacity of the heart. Functional capacity of the heart has direct ties to risks associated with cardiovascular disease and cardiac mortality. CRF is traditionally measured using exercise protocols. Exercise protocols can be contraindicated for cardiac patients. In this case, participants filled a questionnaire to determine the level of cardiorespiratory fitness. The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

**PURPOSE:** The purpose of this study was to determine the level of cardiorespiratory fitness using a questionnaire. CRF was assessed using two prediction equations. The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

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**Table 1:** Cardiorespiratory fitness (CRF) using two prediction equations. The results would suggest the questionnaire is not a valid predictor for CRF. It is important to consider that the questionnaire is subjective and may vary from person to person.

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**RESULTS:** The correlation between the treadmill test and questionnaire was moderate (r = 0.75, r² = 0.56), whereas the observed MAPE values were large (18%). The 95% limits of agreement for the mean difference between the treadmill test and questionnaire were poor (−18.94 mL ∙ kg⁻¹ ∙ min⁻¹ to 10.99 mL ∙ kg⁻¹ ∙ min⁻¹).

**CONCLUSIONS:** Our findings suggest using the questionnaire to assess lower limb strength and control given its higher reliability in novice and experts. The questionnaire was based on knee movement, while LSD was based on trunk, arm, pelvis, knee, and foot. The higher reliability on SLS than LSD may be due to evaluating only one component rather than several simultaneously.
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

Boe M. Burrus1, Jessie Armendariz2, Brian M. Moscicki2.
1Gonzaga University, Spokane, WA. 2Humboldt State University, Arcata, CA. Indiana University, Bloomington, IN. (Sponsor: Dr. Vincent Paolone, FACSFM)

Email: burrus@gonzaga.edu

(No relevant relationships reported)

INTRODUCTION: 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 to determine \( V_{O2\text{peak}} \) (37.4 ± 6.4 ml/kg/min; 366 ± 47 W) and gas exchange threshold (276 ± 59 W) to calculate the resistance needed 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 pedal 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


(No relevant relationships reported)

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. (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-HSRC, 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 \( V_{O2\text{peak}} \). 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 intraclass 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. Intraclass 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.
Dual stress challenges (e.g. paired physical and psychological challenges) have been shown to increase sympathetic activity above that of exercise alone. Although the rise in sympathetic activity represents a maladaptive increase in physiological load, there is a possibility that a dual stress challenge in a warm-up setting may optimize sympathetic activation while minimizing peripheral fatigue. PURPOSE: To determine whether a dual stress warm-up protocol improves performance on the 30 s Wingate Anaerobic Test (WAnT). METHODS: Thirteen college-aged subjects (Mean ± SD; age = 21 ± 3 yr; Height = 177 ± 9 cm; Weight = 81.8 ± 11.8 kg) volunteered to participate and completed a familiarization WAnT on a Monark cycle ergometer using resistance of 28.5% bodyweight prior to testing. On two separate visits, separated by at least 1 d but no more than 1 wk, subjects randomly completed a WAnT preceded by either a) a 5 min warm-up at a resistance of 1.5% BW at a pedal rate of 70-80 rpm (CTRL) or the same warm-up while also completing the Paced Auditory Serial Test, which is a mental arithmetic challenge (EXPT). Zephyr Bioharnesses were used to record heart rate (HR) during the testing sessions. Differences in the warm-up, and WAnT peak power, average power, and power drop were investigated using paired samples t-tests. RESULTS: There were no significant differences in performance or HR response during the warm-up between the CTRL and EXPT. CONCLUSION: These findings suggest that the addition of a mental task during a warm-up on a cycle ergometer has no effect on sympathetic activity or performance during a 30 s WAnT. The lack of significant findings may be due to the small sample size. Future work should focus on more challenging psychological stressors in conjunction with warm-up protocols to determine whether dual stress challenges can be utilized to optimize performance.

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
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<tbody>
<tr>
<td>Age</td>
<td>36.4</td>
<td>± 5.9</td>
</tr>
<tr>
<td>Lean (kg)</td>
<td>61.5</td>
<td>± 5.7</td>
</tr>
<tr>
<td>SMM (kg)</td>
<td>33.0</td>
<td>± 3.4</td>
</tr>
<tr>
<td>HR&lt;sub&gt;rest&lt;/sub&gt; (beats/min)</td>
<td>179</td>
<td>± 9</td>
</tr>
<tr>
<td>VO&lt;sub&gt;2max&lt;/sub&gt; (l/min)</td>
<td>3.822</td>
<td>± 0.611</td>
</tr>
<tr>
<td>VO&lt;sub&gt;2max&lt;/sub&gt; (ml/kg/min)</td>
<td>48.8</td>
<td>± 6.4</td>
</tr>
<tr>
<td>VO&lt;sub&gt;2max&lt;/sub&gt; (ml/kg/min)</td>
<td>62.7</td>
<td>± 6.3</td>
</tr>
<tr>
<td>AT (ml/kg/min)</td>
<td>33.2</td>
<td>± 6.2</td>
</tr>
<tr>
<td>%AT (%)</td>
<td>68.3</td>
<td>± 11.0</td>
</tr>
<tr>
<td>HR&lt;sub&gt;AT&lt;/sub&gt; (beats/min)</td>
<td>134</td>
<td>± 21.8</td>
</tr>
</tbody>
</table>

SD: standard deviation; AT, %AT and HR<sub>AT</sub> indicate oxygen uptake, % of VO<sub>2max</sub> and HR at anaerobic threshold, respectively.

SUMM and number of stages were the main predictors of absolute VO<sub>2max</sub> (R² = 0.72, P<0.001); the equation was VO<sub>2max</sub> (l/min) = −0.00195 + 0.148 x SMM (kg) - Stage (number). The pc between measured and estimated VO<sub>2max</sub> was moderately high (pc = 0.807).

**Conclusions:** We have provided references for body composition and maximal aerobic capacity variables in amateur padel players and a new equation to estimate aerobic capacity from a specific test for the sport of padel. Larger and more heterogeneous datasets are necessary to validate these results.
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 depicting 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 ± 10.8 kg) 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 increase from pre- (272.7 ± 37.401 cm²) to post-training (277.26 ± 29.474 cm², p = 0.201). Muscle fiber CSA did not significantly increase from pre- (4068 ± 865 µm²) to post-training (4221 ± 704 µm², p = 0.368). 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.

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 sleeveless 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 (25.5 °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 watch and sample rate was set to 1 Hz (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-m or 50-m in length) for each condition: no wetsuit (NW), sleeveless 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 next condition. 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:** NW was not influenced by the interaction of time and wetsuit condition (p=0.05) and there was no main effect for time (p=0.05). Mean values at 20°C between NW, SL, and FS were 37.82 ± 0.44 °C, 37.64 ± 0.68 °C, and 37.64 ± 0.42 °C, respectively. 

**CONCLUSIONS:** These pilot results indicate that wetsuit design does not significantly influence thermoregulatory responses.

Listening to music while exercising is thought to enhance physical performance by enhancing focus, elevating mood, increasing motivation, and decreasing perceived effort. Research, however, has debated the actual effects of music on performance, as results of the ergogenic effect 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 ± 4.4 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 during each bench press repetition was completed with each beat, while the music trial required subjects to complete each repetition every other beat. The number of successful repetitions completed was recorded and means from each condition were compared using a dependent t-test (α = 0.05). Individual differences between the conditions were also identified and the difference between conditions for active subjects (n = 11) was compared to non-active subjects (n = 5) using an independent t-test. 

**RESULTS:** 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 ± 25.1 repetitions). There was also no significant difference in change of repetitions completed between active (0.5 ± 6.3 repetitions) and non-active subjects (-1.0 ± 3.3 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.
Valid and reliable methods to measure oxygen consumption (VO₂) and carbon dioxide production (VCO₂) 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, light-weight and scalable metabolic system (CO₂/O₂, 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±13 kg BW; VO₂max 3.8±0.7 L·min⁻¹) performed four identical trials over two laboratory test days. The COBRA and PARVO were used to monitor four steady-state work rates: sitting rest, walk (23-36% VO₂peak), jog (49-67% VO₂peak), and run (60-76% VO₂max) on a treadmill in a laboratory (20±0.5 °C; 45±22% RH). Simultaneous gas samples were averaged over 3-4 minute steady-state periods for each work intensity. Coefficient of determination and Concordance Correlation Coefficients (CCC) were used to evaluate the agreement between the systems when measuring VO₂, VCO₂, 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 VO₂ (R²=0.98), VCO₂ (R²=0.98) and VE (R²=0.99). The COBRA had very low bias compared to the PARVO for VO₂ (0.01±0.13 L·min⁻¹), VCO₂ (0.06±0.13 L·min⁻¹), and VE (2.12±2.75 L·min⁻¹). COBRA was in high agreement (CCC=0.99) with the PARVO across each measure of VO₂, VCO₂, and VE. **Conclusion:** The COBRA device is an accurate mobile metabolic system for measuring respiratory variables across a range of work intensities.

**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.
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 consisting of upper/lower body strength and power events, total body strength events, timed sprints/runs, and a core strength test. Modality down-selection was based on scalability, physical space and equipment requirements, safety, time and cost to administer, and correlations of sailors’ individual performance on the new modalities to both their performance on traditional strength tests and most recent PRT (curl-ups, push-ups, 1.5 mile run).

RESULTS: Seated medicine ball throw (SMBT)—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) assessed agility and aerobic capacity and was highly correlated (r = 0.82) with 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 providing advanced 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.

Accumulating data have demonstrated a link between psychological distress and musculoskeletal injury (MSKI) prevalence. High levels of physical stress are commonly experienced during the career of a military tactical athlete, which can result in injury and subsequently affect functional movement (FM) outcomes. It is also plausible that trauma exposure (TE), a psychologically 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. PURPOSE: The primary objective was to determine the associations of combat exposure (CE) and other modifiable lifestyle factors with FM characteristics. It is vital to understand psychological predictors of FM in tactical athletes to optimize performance and to help attenuate MSKI incidents.

METHODS: Forty-one active duty sailors (30 males; 11 females) completed traditional strength tests and 11 performance fitness modalities consisting of upper/lower body strength and power events, total body strength events, timed sprints/runs, and a core strength test. Modality down-selection was based on scalability, physical space and equipment requirements, safety, time and cost to administer, and correlations of sailors’ individual performance on the new modalities to both their performance on traditional strength tests and most recent PRT (curl-ups, push-ups, 1.5 mile run).

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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 providing advanced 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.

Maximal relative oxygen consumption (VO2max), assessed via a treadmill test to volitional exhaustion, is the foremost measure of aerobic capacity in healthy, recreationally active adults. Habitual exercise may improve the ability to perceive exercise difficulty and predict impending exhaustion. PURPOSE: The primary aim of this investigation 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 = -0.32, p = 0.917) or session 2 (r = -0.315, p = 0.295). A dependent t-test (t(12) = -0.800, p = 0.439) did not reveal significant differences in time to test termination after the tap between session 1 and session 2.

CONCLUSION: 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 standout 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 adults participated in the following study. Mean height, weight, and age were 176±8.6, 72±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-agility 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-values.

- The combined peak force (PF) of the IMTP and the best 505-agility time for the left and right foot had r values of -0.648 (p<0.09) and -0.664 (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 left 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 significant strong inverse correlation exists between left COD ability and the right leg when it is forward and a moderate inverse correlation between right COD ability and the left leg when it is forward. A moderate inverse correlation exists 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.

Introduction: Failure in elite sport climbing is associated with an inability to maintain isometric muscle tension during dynamic movements. It is believed that utilising 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) have 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%; M = 25.4%; SD = 6.5%; M = 24.1%; SD = 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 (M = 32.4%, SD = 8.8%), t(7) = -1.01, p = 0.173. Equivalence was also found between TTF and TTtrain for the high intensity conditions. Conclusion: The duration with which oxygen is extracted and utilised changes, while the attainable high intensity conditions and is related to the ability to maintain task performance.
Numerous prediction equations have been developed to estimate one-repetition maximum (1RM) bench press in various subject populations. While many of these equations have been validated on various groups, rarely have groups of various levels of training been combined to evaluate the accuracy of separate and combined equations developed on participants of differing strength levels and training backgrounds.

**PURPOSE:** To produce and evaluate 1RM bench press prediction equations developed on participants of differing strength levels and training backgrounds.

**METHODS:** A total of 131 male strength-trained college students (UT, n = 119; RT, n = 12) volunteered for this study. UT participants were non-strength-trained college men (UT, n = 119), and athletes (ATH, n = 179) were measured for 1-RM bench press and repetitions-to-fatigue (RTF) on separate days. RT men had trained 3 days/wk for 12 wks using a linear periodization program. ATH had trained for several years using either linear periodization or autoregulatory progressive resistance training. Linear regression equations were generated on validation samples of each group (UT = 119, TR = 120, ATH = 131) using a weight (Reps/Wt) that produced between 2 and 10 RTF. **RESULTS:** All 3 groups differed significantly in 1RM (UT = 87.1 ± 15.5 kg, RT = 88.8 ± 21.7 kg, ATH = 136.2 ± 21.8 kg) but not in %1RM used for RTF (UT = 83.4% ± 7.4%, RT = 83.0% ± 5.5%, ATH = 83.4% ± 6.0%). Despite the nonsignificant difference in %1RM, ATH (6.7 ± 2.4) produced significantly more RTF than UT and RT men (6.1 ± 2.2 and 6.0 ± 2.1, respectively). Multiple correlations and standard errors of estimate (SEE) for group equations were similar for RTF (R = 0.84, SEE = 5.7 kg), RT (R = 0.97, SEE = 3.5 kg), and ATH (R = 0.96, SEE = 6.1 kg). A global equation compiling all 3 groups had comparable results [1RM (kg) = 1.16 Reps/Wt (kg) + 2.07 RTF - 9.4, R = 0.98, SEE = 6.2 kg]. Cross-validation of each equation on 25% randomly selected subsamples accurately predicted 89%-96% of each group within ±10% of actual 1RM. The global equation predicted slightly better in RT (94%) and ATH (96%) than in UT (87%).

**CONCLUSIONS:** A newly developed global prediction equation appears to have acceptable accuracy for estimating 1RM bench press in men with varying resistance training backgrounds.

**REFERENCE:**
Methods: Vertical jump testing was performed using a force plate system (Nike Pro) at the ankle. The test consisted of performing a series of 6 consecutive vertical jumps. Performance variables measured were the average take-off velocity, peak force, average force, total impulse, and power. Subjects were instructed to perform the jumps as fast as possible while maintaining proper form. The average of the best 3 jumps was used for analysis.

Results: The average take-off velocity was 3.7 m/s, the peak force was 985 N, and the average force was 850 N. The total impulse was 4,200 Nm, and the power was 1,200 W. All subjects were able to maintain proper form throughout the test, indicating good motor control and lower extremity function.

Conclusions: This study demonstrates the usefulness of using a force plate system to assess lower extremity function. The test is easy to administer, requires minimal equipment, and can be used as a screening tool for individuals with lower extremity pain or injury. Further research is needed to determine the validity and reliability of this test for clinical use.
PURPOSE: Investigate whether baseline physical activity behaviors predict aerobic fitness levels in our older adult population. As expected, baseline physical activity and fitness were positively associated with baseline fitness (r = .25). 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.

RESULTS: 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.

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.

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% loads in female lifters. METHODS: Participants were 19 college-aged (25 ± 4.3 years) females with a minimum of 2 months RT experience (average experience 76 ± 42 months). Three exercise sessions were conducted under the supervision of certified EPs. For session one, 1RM testing was completed. For sessions two and three, participants completed as many reps as possible for 80% 1RM and 60% 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 repetition). 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.

PURPOSE: To develop an equation for predicting VO2max in athletes submitted to cardiopulmonary exercise test (CPT) using a treadmill ramp protocol. Secondly, 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 whey 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, use of creatine and use of 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 training) - (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 using stepwise individualized assessment of athletes using ramp warm-up protocol, as well as exploring dynamic physiological variables that are not properly evaluated in traditional staggered protocols.

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3466  Board #154  June 1 9:30 AM - 11:00 AM
Predicting Metabolic Costs Of Heavy Backpacking

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 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 backpacing equation (0.46 ± 0.36 W·kg⁻¹) versus the existing LCDA graded walking equation (1.61 ± 1.32 W·kg⁻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.

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.

3467  Board #155  June 1 9:30 AM - 11:00 AM
Accuracy Of Indirect Calorimetry And Predictive Equations For The Measurement Of Resting Metabolic Rate
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(No relevant relationships reported)

Indirect calorimetry is used to measure oxygen consumption for estimating resting metabolic rate (RMR). Laboratory devices are available for the measurement of RMR, such as the BodyGem® indirect calorimeter and the Vaccum VO2 Lab metabolic measuring system. Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris-Benedict (HB), and Fleisch, can also be used to provide an estimate of RMR.

Purpose: The purpose of this study was to compare the RMR of college-aged participants measured using a BodyGem® indirect calorimeter, a Vaccum VO2 Lab metabolic cart, and established prediction equations.

Methods: Each participant (male = 15; female = 15; age = 22.7 ± 3.3 yrs; wt = 77.3 ± 14.5 kg; ht = 173.5 ± 9.6 cm) completed a thirty-minute supine resting session in a quiet environment. Five minutes of resting data were then collected using the Vaccum while in the supine position. Immediately thereafter, five minutes of resting data was collected using the BodyGem® indirect calorimeter while in the seated position. The RMR values for the HB and Fleisch prediction equations were calculated using the proprietary software utilized by the Vaccum metabolic system, while the MSJ estimate of RMR was hand-calculated.

Results: A repeated measures ANOVA showed a significant difference among the measurement methods (BodyGem = 1995.0 ± 540.5 kcal; Vaccum = 1520.9 ± 452.5 kcal; MSJ = 1669.3 ± 242.9 kcal; HB = 1749.0 ± 275.1 kcal; Fleisch = 1609.3 ± 220.7 kcal) (p < 0.001). A post hoc paired samples t-test indicated RMR measured using the BodyGem® was significantly higher than the Vaccum, HB, Fleisch, and MSJ (p < 0.01). The HB estimation of RMR was greater than that of the Vaccum measurement (p < 0.025). For the equations, the RMR estimate of the Fleisch was higher than the MSJ (p < 0.025), while the HB was greater than both the Fleisch and the MSJ (p < 0.01).

Conclusions: The Vaccum VO2 Lab metabolic cart measured RMR closer to the prediction equation estimates compared to the BodyGem® indirect calorimeter. Further research needs to be conducted comparing laboratory instruments to established prediction equations, on various populations, before those methods can be deemed accurate for measuring RMR.

3468  Board #156  June 1 8:00 AM - 9:30 AM
Effects Of A Pre-season Intervention On Hydration In Female Collegiate Volleyball Athletes
Alyssa M. Pollard-Grundy, Brian C. Rider, Adam M. Coughlin, Saginaw Valley State University, University Center, MI. Hope College, Holland, MI. (Sponsor: Tamara Hew-Butler, FACSM)

(No relevant relationships reported)

Urine specific gravity (USG) is commonly utilized to assess hydration status. Athletic performance has been shown to be affected by hydration status. In addition to nutritional and hydration practices, environmental conditions can also influence hydration status. Therefore, healthcare professionals should also consider environment, both indoor and outdoor, when assessing hydration. PURPOSE: To compare base-line USG to season-long urine collections following a one-time, pre-season hydration intervention. METHODS: Fourteen NCAA Division II female collegiate volleyball athletes participated in this study. Urine was collected in sterile cups in the hours preceding either a game or practice. Collections were roughly two weeks apart, starting August 25th and ending November 4th, 2017, resulting in a total of 10 urine collection sets. The hydration intervention consisted of information and guidelines presented to the team and coaching staff. The intervention was administered verbally immediately following base-line urine collection. Written guidelines were left with athletes and coaching staff. Urinalysis was conducted via reagent strips. Data was analyzed via SPSS v22 with a priori level of 0.05. Subsequent urinalyses were compared to the baseline urinalysis. RESULTS: USG statistically decreased from base-line to the second collection and did not statistically differ again until the final three collections (base-line = 1.021 ± 0.008, 1.007 ± 0.003*, 1.015 ± 0.008, 1.013 ± 0.006, 1.020 ± 0.016, 1.014 ± 0.005*, 1.011 ± 0.008*, and 1.013 ± 0.003*, *p < 0.05 compared to baseline). DISCUSSION: The hydration intervention illustrated a short-term effect on USG. A correlation existed between USG and environmental temperatures was evaluated post hoc for the final six urine collections, arguably when the effects of the intervention had subsided. The coefficient of determination (r²) revealed that 35.7% of the difference in USG was due to the environmental temperature, which was statistically significant (r = 0.597, p < 0.05). CONCLUSION: The intervention appeared to have a limited impact on USG. Differences in USG were evident again later in the season (late October to early November). Further analysis demonstrated a statistical influence of cooler temperatures on lower USG near the end of season.

3469  Board #157  June 1 8:00 AM - 9:30 AM
The Effects of Back Squats and Front Squats on Sprint Speed and Vertical Jump with Active Individuals
Afton Staheli Balderree, Mark DeBeliso, FACSM, Southern Utah University, Cedar City, UT.

(No relevant relationships reported)

The back squat (BSQ) is among the most popular resistance training (RT) modalities for the purpose of increasing muscular strength and power output. Front squats (FSQ), while not as popular as the BSQ, are arguably another squat modality that may improve muscular strength/power. PURPOSE: This study compared the effects of performing the BSQ and FSQ on sprint, strength, and vertical jump (VJ). METHODS: Active individuals both males (n=9, age: 30.6±7.6 yrs, height: 179.1±3.8 cm, mass: 87.8±17.8 kgs) and females (n=16, age: 29.4±6.5 yrs, height: 165.3±5.9 cm, mass: 68.5±10.7 kgs) were separated into two groups via a randomized matched pair design based on initial one repetition maximum (1-RM) squat strength. Both experimental groups employed linear periodization RT protocols differing only in that one group executed the BSQ and the other group performed the FSQ as the low-intensity RT program. No additional lower body auxiliary movements were performed in the study. The dependent variables (DVs) of VJ, 36.6 meter sprint speed, and 1-RM squat strength were collected prior to and following the 6-week RT period. Post-t-tests were used to compare the DVs from pre to post RT intervention within experimental groups. Independent t-tests were used to compare the gain scores for each of the DVs between experimental groups.

RESULTS: The VJ had a significant improvement from pre to post RT for both the BSQ (pre: 52.9±10.1, post: 56.0±10.9 cm) and FSQ (pre: 47.4±10.9, post: 49.9±12.1 cm) groups (p<0.05). The 36.6 m sprint improved significantly from pre to post RT for both the BSQ (pre: 5.9±0.7, sec, post: 5.6±0.5 sec) and FSQ (pre: 6.3±0.7, sec, post: 5.8±0.6 sec) groups (p<0.05). The squat 1-RMs also improved significantly from pre to post RT for both the BSQ (pre: 5.9±0.7, sec, post: 5.6±0.5 sec) and FSQ (pre: 6.3±0.7, sec, post: 5.8±0.6 sec) groups (p<0.05). When comparing gain scores between each group there were no significant differences between the BSQ and FSQ groups for any of the DVs (p<0.05). CONCLUSION: Within the parameters of this study, both BSQ and FSQ RT programs improved muscular strength, power and
### 3470 Board #158 June 1 8:00 AM - 9:30 AM

**Impact Forces When Exercising On The Freebounder™**

John Porcari, FACSM, Megan Thiel, Nagmeh Ghedi, Susan Branwell, Abigail Ryskey, Carl Foster, FACSM. University of Wisconsin-La Crosse, La Crosse, WI

(No relevant relationships reported)

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 0 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) when exercising on the Freebounder™ were significantly lower (p<.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**

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(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:** Thirty 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 (mircoFET3, 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±0.05) 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±16.27), 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**

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(No relevant relationships reported)

Short-distance running with change of direction (SR-COD) is one of the baseline practice regularly 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, respectively.

**Methods:** 16 collegiate male tennis players (22.2 ± 1.7 yrs., 175 ± 5 cm, 69.2 ± 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-2min-20stroke/min, 2min-2min-20stroke/min, 1min-4m-20stroke/min and 1min-2m-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 (Anl) 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%.

**Result:** The energy contributions of SR-COD was Aer 37.4±40.0kJ (32.1±41.7%, Anl 15.1±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 Anl, there was significant increase in Aer and Anl (P<0.05, except Aer when increasing frequency). Further, %Anl 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 duration (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 Anl 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**

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(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 1RM 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 >
Objective: To compare the effects of vibration training (V) and control training (C) on core 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 (MAXE), and directional control (DCL). The core stability was evaluated by the performance of grade 8 abdominal bridge. Core muscle strength were indirectly evaluated by integrating electromyography (iEMG). Student t-tests were used for data analysis. Results: TL (1.7 ± 0.9 deg/sec, P < 0.01), MAXE (0.88%, P < 0.01), DCL (2.86%, P < 0.05) in group V were significantly higher after the Vibration Intervention. EPE (8.86%, P < 0.01), MAXE (4.43%, P < 0.01) in group C were higher after the control training. The percentage range was higher in group V (8.29% than 4.50%). No significant differences were found in LS between the groups at 12 weeks of follow up. The full score of grade 8 abdominal bridge 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 (0.100% mV s/P < 0.01), left rectus femoris 0.71 mV s/P < 0.05), left tibialis 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), right rectus abdominis (0.34 mV s, P < 0.05) in group V were higher than C. Over time, these participants demonstrated the ability to improve on core balance, left rectus femoris, left erector spinae and left gluteus maximus between group V and C. Conclusion: Vibration training improved core balance, core stability and muscle strength of movements in young martial arts athletes.

PURPOSE: To compare the effects of vibration training (V) and control training (C) on core 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 (MAXE), and directional control (DCL). The core stability was evaluated by the performance of grade 8 abdominal bridge. Core muscle strength were indirectly evaluated by integrating electromyography (iEMG). Student t-tests were used for data analysis. Results: TL (1.7 ± 0.9 deg/sec, P < 0.01), MAXE (0.88%, P < 0.01), DCL (2.86%, P < 0.05) in group V were significantly higher after the Vibration Intervention. EPE (8.86%, P < 0.01), MAXE (4.43%, P < 0.01) in group C were higher after the control training. The percentage range was higher in group V (8.29% than 4.50%). No significant differences were found in LS between the groups at 12 weeks of follow up. The full score of grade 8 abdominal bridge 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 (0.100% mV s/P < 0.01), left rectus femoris 0.71 mV s/P < 0.05), left tibialis 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), right rectus abdominis (0.34 mV s, P < 0.05) in group V were higher than C. Over time, these participants demonstrated the ability to improve on core balance, left rectus femoris, left erector spinae and left gluteus maximus between group V and C. Conclusion: Vibration training improved core balance, core stability and muscle strength of movements in young martial arts athletes.

High intensity functional training (HIIT), due to its constant variance and multi-modal approach presents a unique challenge in quantifying external loads. The session rate of perceived exertion (sRPE) method has been shown valid in determining training loads (TL) in a variety of sports. However, sRPE has yet to be psychometrically evaluated within HIIT. PURPOSE: To estimate the psychometric properties of the sRPE method within HIIT. METHODS: Forty-five healthy recreationally active men and women (n=45; age = 22.6 ± 3.5 years; body mass = 71.6 ± 11.3 kg; height = 166.5 ± 8.1 cm) and women (n=12; age = 21.0 ± 1.5 years; body mass = 70.5 ± 11.3 kg; height = 177 cm) performed a six-week HIIT intervention. Participants were followed over one season (46 weeks) of competition. Workload 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: In training block 1 (i.e., weeks 1-3), sRPE significantly predicted both Edwards’ TL (n = 271, r = 0.81, p < 0.001; R² = 0.67, 95% CI = 0.60-0.73) and TRIMP (n = 260, r = 0.83, p < 0.001; R² = 0.68, 95% CI = 0.61-0.75). In training block 2 (weeks 4-6), these associations remained significant but also improved in their predictive capability for both Edwards’ TL (n = 268, r = 0.88, p < 0.001; R² = 0.78, 95% CI = 0.73-0.82) and TRIMP (n = 258, r = 0.87, p < 0.001; R² = 0.72, 95% CI = 0.66-0.80). However, reliability estimates (n = 554, ICC = 0.58, 95% CI = 0.52-0.63, p < 0.001; Coa = 52%) between perceived exertion and HR were generally poor. CONCLUSION: We observed the sRPE method was a valid tool across individual, group, and sex levels when compared to criterion heart rate-based measures. However, the utility of this strategy within HIIT is limited due to poor reliability in participants’ abilities to correctly match their perceived exertion with the relative level of physiological effort (i.e., percentile of maximum heart rate). Over time, these participants demonstrated the ability to improve on core balance, left rectus femoris, left erector spinae and left gluteus maximus between group V and C. Conclusion: Vibration training improved core balance, core stability and muscle strength of movements in young martial arts athletes.
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±0.51 yr, 108.8±18.2 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 test, 3-cone drill, pro- agility test, broad jump and vertical jump. Post-training values were obtained from the players combine or pro-day 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). Combine 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 a practice squad contract, 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: Limited studies have addressed spin rate (SR) and hitting speed (HS) in recreational table tennis players during a self-regulated training program. The use of the robot and the biomechanical feedback in order to maintain balance. Thus, an emerging trend is the utilization of suspension devices to increases the amount of instability. In this study, we examined how the use of a table tennis robot would improve SR and HS of the FLD for recreational table tennis players. This study examined how the use of a table tennis robot would improve SR and HS of the FLD among recreational table tennis players during a self-regulated training program. METHODS: Thirteen middle-aged (46.7±18.3 yr, 8 males) players with 4.8±4.1 yr. of recreational table tennis experience participated in an eight-week table tennis program that met twice a week with the purpose of increasing SR and HS in FLD. A pretest and posttest were conducted to assess average SR and HS from five consecutive trials in a randomized order against balls served by the robot. The ball, after its bounce on the table, arrived to the participants at the speed of approximately 2.9 ms⁻¹ with a SR of approximately 21 °/s. Each training session included a 20-min practice of FLD against balls served by the robot. The eight-week training with a robot significantly improved SR and HS in FLD for recreational table tennis players. The use of the robot and the biomechanical feedback for self-regulated training seem to be successful tools in developing SR and HS in recreational table tennis setting, where working with a personal coach is often limited. The effective use of technology helps the middle-aged population to meet ACSM’s recommendation for neuromotor exercise training.

PURPOSE: The aim of the study was to investigate the effects of suspension training in lower body muscle strength and balance in sedentary adults. 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 yrs) (SSG), and traditional strength group (TSG) (39.10±3 yrs). In SSG were applied suspension exercises 8 weeks, twice in a week, 40-45 min. In TSG were applied traditional strength exercises 8 weeks, twice in 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 exercises 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 training group and only squat (54.27±22.67 vs. 61.60±22.39, p=0.05), curls (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 (25.10±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 increases 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±3.31y, 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 (FL, RF), biceps femoris (BF), gluteus medius (Gmed), 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 (% MVC). 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(2,32) = 7.678 p<0.002], BF [F(2,32) = 4.076 p=0.026], Gmed [F(2,32) = 33.878 p=0.000], VL [F(2,32) = 3.508 p=0.042] and RF_RL [F(2,32) = 5.704 p=0.008], except for VM [F(2,32) = 2.346 p=0.112]. The suspended lunge-Bosu showed a higher activation for RF_FL, Gmed, and VL (44.25%±4.78; 66.50%±8.84; 75.58%±4.48, respectively) respect Bulgarian squat (RF_FL: 33.13%±3.87 p=0.024; Gmed: 47.97%±4.41 p<0.000) and suspended lunge (RF_FL: 33.86%±3.82 p=0.006; Gmed: 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: 35.69%±4.19 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) 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-ups 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 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 7.48±1.74 vs. ME 7.06±1.86 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.

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 than only the ipsilateral EF but also the contralateral EF (contralateral repeated bout effect: CL-RBE; Chen et al. MSSE 2016). 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 contraction (MVC), followed 1 week later by 5 sets of 6 100%EC and the CON group performed 100%EF 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: 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).

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

Orville Byfield, Rachael Irving. University of the West Indies, Kingston, Jamaica. (Sponsor: Melanie Poudlevigne, 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 gauze 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 of distance > 1000m (group M, n=5) and the other in running events of distance < 1000m (group M, n=5) and the other group comprised 20 athletes who were 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 12 weeks and each four weeks up to 12 weeks. Blood pressure and heart rate saturation was recorded using a pulse oximeter for each participant before the start of 12 weeks and each four weeks up to 12 weeks. Results from Two Different Push-ups Training Programs

Taylor J. Manes1, Eric G. Yackle1, Jacob D. Morris1, Jerry L. Mayhew2, Bryan Mann2, Truman State University, Kirkville, MO. Miami University, Miami, FL.

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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 player performance. Explosive generation of force is a fundamental component of many sports. Explosive generation of force is a fundamental component of many sports. Explosive generation of force is a fundamental component of many sports. Explosive generation of force is a fundamental component of many sports. Explosive generation of force is a fundamental component of many sports.
MINIMALISTIC STYLE MILITARY BOOT DOES NOT IMPROVE WALKING ECONOMY UNDER LOAD IN TRAINED MALES

D.W. Sharp1, M.T. Pace1, J.C. Swan1, R.T. Albino1, J.M. Green1, L.G. Killen1, H. Chandler2, J.D. Simpson1, E.K. O’Neal1. 1University of North Alabama, Florence, AL; 2Mississippi State University, Mississippi State, MS. 3University of West Florida, Pensacola, FL.

Footwear may be a simple external factor to improve rucking economy (RE) for soldiers that must carry heavy external loads, but it is also possible that with no flight phase, RE may not be enhanced by footwear style. This study compared RE with an ~500 g minimalist style boot (MIN) versus an ~800 g traditional style boot (TRD) while wearing a 16 kg external load consisting of a 7.5 kg weighted compression vest and ruck sack with 8.5 kg of weight. Male participants (n = 14) completed two testing sessions for this study. In session 1 participants completed a VO2 peak test (46.6 ± 7.3 ml/kg/min) under load while wearing their normal athletic shoes. The second session consisted of two 5-min walking treadmill sessions under load. Treadmill speed was based on the highest speed stage that allowed the participant to walk for the full stage during the VO2 peak test. RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5. Steady state was defined by a difference of < 0.1 L/min between minutes 4 and 5. MIN and TRD were worn in a center-balanced crossover order. There was a 10-min rest period between rucking bouts. RER did not differ between treatments (MIN = 0.86 ± 0.48; TRD = 0.86 ± 0.51; p = 0.96). A two-tailed t-test with an α = 0.05 was run for all data (n = 0.05). Although MIN (1.79 ± 0.23 L/min) tended (p = 0.13) to improve RE versus TRD (1.85 ± 0.30 L/min), breathing RPE was the only measure that reached significance (p = 0.045) between MIN (2.0 ± 0.9) versus TRD (2.4 ± 1.2). Altering boot type does not improve RE.

Board #174
June 1 8:00 AM - 9:30 AM

Minimalist Style Military Boot Does Not Improve Walking Economy Under Load In Trained Males

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(No relevant relationships reported)

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

D.W. Sharp1, M.T. Pace1, J.C. Swan1, R.T. Albino1, J.M. Green1, L.G. Killen1, H. Chandler2, J.D. Simpson1, E.K. O’Neal1. University of North Alabama, Florence, AL; Mississippi State University, Mississippi State, MS; University of West Florida, Pensacola, FL.

Footwear may be a simple external factor to improve rucking economy (RE) for soldiers that must carry heavy external loads, but it is also possible that with no flight phase, RE may not be enhanced by footwear style. This study compared RE with an ~500 g minimalist style boot (MIN) versus an ~800 g traditional style boot (TRD) while wearing a 16 kg external load consisting of a 7.5 kg weighted compression vest and ruck sack with 8.5 kg of weight. Male participants (n = 14) completed two testing sessions for this study. In session 1 participants completed a VO2 peak test (46.6 ± 7.3 ml/kg/min) under load while wearing their normal athletic shoes. The second session consisted of two 5-min walking treadmill sessions under load. Treadmill speed was based on the highest speed stage that allowed the participant to walk for the full stage during the VO2 peak test. RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5. Steady state was defined by a difference of < 0.1 L/min between minutes 4 and 5. MIN and TRD were worn in a center-balanced crossover order. There was a 10-min rest period between rucking bouts. RER did not differ between treatments (MIN = 0.86 ± 0.48; TRD = 0.86 ± 0.51; p = 0.96). A two-tailed t-test with an α = 0.05 was run for all data (n = 0.05). Although MIN (1.79 ± 0.23 L/min) tended (p = 0.13) to improve RE versus TRD (1.85 ± 0.30 L/min), breathing RPE was the only measure that reached significance (p = 0.045) between MIN (2.0 ± 0.9) versus TRD (2.4 ± 1.2). Altering boot type does not improve RE.
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 walking while pushing the sled (WP), and maximal speed walking while pushing the sled (WP).

**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 three conditions: W (65.1 ± 3.0), WP (62.2 ± 4.1), and RP (65.6 ± 4.8). Cadence decreased while WP (92.5 ± 0.1), yet increased during RP (169.9 ± 4.9), compared to W (109.6 ± 6.7). During resistance conditions (WP and RP) participants demonstrated greater gait cycle percentage in stance phase [(WP, stance phase: 66 ± 1.6, swing phase: 34 ± 1.6) and (RP, stance phase: 57 ± 2.7, 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 #179 June 1 8:00 AM - 9:30 AM**

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

Emmet Crowley. 
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**PURPOSE:** Specificity is an integral component in understanding the mechanism of transfer of dry-land resistance training exercises (RT) to front crawl swimming (FC). The specificity of intra and inter muscular coordination is deemed to be important, with neuromuscular adaptations at the forefront namely motor unit recruitment, synchronisation and contraction. Limited research has investigated the muscular coordination between FC and RT. Therefore, the aim of this investigation is to explore the muscular coordination between FC and RT.

**METHODS:** Fourteen male international and national level swimmers were recruited. EMG and 2D kinematic data were collected whilst FC, bench press (BP) and pull-up (PU) were performed. A standardised warm up was conducted followed by 3 x 35 m FC bouts, 1 x 70% and 2 x 100% of maximal exertion, with 5 minutes’ recovery between bouts. The BP and PU were performed using the same protocol, with participants performing 3 x 5 RM. EMG data were filtered using a 4th order Butterworth filter and normalised to peak EMG. The EMG data were presented using a 50% threshold of peak EMG and 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 < 0.001) 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 < 0.001), 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.

**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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**PURPOSE:** To compare the effect of 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). However, 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 increasing 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 VO₂ max.

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**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 CS group trained 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 CS group trained 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.

**Papers included in this supplement are embargoed until 11:00 AM on June 1, 2019. Abstracts may be published in part or in full in the Journal of Applied Physiology.**
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 2-week period of no intervention. 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 566.12 W vs 563.05 W; P < 0.01). CMJ increased in CC (29.75±3.87 cm vs 33.68±4.48 cm; p<0.05) and 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 (28.4±0.3, 78 cm vs 30.9±4.3, 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

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(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: 13 softball players (17.49 ± 0.63 yrs.; BMI 28.4±5.6) and 10 baseball players (17.57±0.56 yrs.; BMI 24.6±4.7) participated in the study. Both interventions increased IR over the course of the 5 days, but there was no significant difference (p=0.66) between SS and BB. When performing SS, the mean IR was 45.7±11.38 degrees immediately after the throwing session and significantly improved to 53.06±10.95 degrees on day 5. When performing BB, the similar incremental increase was from 47.39±12.15 degrees to 55.36±8.61 degrees. There was no statistically significant difference in preference between the SS (51.1%) and the BB (48.9%).

CONCLUSIONS: The BB and the SS were both observed to be effective at increasing IR ROM in healthy in-season baseball and softball players over 5 days, yet neither proved to be superior with regard to degree of improvement nor speed of attaining increased IR.

### 3495  Board #183  June 1 8:00 AM - 9:30 AM  The Influence Of Previous Training Intensity On The Rating Of Perceived Exertion

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(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 overtraining and 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’s RPE. Linear regression was used to analyze the relation between dRPE and the average RPE from, respectively, the previous 1, 2, 3, 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.

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 yrs; 1.62 ± 0.15 m; 54.2 ± 9.6kg; BMI 21.2 ± 3.18 kg/m²) 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: 75.2 ± 10.8% versus 68.0 ± 16.6%; t(69)=3.25, 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 ± 17.0%; 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: 88.6 ± 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)=4.46, P<0.01)

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

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 controlled 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 muscle 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/m²), without lesions, were 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 muscle laterality. However, the jump test showed a negative post-intervention response (Table 1).

Table 1. Results of the pre- and post-intervention tests.

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### Relationship Between Cumulative Training Loads and Treatments of Division II Swimmers

**Cristopher Lara, Candace Juhala, James Mout, IV, Jose Alvarez, Bianca Lagamon, Angel Quintero, Adam Murphy, Cameron LeBato, Shrutti Bali, Vivy Hua, Derrick Gardner, Nicole Kuhan, Arianna Mazzarini, Marcela Fernandez-Alvez, Vanessa Yingling, FACSM. CSU East Bay, Hayward, CA. (Sponsor: Vanessa Yingling, FACSM).**

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**Abstracts were prepared by the authors and printed as submitted.**

**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 different age groups and with subjects of other sports and artistic modalities.

**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 \( \pm 20.9 \) \( \pm 1.4 \) years; height \( \pm 179.8 \) \( \pm 8.9 \) cm, weight \( \pm 72.4 \) \( \pm 12.2 \) kg) korfball players 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 directions of SEBT (\( t=-3.1, p<0.05 \)) after the experiment in the TG. However, there were no significant changes 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 (\( t=1.3, p>0.05 \)).

**Conclusions:** The core strength training could improve core endurance and directions of the SEBT in collegiate korfball players, but not in agility. Consequently, if the goal of training is to enhance agility, then CST has limited. (This study was supported by Fundamental Research Funds for the Central Universities at SWU Grant 1309232)

**3498 Board #186 June 1 8:00 AM - 9:30 AM**

**Relationship Between Cumulative Training Loads and Treatments of Division II Swimmers**

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 session duration (Gabbett et al., 2004). Among NCAA Division II athletics, monitoring 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 swimming team.

**Methods:** For one 14 weeks the swimmers had a total of 152 treatments, 91 of which occurred following TL’s between 4000 au and 7000 au. **Results:** A significant negative correlation was found between TL’s and treatments, possibly contributing to a cost-effective method, like that of RPE and session duration. A Pearson correlation was performed to compare groups (experimental, control) and times (before, after) for each of the parameters. Tukey’s HSD tests were conducted for post-hoc comparisons. The alpha level was set at <0.05.

**Results:** There were significant group by time interactions for release \( (F_{1,32} = 6.4, p<0.05) \), catch slip \( (F_{1,32} = 33.18, p<0.001) \) and leg speed \( (F_{1,32} = 7.95, p<0.005) \). The main effect for group was significant for catch slip \( (F_{1,32} = 16.3, p<0.001) \), average force \( (F_{1,32} = 37.64, p<0.001) \), leg speed \( (F_{1,32} = 22.63, p<0.001) \) and power \( (F_{1,32} = 9.25, p<0.05) \). The main effect for group was significant for release \( (F_{1,32} = 3.5, p<0.05) \), release \( (F_{1,32} = 4.61, p<0.05) \), release slip \( (F_{1,32} = 8.15, p<0.001) \). The release of experimental group significantly increased larger than that of control group (8.25 \( \pm 2.06 \) vs. 1.28 \( \pm 2.10 \)), so that with release slip \( (7.88 \pm 2.51 \) vs. 1.39 \( \pm 2.67 \).)

**Conclusions:** Single scull training dose have effect in improving release and release slip for sweep rowers.
Conclusions: The purpose of this study was to determine if 3D MOT training increases pelvic and core strength training. These attributes have the potential to enhance sports performance. The ability to rapidly extract data from the environment thereby enhancing decision making capabilities. These attributes have the potential to enhance sports performance.

Purpose: 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 asssented, (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- pelvic 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), were assessed along with one IMU-based jump task. Jump height and GRF were estimated using an inertial sensor (BTS G-Sensor 2, 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: The 3D MOT program significantly improved in strength, balance, and alignment were demonstrated by this cohort. Jump performance did not show improvement, but was trending to improve (p=0.084). No G-Sensor jump parameters showed improvement.

Conclusion: Significant improvements in strength, balance, and alignment were demonstrated by this cohort. Jump performance did not show improvement, but was a familiar task to the subjects at the beginning of the training; it will be monitored as training continues.
analysed using mixed model ANOVAs. RESULTS: STROOP task showed reaction time in both groups decreased at post-test. However, BET decreased significantly more than standard training alone in boosting cognitive and physical performance in elite football players.

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±14.39yrs; height: 1.61±0.07; mass: 68.31±5.17kg). The weights of the WTCB group 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±6.94, p<.05), but no significant difference was found in the control group. The HR, blood pressures, ROM and SF-36v2 physical and mental health were not significantly different between two groups, however, the WTCB group had significant 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 because 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

CONCLUSIONS: This study is the first study to quantify comprehensive improvements in aerobic fitness, body composition, resting metabolic rate, resting blood pressure, and triglycerides after a brief 6-week HIIT regimen. The implications of franchised group exercise with wearable technology serves as an interesting scientific approach to understand novel exercise prescriptions on health-fitness outcomes. Future research should investigate sociological aspects of program adherence, while biological applications should be examined to determine the efficacy of HIIT training on health and fitness improvements.

The requirement 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 muscular strength. PURPOSE: To quantify changes in completed pull-ups between 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 d wk-1 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: 19 ± 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.

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: 1) 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, push, rotational, squat, and lounge movements; participants also engaged in utilizing stability balls 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 ± 3.5, p < .001) and MAPS (52.9 ± 10.3 to 56.3 ± 9.7, p < .001) values, as well as mean quantity of push-ups (24.9 ± 11.5 to 29.4 ± 13.9, p = .004) and handgrip dynamometer (78.0 ± 21.7 kg to 85.6 ± 24.0 kg, p = .006). There were no significant changes in
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-assessment. 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 Andrea C. Moitoza1, William P. Lydona1, J. Mark VanNessa1, Alexis C. King2, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2University of Illinois at Urbana-Champaign, Champaign, IL. (No relevant relationships reported)

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 (0% preservation) to 1.00 (100% preservation). Mean endurance was the mean value of all 6 sets. Protexus 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 84.6 ± 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=0.149; 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 overload throwing, elevating risk of injuries overuse. Use of Protexus may provide modes of exercise unrecognised 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 Piloti-Riley1, Erik Boll2, Stephen J. McGregor2, Davor Stojanov1. 1Eastern Michigan University, Ypsilanti, MI. 2Clarkson University, Potsdam, NY. (Sponsor: Mark Peterson, FACSM)

Email: marif@emich.edu (No relevant relationships reported)

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 IRSC. 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 game sessions. 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 reduced 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 trained to test real-time applicability to real-time game setting. Results
The trained YOLO network was applied to the 4th game video that had 32 validated sensor impacts. The model successfully detected all 32 impacts but generated 1000 false positives. With a 30 frame filter, the model detected 20 of the 32 impacts 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 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.

3511 Board #199 June 1 8:00 AM - 9:30 AM Relationship Between the Perceived Training Loads of Division II Swimmers and Coaches Bianca Lagamone, Angel Quintero, Derrick Gardner, Vanessa Yingling, FACSM, James Moutv IV. California State University, East Bay, Hayward, CA. (Sponsor: Vanessa Yingling, FACSM) (No relevant relationships reported)

Monitoring training loads provides coaches the opportunity to create effective programs for their athletes to achieve optimal fitness for competition and to manage fatigue, reduce the risk of soft-tissue injuries and non-functional overreaching. An athlete’s training load is a combination of the external load (work completed by the athlete) and internal load (physiological or psychological stress from that work). The individuality of perceived training loads is an important consideration for a coach as the athlete’s perception may be different from the intended demands from the coach. The difference in perceived training loads between the coach and athlete can increase the risk of undertraining or overtraining. PURPOSE: To compare the perceived training loads between a coach and athletes on a Division II women’s swimming team. METHODS: Twenty-four athletes participated (age 20.2 ± 1.2 years; height 169.03 ± 7.2 cm; mass 68.7 ± 8.9 kg). The expected training loads of the coach and perceived training loads of the athletes were monitored for one season. A survey link was sent to the coach and players to report the date, the duration of training in minutes and the rate of perceived exertion (RPE) for each practice and competition. Training load (TL) was calculated as the product of the RPE and training session duration in minutes and labeled arbitrary unit (AU). The relationship between the coach’s expected training loads and the athletes’ perceived training loads were examined using paired t-test and Pearson correlation. RESULTS: The swimmers average TL over the 54 sessions was 554.5 ± 237.1 AU which showed no significant difference from the coach’s average perceived TL, 553.6 ± 246.5 AU (p=0.85). A strong correlation was found between the TL of the coach and the average TL of the 24 athletes (p=0.87; CI=0.79-0.92; p=0.0001). CONCLUSION: On average, the athletes perceived the training sessions to be harder than what the coach expected. Differences in training expectations and perception could be due to influence from levels among athletes, sleep (quantity and quality), academic stress or illness. However, the differences in TL expectation and perception could result in fatigue, injury and/or suboptimal training adaptation. Monitoring planned and perceived training load is critical to optimize performance and reduce injury.

3512 Board #200 June 1 8:00 AM - 9:30 AM Relationships Between Isometric and Dynamic Strength in Recreationally Active Women Stephen J. McGuire, Sam D. Blacker, Jason Lake, Stephen D. Myers. University of Chichester, Chichester, United Kingdom. (No relevant relationships reported)

Women entering training for physically demanding occupations typically perform strength oriented tasks less well than their male counterparts. However, they are not often strength-trained and appropriate training may reduce these differences. Force- time assessment of the isometric mid-thigh pull (IMTP) has been used to monitor strength adaptations in athletes as they relate to dynamic task performance. The ratio between peak countermovement jump (CMJ) concentric force and IMTP peak force (Dynamic Strength Index [DSI]) has also been used to guide prescription of maximal or ballistic strength training. PURPOSE: To examine the efficacy of IMTP and DSI to monitor and prescribe strength training in untrained women. METHOD: Following familiarization, 26 civilian women volunteers (mean ± SD, age: 24 ± 3 years, height: 1.64 ± 0.05 m, body mass: 65.4 ± 11.8 kg) completed five tests in this order: bench press one-repetition maximum (1RM); CMJ; IMTP; seated medicine ball throw (MBT); dominant handgrip strength. Force plates sampling at 1000 Hz recorded IMTP and
CMJ performance, and 1RMs were predicted from submaximal load-velocity profiles. Relationships were assessed between IMTP and dynamic tests (Pearson’s r), and performance compared between Low (<0.60, n = 8) and High (>0.80, n = 10) DSI participants (Bonferroni adjusted t-tests or Mann-Whitney U test), with effect sizes calculated (Hedges g). **RESULTS:** Absolute peak IMTP force (minus body weight) correlated moderately with handgrip strength (r = 0.66), MBT (r = 0.70) and 1RM (r = 0.57), and relative IMTP peak force (per kg body mass) with CMJ height (r = 0.48). The 1RM (Low vs High DSI: 45.0 ± 11.0 vs 31.5 ± 6.5 kg, g 1.6), absolute IMTP (1386 ± 276 vs 709 ± 166 N, g 2.9), relative IMTP (20.7 ± 2.8 vs 11.0 ± 1.9 N·kg⁻¹, g 4.9), MBT (3.3 ± 0.3 vs 2.7 ± 0.3 m, g 2.4) and handgrip (34.5 ± 1.8 vs 26.2 ± 3.9 kg, g 3.1) were greater in Low DSI participants (p < 0.01), with no difference in CMJ height (0.23 ± 0.03 vs 0.19 ± 0.05 m, g 0.51). **CONCLUSION:** Moderate relationships between IMTP force and dynamic performance are consistent with current athletic literature, thus absolute and relative force are both recommended to monitor strength training adaptations in untrained women. Similar ballistic (CMJ) performance between Low and High DSI individuals supports its use to prescribe training modality.

**G-39 Free Communication/Poster - Anterior Cruciate Ligament**

**Saturday, June 1, 2019, 7:30 AM - 11:00 AM**
**Room: CC-Hall WA2**

**Board #201 June 1 9:30 AM - 11:00 AM Quadriceps Oxygen Consumption During Exercise in Patients with ACL-Reconstruction**

Abbs Jafrri, Maggie Lynch, Susan Saliba, Joe Hart, FACSM.
University of Virginia, Charlotteville, VA.
Email: ajh8uw@virginia.edu
(No relevant relationships reported)

**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 (TM/3F, 22.9±3.5y, 170.8±7.9cm, 73.7±15.1kg) and 10 matched controls (TM/3F, 22.9±3.5y, 170.4±10.7cm, 68.8±9.5kg) participated. Each participant completed a single data collection session consisting of 7-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 averaged and plotted for each contraction intensity with associated 90% confidence intervals. Statistically significant differences were defined as portions of the exercise trials where confidence intervals of the O2Hb graph did not overlap. Effect sizes calculated (Hedges g). **RESULTS:** Absolute peak IMTP force (minus body weight) correlated moderately with handgrip strength (r = 0.66), MBT (r = 0.70) and 1RM (r = 0.57), and relative IMTP peak force (per kg body mass) with CMJ height (r = 0.48). The 1RM (Low vs High DSI: 45.0 ± 11.0 vs 31.5 ± 6.5 kg, g 1.6), absolute IMTP (1386 ± 276 vs 709 ± 166 N, g 2.9), relative IMTP (20.7 ± 2.8 vs 11.0 ± 1.9 N·kg⁻¹, g 4.9), MBT (3.3 ± 0.3 vs 2.7 ± 0.3 m, g 2.4) and handgrip (34.5 ± 1.8 vs 26.2 ± 3.9 kg, g 3.1) were greater in Low DSI participants (p < 0.01), with no difference in CMJ height (0.23 ± 0.03 vs 0.19 ± 0.05 m, g 0.51). **CONCLUSION:** Moderate relationships between IMTP force and dynamic performance are consistent with current athletic literature, thus absolute and relative force are both recommended to monitor strength training adaptations in untrained women. Similar ballistic (CMJ) performance between Low and High DSI individuals supports its use to prescribe training modality.

**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 established so treatment options can be targeted to 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. METHOD: 28 individuals with primary unilateral ACLR (Age=16.6±2.7; Weight=71.8±17.7; 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 respectively) compared to the uninjured limb. Injured limb CSA increased at RTA (4.5±1.6cm² vs 5.2±1.9cm²; p<0.05) while the uninjured limb did not (p=0.13). No differences in PF were found between limbs (p=0.18, and p=0.43, respectively) or time point (p=0.67, and p=0.92, 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=0.32, p=0.05, and r=0.26, p=0.09, respectively). Injured limb PF was negatively associated with IKDC scores at both time points (r=-0.55, p=0.01, and r=-0.39, p=0.02, respectively). CONCLUSIONS: Inter-limb 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 treatment targets to improve patient function 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 (82.8±20.3kgs, 1.7±0.1m, 18.4±2.8yrs, 8M, 11F) completed this study. One month post-surgery (1.1±0.3 months) individuals completed the Knee Osteoarthritis Index (KOOS) questionnaire, 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) in the 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, KOOS scores, and VAS scores, while controlling for height and mass, were associated with RTD progression.RESULTS: Fourty percent of patients who underwent anterior cruciate ligament (ACL) reconstruction develop knee osteoarthritis (OA) within eight years of the procedure. To determine if levels of IL-1β, KOOS scores, and VAS scores, while controlling for height and mass, were associated with RTD progression three months post-ACLR reconstruction. Future studies should include follow-up time points and a larger sample size. Supported by NIH R25NS095371 and NIH R01-HD087459.
of inflammation one month after surgery may not explain muscle function six months after surgery, patient reported outcomes for pain and sport performance can, suggesting early clinical use to help drive targeted rehabilitation.

3519 Board #207
June 1 9:30 AM - 11:00 AM
Differences in T1ρ Relaxation Time in the Vastus Lateralis after an Anterior Cruciate Ligament Tear
Madalyn G. Romines, Lauren N. Erickson, Kylee A. Davis, Peter A. Hardy, Anders H. Andersen, Cale J. Jacobs, Brian Noehren, FACSM. University of Kentucky, Lexington, KY.

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 works 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 ± 4.2 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 to the non-involved limb (involved: 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 measures a different factor than peak strength and additional variables of muscle function should be evaluated.

NIH R01AR071398

3521 Board #209
June 1 9:30 AM - 11:00 AM
Blood Flow Restriction Does Not Augment Low Force Contractions Taken to or Near Task Failure
Samuel L. Buckner1, Matthew B. Jesse2, Scott J. Dankel3, Kevin T. Mattock4, James G. Mouser5, Zachary W. Bell6, Takashi Abe7, John P. Bentley8, Jeremy P. Loenneke9, 1University of South Florida, Tampa, FL. 2University of Southern Mississippi, Hattiesburg, MS. 3University of Mississippi, University, MS. 4Lindenwood University-Belleville, Belleville, IL. 5Troy University, Troy, AL.

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G-40 Free Communication/Poster - Blood Flow Restriction
Saturday, June 1, 2019, 7:30 AM - 11:00 AM
Room: CC-Hall WA2

3520 Board #208
June 1 9:30 AM - 11:00 AM
Acute Muscular Responses to Practical vs. Traditional Blood Flow Restriction Resistance Exercise
Robert Thiebaud1, Takashi Abe2, Jeremy Loenneke2, Tyler Garcia3, Yohan Shraiz4, Javier Fiol5, Ross McArthur.1Texas Wesleyan University, Fort Worth, TX. 2The University of Mississippi, University, MS. 3University of Kentucky, Lexington, KY.

PURPOSE: To compare the impact of blood flow restriction (BFR) resistance exercise on changes in muscular force output (MVC), muscle thickness (MTH) and total exercise volume (TEV) when using elastic knee wraps (practical) or nylon cuffs (traditional) inflated to 40 and 80% of arterial occlusion pressure (AOP).

METHODS: Participants (male=7, female=2) were 22 (4) years and had a body mass index of 25.4 ± (1.5) kg/m2. A randomized cross-over study design used unilateral knee extension exercise (4 sets to failure) with six different conditions at three separate visits. Low-load (LL, 30% 1-RM) exercise was performed with four conditions: elastic knee wraps (VaBo 8) ± 4 mm cuff inflation and 80% AOP. MVC and MTH were measured pre and post exercise. TEV was also calculated for each condition. Two-way [Condition x Time] repeated measures ANOVA and one-way repeated measures ANOVA were used to analyze the data. Data reported as mean (standard deviation). Statistical significance was set at p=0.05.

RESULTS: MVC decreased from pre to post-exercise for all conditions [AHL: -90 (81) N, ABFR40: -168 (89) N, ABFR80: -240 (134) N, AK2: -178 (91) N, AK85: -197 (57) N, p=0.05]. The changes in MVC were significantly different in K85 vs. HL (p<0.001) and K85 vs. LL (p=0.013). HL and BFR80 MVC at 15 minutes post-exercise were not different from pre-values [AHL: -53 (68) N, p=0.095; ABFR80: -87 (77) N, p=0.138] but LL, BFR40, K2 and K85 were still significantly below pre-values (p<0.05). MTH changes were similar from pre to post-exercise [AHL: 0.22 (0.22) cm, ALL: 0.26 (0.1) cm, ABFR40: 0.26 (0.14) cm, ABFR80: 0.28 (0.19) cm, AK2: 0.26 (0.21) cm, AK85: 0.25 (0.13) cm, p=0.892]. HL TEV was higher [889.6 (227.7) cm²] compared to all the other conditions (p<0.05) while the LL [686.1 (173.1) cm²] was the same as K85 [576.8 (160.7) cm²] but higher than the BFR40 [434.9 (142.3) cm²] and K85 [520.2 (132.2) cm²], p<0.023 conditions.

CONCLUSIONS: Exerciseing with fatigue to elastic knee wraps could be used to produce similar acute changes in MVC, MTH and TEV compared to known BFR pressures.

Abstracts were prepared by the authors and printed as submitted.
In conclusion, the present data suggest that NO is a key signaling molecule activating

CONCLUSIONS

with Placebo infusion from baseline (9.7 ± 3.3 MSC per 100 myofiber) to Post1 (15.0

increased 98 % (26.8 ± 9.2 to 53.1 ± 7.9 %) with NOS inhibition (P<0.001), while
decreased 37 % (0.57 ± 0.14 L/min to 0.36 ± 0.12 L/min) and oxygen extraction

samples were obtained before and after exercise (30min) for assessment of leg blood-

infusion of the NO synthase (NOS) inhibitor, NG-monomethyl-L-arginine (L-NMMA)

(2.04, 4.25) kg]; 15/0 [-0.06 (-1.13, 1.01), 15/40 [0.066 (-1.06, 1.20), and 15/80 [0.68

were main effects of time for isometric MVC [10.51 (3.87, 17.16) Nm, p<.002] and

isokinetic MVC at 180°/s [change = 8.61 (5.54, 11.68) Nm, p<.001]. Isokinetic MVC

at 60°/s did not change [2.45 (-1.84, 6.74) Nm, p=.261]. There were no condition x
time interactions for muscle thickness sites (all p≥.313), which increased over time
(all p<.001). There were main effects of condition for each site (700 was greater, all
p<.001) except 30% lateral (p=.059).

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 exercise bout
favoring high restriction pressures should be explored further regarding underlying
mechanisms. These results are relevant to mechanistic exploration, therapeutic
purposes, and program design.

Muscle cell swelling is a purported mechanism for the muscle hypertrophy following
blood flow restriction (BFR) training. There are numerous cuff widths used in literature
in BFR. It is presently unknown if cuff width impacts the swelling response and
whether this differs between sexes. PURPOSE: To examine whether the acute muscle
swelling response differs based on cuff size and sex. METHODS: Forty-nine (25
men, 24 women) participants completed two conditions in a random order (one each
arm). Participants completed four sets of unilateral elbow flexion exercise to failure
using 30% of their one repetition maximum with BFR applied with either a narrow
(5cm) or a wide (12 cm) cuff inflated to 40% of the arterial occlusion pressure. Muscle
thickness and echo intensity were measured before and after each exercise bout in
the supine position. A repeated measures analysis with a between subject factor of sex
was used to assess changes between conditions. Default priors were used for fixed
effects (r=0.5) and random effects (r=1). Bayes Factors (BF10) were used to quantify
evidence for the null and alternative hypothesis. Data are presented as mean (SD)
unless otherwise stated. RESULTS: For muscle swelling, there was evidence for an
interaction. Men had greater swelling than women [Men: 0.57 (0.18) vs. Women: 0.39
(0.15) cm] with the narrow cuff [median 6 (95% credible interval) .903 (324, 152); BF10: 38.57]; but there was no evidence of a difference within the wide cuff [median 6 (95% credible interval) .348 (.170, .902); BF10: 690]. There was some evidence that men had greater swelling with the narrow [0.57 (0.18) cm] cuff compared to the wide [0.49 (0.14) cm] cuff [median 6 (95% credible interval) .602 (071, 1.174); BF10: 2.61]. However, there was no evidence (BF10 : .439) for this in women [Narrow: 0.39
(15) vs. Wide: 0.43 (12) cm]. For changes in echo intensity, there was no evidence
for an interaction or an effect of cuff [Narrow: 1.2 (8) vs. Wide: 5.7 (AU); BF10: .41]. There was evidence for the null with sex (BF10 : .322). CONCLUSIONS:
Acute muscle swelling occurs in both men and women, even when using a wide cuff.
There is evidence, however, that the change in swelling is greater in men, particularly
with the narrow cuff. Whether these acute changes translate to differences in chronic
adaptations is currently unknown.

Blood flow restricted (BFR) resistance training leads to increased muscle mass
and strength but the time course of adaptations may be different as they are often
to a lesser magnitude than high-load (HL) training. PURPOSE: To evaluate the impact
of resistance training using interruptions on older adults’ muscle mass and
strength following BFR or HL training. METHODS: Twenty-one older adults (67-
90 years) were randomly assigned to HL (n=11) or BFR (n=10) training on the knee
extensors and flexors twice per week for 12 weeks. Muscle strength was measured
with 10-repetition maximum (10-RM) and muscle mass was assessed via magnetic
resonance imaging and quantified as cross-sectional area (CSA). The measurements
were performed before and after 12 weeks of training. RESULTS: After 12 weeks of
resistance training, the HL and BFR interventions increased 10-RM knee flexion
strength by 36.9±25.4% and 18.9±25.5%, respectively, but there was not a significant
time x group interaction (P=.16). CSA of the knee flexors increased an average of
4.8±2.9% among the HL and BFR training interventions (time main effect P=.01) but
was not different between the training groups (time x group interaction P=.49). There
were similar rates of progression of knee flexion training load and repetitions (time
x group interactions of each variable P>.05) as the groups combined averaged an
increase of 28.7±1kg/session and 97±5 repetitions/session (of training main
effects P=.05). Participants in the HL training group experienced greater improvements
in knee extension 10-RM strength than the BFR group (60.7±56.0% vs. 35.3±32.5%: p=0.03). The growth in quadriceps CSA was significant (time main effect P<0.01) and to a greater magnitude than the BFR group (7.7±4.8% vs. 2.8±1.8%: p=0.03). The BFR training group progressed at a rate of 1.8±0.6% per session while the NL group progressed at 1.1±0.2% per session (P=0.003).

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

Supported by NIH grant R15 A6040700-01A1

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 Heath L. Petrick,1 Christopher Pilgrinnelli,2 Tyler A. Churchward-Venne,3 Luc J.C. van Loon,1 Jamie F. Burr, FACSM,1 Gijs H. Goossens,3 Graham P. Holloway,4 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: (1) Determine if rotator cuff (RC) exercises combined with blood flow restricted (BFR) training promote greater increases in strength, muscular endurance, and lean mass 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.

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 PdO₂ on in vitro mitochondrial bioenergetics.

RESULTS: Exercise resistance, with or without BFR, did not alter maximal respiratory capacity or mitochondrial sensitivity to ADP. While maximal mitochondrial ROS emission was unchanged following RT, BFR decreased this response compared to rest (66.6 vs. 86.2 pmol min⁻¹ kg 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<0.01) and between (50.3% vs. 61.1% saturation respectively, p<0.01) 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, which mechanism 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 Lambert1, Corbin Hett1, Eden Eper2, Kalyan Chakilii2, Chadle Wang3, Joshua Lee1, Ayash Roensing4, Patrick McCulloch1. 1Houston Methodist Hospital, Houston, TX. 2Rice University, Houston, TX. 3Texas A&M University, College Station, TX. Email: bslambert@houstonmethodist.org (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 exercise resistance (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 musculature.

METHODS: Eighteen healthy adults (11, 32±5yr, 92.3±15.2kg | 7, 34±7yr, 81.9±6.3kg) were recruited and randomized into 2 groups (BFR-Rx, NoBFR-Rx). Each performed 8wks of LIX (2/wk) using 4 RC exercises: cable external rotation (ER), cable internal rotation (IR), dumbbell scaption, and side-lying dumbbell ER; 20%1RM; 1set/30reps followed by 3sets/15reps (30s interval between sets, 2min rest between exercises; 1x12 repetitions each week all repetitions achieved). For the BFR-Rx group, BFR was applied to using a tourniquet system (Delphi®) that maintained 50% limb occlusion pressure during each exercise with pressure released between exercises. A group x time ANCOVA (covaried 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, Delays®) recorded during acute ER and IR fatigue tests in all subjects. Type I error was set at α=0.05.

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.
Inhibition Of miR-16 In Vitro Decreases Glucose Uptake And Insulin Signaling

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 resistance states. METHODS: This study was performed in three experiments. Experiment (Ex) 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-oeoly-2-acyetyl-sn-glycerol (OAG), to simulate lipid overload-induced insulin resistance, cells were transfected with plasmid to overexpress functional miR-16. Ex 3: To test if primary-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.

Supported by a Student Research Fellowship Award: Crohn’s & Colitis Foundation (Sponsor: Sara C. Campbell, PhD, FACSM, Rutgers University, New Brunswick, NJ.

Other (please describe); Supported by a Student Research Fellowship Award: Crohn’s & Colitis Foundation (Ref #: 335042).

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 protects the colon epithelium from luminal microbes and the external environment. A dense dual layered mucus barrier, comprised of the muc2 mucin glycoprotein, protects the colon epithelium from luminal microbes and the external environment. A dense dual layered mucus barrier, comprised of the muc2 mucin glycoprotein, protects the colon epithelium from luminal microbes and the external environment. A dense dual layered mucus barrier, comprised of the muc2 mucin glycoprotein, protects the colon epithelium from luminal microbes and the external environment.
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 the liver tissue, fixed in RNA-later 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 presented as relative expression using the ΔΔCT method. RESULTS: For females, Akt and Ire1 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.

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 (429.37±225.43g and 464.42±244.02cm3). However, the magnitude of change in VATmass and VATvolume was greater in the HF diet (374.1±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 two-week dietary interventions in healthy sedentary individuals. Thus, future studies examining long term effects of HF diets in a various subject populations, including obese people, may provide more accurate information regarding a role of HF diets in body composition and visceral adipose tissue.

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 significantly reduce the development of these cardiometabolic diseases, thereby improving healthcare outcomes such as quality of life and associated costs. The utility of mid-upper arm circumference as a metric of MetS risk has not been widely investigated. There is paucity in the literature exploring the relation between mid-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 >29cm (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.

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
Waris Wongpipit, Jane J. Yu, Stephen H.S. Wong. FACSMM. The Chinese University of Hong Kong, Hong Kong, Hong Kong. Email: waris.ws@link.cuhk.edu.hk (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: 23.24 ± 3.65 years; body mass index: 29.78 ± 3.17 kg/m²; 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) at 3.2 km h⁻¹, 3) 6 min-walking every 60 min (6-min) at 3.2 km h⁻¹ separated by 7-14 days washing period. Standardized mixed meals (50% carbohydrate, 30% Fat, and 15% Protein) were provided at 0 and 3 h. Blood samples were collected at -1, 0, 0.5, 1, 2, 3, 4, 5, and 6 h. 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 (F₁,18 = 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 trial (F₁,18 = 5.048, 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 (F₁,18 = 66.589, P < 0.001, η² = 0.769) with the TG concentrations significantly increased from 1 h to 6 h (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 benefit on reducing postprandial TG than SIT trial in East-Asian young men with central obesity.

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
Emma R. Lucas, Nicholas V. Neuwald, Arlette C. Perry, FACSMM, Wesley N. Smith. University of Miami, Coral Gables, FL. (Sponsor: Arlette Perry, FACSMM)
Email: ecx192@miami.edu (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, legumes, vegetables, nuts, beans, whole grains, and seeds. 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
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**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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(No relevant relationships reported)

**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 mice were notably increased and only hepatic AMPKα mRNA expression in HMR group was significantly increased.

**Conclusions:** 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-PGC-1α-CREB.
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.

3540  Board #228  June 1 9:30 AM - 11:00 AM  
Effect Of Exercise Intervention On Expression And Translocation Of FAT/CD36 In Aging Mice 
Jingyu Sun, Yajuan Su, Lili Qin, Yunhe Zhou, Jingmei Dong, Jingmei Dong. Tongji University, Shanghai, China. 
Email: jysun@tongji.edu.cn

The international trend of rehabilitation medicine is leaning towards the prevention of metabolic disease these years. Especially in the prevention of insulin resistance, exercise therapy has become an effective means of rehabilitation. In view of the close association of fatty acid metabolism with insulin resistance, the potential role of Fatty Acids Translocase/CD36 (FAT/CD36) in treatment of aging-induced insulin resistance has been attracted more attentions. However, the regulative role of FAT/CD36 in exercise improving insulin sensitivity remains unclear.

PURPOSE: To determine the regulative role of FAT/CD36 in exercise improving aged-insulin muscle insulin resistance.

METHODS: Male C57BL/6j mice (8-week old) 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 semi-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. 0.851, P = 0.05) and CPT-1β (1.033 ± 0.167 vs. 0.528 ± 0.055, P < 0.05) in the EX group were significantly decreased, 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. 0.095, P > 0.05). The immunofluorescence pictures showed that FAT/CD36 were localized to the caveolae of plasma membrane, but not the mitochondrial membrane.

CONCLUSIONS: Exercise intervention protects against aging-induced insulin resistance by regulating FAT/CD36 expression and translocation. Supported by the National Natural Science Foundation of China (No. 31600966).

3541  Board #229  June 1 9:30 AM - 11:00 AM  
An Attempt To Reverse Diabetic Cardiomyopathy By Aerobic Interval Training In High-fat Diet And Streptozotocin Induced Type 2 Diabetes Rat Models 
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Purpose: Diabetes mellitus (DM) is an important risk factors of cardiovascular disease. Long-term hyperglycemia, hyperlipemia 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 an non-pharmacological strategy against diabetes complications. Therefore, we aimed to investigate whether AIT can reverse diabetic cardiomyopathy.

METHODS: 40 male Sprague-Dawley rats were randomly divided into control group (CON, n=10), diabetes group (DM, n=10), diabetes model + AIT group (AIT, n=10) and AIT + hyperinsulinemic euglycemic clamp group (CAMP, n=10). Rats in DM group were fed with high fat diet and STZ to induce diabetes models. Rats in AIT group were subjected to 8 weeks AIT intervention. At baseline, FBG was 12.5 ± 1.25 mmol/L and at 8 weeks AIT intervention, FBG decreased to 6.6 ± 1.12 mmol/L. At baseline, HbA1c was 7.3 ± 0.36% and at 8 weeks AIT intervention, HbA1c decreased to 5.8 ± 0.18%.

CONCLUSIONS: AIT intervention could reverse the compromised cardiac function in diabetic cardiomyopathy rats, which represented that AIT might be an effective therapy for the treatment of diabetic heart disease.

3542  Board #230  June 1 9:30 AM - 11:00 AM  
Predictors of Clinical Measures of Insulin Resistance 
Vincent M. Smith, Gabrielle A. Volk, Elizabeth A. Sohns, Callan R. Conroy, Rebecca E. Bartram, Casey R. Heindl, Kyle T. Timmerman, FACS/M. Miami University, Oxford, OH.

(No relevant relationships reported)

CONCLUSIONS:

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) body composition (bioelectrical impedance), blood glucose (glucometry), insulin (enzyme-linked immunosorbent assay), and HbA1c (HbA1c Analyzer) were assessed. In a subset of 30 subjects, physical activity was assessed via accelerometry (Actical). Further, in a subset of 16 subjects, glucose area under the curve (gAUC) was calculated following mixed nutrient challenge (0.5 g dextrose/kg lean mass + 0.3 g protein/kg lean mass). Partial correlations (controlling for age and sex) were utilized to examine associations. Significance was set at p<0.05.

RESULTS: Subject characteristics included: age = 67.9 ± 6.6; BMI=29.3 ± 7.5 kg/m²; FBG=104.0 ± 19.0 mg/dL; HOMA-IR=2.61 ± 1.95; and HbA1c=5.42 ± 0.25%. FBG was significantly correlated with body mass (r=0.62), body fat percentage (r=0.33), and gAUC (r=0.59). HOMA-IR was significantly correlated with body mass (r=0.64) and body fat percentage (r=0.51). HbA1c was significantly correlated with GAUC (r=0.83). There was a trend for a correlation between HbA1c and habitual, daily moderate-to-vigorous intensity physical activity (r=−0.36, p=0.06).

CONCLUSION: These preliminary data support previous findings that clinical indices of insulin sensitivity are associated with body composition. Interestingly, our data show blood glucose response to mixed nutrient intake, but not FBG, is predictive of HbA1c.

3543  Board #231  June 1 9:30 AM - 11:00 AM  
A Family History Of Type 2 Diabetes Does Not Limit Exercise Induced Improvement In Aerobic Fitness And Mitochondrial Function In Normoglycemic Sedentary Men 
Jasmin Jenkins¹, Conrad P. Earnest, FACSFM,² Kevin Conley¹, Steven R. Smith³, Sudip Bajpayi¹, ¹University of Texas at El Paso, El Paso, TX. ²Texas AM University, College Station, TX. ³University of Washington Medical Center, Seattle, WA. ⁴Sanford Burnham Prebys Medical Discovery Institute, Orlando, FL.

(No relevant relationships reported)

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 (ATPₚₚ), are impacted by a FH+. PURPOSE: The purpose of this study was to 1) determine if normoglycemic, sedentary healthy individuals with FH+ have a lower IS, VO₂max, and ATPₚₚ compared to those without a family history of T2D (FH-) and 2) if exercise induced changes in IS, VO₂max, and ATPₚₚ is impeded in those with a FH+. METHODS: Fourteen normoglycemic sedentary males with (n=6; age=27.33 ± 2.65 years, BMI=26.46 ± 0.75 kg/m²) or without (n=8; age=26.63 ± 1.44 years, BMI=26.46 ± 0.57 kg/m²) FH were randomly assigned to a control or exercise group. The exercise group conducted three weeks of exercise training and the control group did not. VO₂max and IS were assessed by hyperinsulinemic euglycemic clamp. ATPₚₚ was measured by magnetic resonance spectroscopy, and VO₂max was measured by a standardized graded exercise test. RESULTS: There were no differences in IS, ATPₚₚ and VO₂max between groups at baseline (one-way ANOVA all p>0.05). Three weeks of exercise increased VO₂max (Control: 2.08 ±0.02 mL/kg/min, p=0.08; FH+: 2.12 ±0.03 mL/kg/min, p=0.04), heart GLP-1 expression (144%, P<0.01) and GLP-1R expression (219%, P<0.01) in FH+ but not in FH-. These preliminary data support previous findings that clinical indices of insulin sensitivity are associated with body composition. Interestingly, our data show blood glucose response to mixed nutrient intake, but not FBG, is predictive of HbA1c.
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 was 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±10^6/mm3 in OLETF rats, 71.1 to 74.8% and 20.1 to 22.5±10^6/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.

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**3546**

**Board #234**

**June 1 9:30 AM - 11:00 AM**

**Weight Loss Combined with Increased Water Consumption Improves Cognitive Performance in Overweight Older Adults**

Kayla J. Airaghi, Brenda M. Davy, FACSM, Elaine L. Martink, Kevin P. Davy, FACSM, Tina Savla, Benjamin Katz, Virginia Tech, Blacksburg, VA.

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(No relevant relationships reported)

Existing research has established links between cognition and hydration in athletes and young adults, and a higher BMI has been linked to deficits in inhibitory control and attention. We recently reported that hydration status was associated with cognitive performance in overweight older adults. However, there is little work exploring the influence of weight loss interventions that also increase water intake on cognition.

**PURPOSE:** This study investigated the impact of a short-term weight loss intervention with and without increasing water intake on attention and inhibition in older overweight adults.

**METHODS:** Older adults aged 50-69 (n=23) were randomly assigned to one of two groups for 4 weeks: 1) hypocaloric diet+ 16 oz. of pre-meal water 3 times/d (n=13; “water”), 2) hypocaloric diet with no additional water (n=10; “nonwater”). Assessments at baseline and week 4 included weight, hydration (urinary specific gravity; USG), and the AX-Continuous Performance Task (CPT), a measure of inhibitory control and attention. Univariate ANCOVAs with experimental condition as a fixed factor, pre-test as a covariate, and post-test performance as the dependent variable were used to examine the outcome of the intervention on cognition.

**RESULTS:** Weight loss was 4.7%±0.7 and 4.3%±0.2 of baseline bodyweight for water and non-water groups, respectively, with no group difference. Intervention compliance was demonstrated lower USG in the nonwater group (1.009±0.002) than the nonwater group (1.015±0.002, p=0.007). Furthermore, at week 4, the nonwater group was 7% faster (p=0.046) and 4% less accurate (p=0.076) than the water group on the final block of the CPT after controlling for baseline performance. These results suggest a speed-accuracy tradeoff, such that individuals who were randomized to drink additional water while consuming a hypocaloric diet performed more slowly but more accurately on the later stages of the attention task.

**CONCLUSIONS:** Among older, overweight adults undergoing weight loss, increasing water consumption may reduce cognitive fatigue during an attention task such that more hydrated individuals may favor accuracy over speed, relative to less hydrated individuals.

Supported by the Virginia Tech Institute for Society, Culture, and Environment.

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**3547**

**Board #235**

**June 1 9:30 AM - 11:00 AM**

**Effectiveness Of 12-week Exercise Training On Body Composition And Lipid Metabolism Of Non-alcoholic Fatty Liver Disease**

Zhu Lin1, Jing-xin Liu1, Guangzhou Sport University, Guangzhou, China. 2Shanghai University of Sport, Shanghai, China.

Email: 40848567@qq.com

(No relevant relationships reported)

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:** Three hundred and sixty participants (male: 10, female: 10, age 45.82±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 (-4.61 ± 1.87kg, 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 (-1.97 ± 1.28%, 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 mg/dL, 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) were recruited and randomized into two exercise groups: NE and NR. The intervention consisted of 6 weeks of aerobic exercise and autophagy and inflammation. IL-10 protein expression increased and IL-1β was decreased significantly both in NE and NR group compared with NC group. IL-6 increased and IL-10 decreased significantly in NR group when compared with NE group. Finaly 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 in fat reduction. The autophagic activity of visceral adipose tissue was inhibited after aerobic exercise, especially after aerobic exercise. Autophagy 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.
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 osteoarthritic 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 hypertensive response in conventional resistance exercise). The combination of compression technology with core cooling further lowers the exertional requirements and has been used in cardiology 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 levels, especially Glycohemoglobin levels and weight.

**METHODS:** Thirty Type II Diabetics agreed to 3 training sessions a week for 6 months. Biomarker levels 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 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.

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Women with Polycystic Ovary Syndrome (PCOS) present substantial weight gain that may increase the risk of developing cardiovascular diseases. Hormonal, metabolic and cardiac autonomic changes also occur and increase the risk of these diseases. However, despite advances, the effects of aerobic exercises on the different aspects of this syndrome are still unknown, especially when the body fat percentage is considered.

**PURPOSE:** To investigate the effects of aerobic exercise on hormonal and metabolic aspects and cardiac autonomic modulation in women with PCOS with different percentages of body fat. **METHODS:** Women with PCOS (N=60) and without PCOS (control, N=60), between the ages of 18 and 39 years, were divided into three groups, according to their body fat percentage (22-27%, 27-32% and 32-37%). The participants were submitted to assessment of the following parameters before and after the aerobic physical training (16 weeks); body composition, fasting glucose and insulin, androgens, leptin, adiponecin, tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and the analysis of heart rate variability (HRV). **RESULTS:** Women with PCOS had increased serum levels of androgens, insulin (insulin resistance), leptin, TNF-α and IL-6 associated with reduced serum levels of adiponectin. Autonomic assessment revealed that these women also exhibited an impaired autonomic modulation characterized by reduced HRV, but mainly in high-frequency oscillations (HF=0.2-0.5Hz), corresponding to vagal modulation. These findings were directly associated with the body fat percentage; however, according to some parameters evaluated (insulin, TNF-α, IL-6, and HRV), PCOS was not able to play a role in the aerobic physical training was effective in improving almost all the parameters evaluated, except the serum levels of androgens and TNF-α. **CONCLUSIONS:** The results showed that PCOS has been found to be associated with significant endocrine/metabolic disturbances and cardiovascular autonomic dysfunction, which are exacerbated by overweight. Aerobic physical training proved to be an effective treatment for most parameters evaluated and should be prescribed as an adjunct treatment for PCOS, the same way it has been used to treat chronic degenerative diseases.
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 overeating induced by food reward dysfunction in obesity. We therefore explored the mechanisms.

METHODS: Male C57BL/6J 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 m/min, about 58%-75% VO2max, 30 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 < 0.001, but were 18.2%, 37.28% and 26.35% higher, respectively, in OE than O (P < 0.05). TH+ cells in substantia nigrapars 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 15.33% in OE compared to O (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.

Effect Of Physical Training In Leptin-deficient Ob/ob Mice: Oxidative Stress Evaluation In Prefrontal Cortex

Matheus Santos de Sousa Fernandes, Sr., Lucas Lucena, Diorginis José S. Ferreira, Anderson Pedroza, Severina Andrade-Silva, Gianbheri Braz, José Stefano Tadeu, PhD, Fabiana Santana Evangelista, PhD, Claudia Pinho Marques, Souza de Oliveira, PhD, MD, Claudia J. Lagrancha.1 University of São Paulo, São Paulo, Brazil. 2Federal University of São Francisco Valley, Petrolina, Brazil. 3Federal University of Pernambuco, Vitória de Santo Antão, Brazil. Email: theusfernandes10@hotmail.com

(No relevant relationships reported)

PURPOSE: The overweight/obesity affects brain function from cellular to structural levels, and due to the mitochondria importance, several studies have focused upon its involvement in the obesity and brain function. On rodents, previous data have already identified impairments of the prefrontal cortex triggered by obesity and its association with the oxidative stress. As the effect of moderate exercise training in the amelioration of the oxidative balance on prefrontal cortex was not examined in leptin-deficient ob/ob mice, this study assesses the effect of moderate physical exercise on oxidative stress parameters in the prefrontal cortex of leptin-deficient ob/ob mice. METHODS: Male ob/ob mice (Jackson Laboratories, Bar Harbor, ME, USA) with nine-weeks-old (32 g) were assigned into groups sedentary (S) and trained (T), housed in temperature and humidity controlled rooms, and kept on a 12 h light/dark cycle with food and water ad libitum. The physical training was performed at 60% of the maximal running capacity, 5 times/week, for 8 weeks. Forty-eight hours after last training, the animals were sacrificed and the prefrontal cortex quickly collected for oxidative balance analysis. RESULTS: We did not observe differences in the lipid (p = 0.3285) and protein oxidation (p = 0.3289) in leptin-deficient ob/ob mice, with concurrent unchanged in the superoxide dismutase activity (p = 0.2366) and catalase (p = 0.7068). However, we observed that the physical training significantly increased glutathione-S-transferase activity (S: 0.93 ± 0.3 vs. T: 3.63 ± 0.8 U/mg prot; p = 0.04). Moreover, the physical training increased the non-enzymatic antioxidant defense (GSH+GSGH): S: 5.1 ± 0.3 vs. T: 6.41 ± 0.66 μM/mg prot; p = 0.04; SH: S: 4.89 ± 0.016 ± 0.003 vs. T: 7.031 ± 0.001 mM/mg prot; p = 0.021. Additionally, we evaluated the AMPK and PGC1α expression, and we observed that AMPK was not modified after 8 weeks of physical training (p = 0.86), however, PGC1α expression increased significantly (S: 1.00 ± 0.2 vs. T: 1.98 ± 0.20 ddCT; p = 0.013). CONCLUSIONS: We suggest that physical exercise can minimize the detrimental effect of the obesity-induced oxidative stress in prefrontal cortex by activates an important transcription factor and possibly stimulates mitochondrial biogenesis.
Exercise as Supportive Care Has Selective Benefits for Chemotherapy Tolerance and Weight Gain
Amy A. Kirkham1, Kelecy A. Bland2, Karen A. Gelmon2, Donald C. McKenzie2, Kristin L. Campbell, FACSM*, 1University of Alberta, Edmonton, AB, Canada. 2Australian Catholic University, Melbourne, Australia. 3British Columbia Cancer Agency, Vancouver, BC, Canada. 4University of British Columbia, Vancouver, BC, Canada. (Sponsor: Kristin Campbell, FACSM)
Email: amy.kirkham@ualberta.ca

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 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

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 doxorubicin chemotherapy, and dose reductions due to neutropenia and fatigue.

Adherence To an Identical Supervised Exercise Intervention During Versus After Chemotherapy: Influence on Exercise Tolerance
Kendra Zadravec1, Kelecy A. Bland2, Amy A. Kirkham1, Josh Bovard1, Tamara Shenniker1, David Zucker1, Margot K. Davis1, Donald C. McKenzie1, Karen A. Gelmon1, Kristin L. Campbell1, 1University of Alberta, Edmonton, AB, Canada. 2Australian Catholic University, Melbourne, Australia. 3British Columbia Cancer Agency, Vancouver, BC, Canada. 4University of British Columbia, Vancouver, BC, Canada. 5Swedish Cancer Institute, Seattle, WA.

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±23%; 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 (35%) (i.e. fatigue) and non-treatment-related 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 does not appear to vary by timing relative to treatment, further analysis is required to determine if the timepoint of exercise delivery has differential effects on physical and psychological benefits.

Changes of Total and Tumor Specific Cell Free DNA During an Exhaustive Cycling Exercise Test
Tobias Ehrltt, Suzan Botzenhardt, Perikles Simon. Johannes Gutenberg University, Mainz, Germany.

PURPOSE: Circulating, cell-free DNA (cfDNA) is known to directly accumulate in a load-dependent fashion in various aerobic and anaerobic exercise sessions within minutes. Furthermore, increases of cfDNA at baseline have been reported for different patient groups, with cancer to depend on malignancy and tumor progression. Typically, such analysis did not differentiate between cfDNA and circulating tumor DNA (ctDNA). Here, we investigated the first time, whether exercise to voluntary exhaustion induces increases in cfDNA and ctDNA in patients with advanced stage cancer.

METHODS: In a pilot study, individuals with solid tumors of diverse entities and an age matched control group (n=5) were subjected to a step-wise incremental cycling spiroergometry until exhaustion. Blood samples were taken before, directly after, and 90 minutes after the end of the test. Total cfDNA was quantified directly from the blood plasma using a qPCR targeting repetitive Line-1 elements and ctDNA was measured following silica-based total DNA purification and enrichment from plasma and subsequent specific quantification using a nested qPCR assay targeting the most frequent oncogenic KRAS sequences in comparison to wild-type sequence. Additionally, DNase activity reduction was measured with a commercial ELISA kit.

RESULTS: We quantified total cfDNA in all blood samples and detected and quantified ctDNA concentrations in all three samples of one cancer patient with metastatic colon cancer. Total cfDNA concentrations increased 1.7-fold (95% CI 1.28-2.22-fold; p=0.01) in all tumor patients during exercise, but to a significantly lesser extent (p=0.003) than in the healthy control group (3.7-fold; CI 2.23-6.15-fold; p=0.01). The decrease of cfDNA concentrations during the recovery period was significantly lower in tumor patients than in the healthy control (1.8-fold vs 5.5-fold decrease, p=0.001), independent of the DNase activity. Tumor DNA increased only to a lesser extent (p=0.003) than in the healthy control group (1.28-fold; CI 1.22-1.38-fold; p=0.01). The decrease of cfDNA concentrations during the recovery period was significantly lower in tumor patients than in the healthy control (1.8-fold vs 5.5-fold decrease, p=0.001), independent of the DNase activity. Tumor DNA increased only to a lesser extent (p=0.003) than in the healthy control group (1.28-fold; CI 1.22-1.38-fold; p=0.01). The decrease of cfDNA concentrations during the recovery period was significantly lower in tumor patients than in the healthy control (1.8-fold vs 5.5-fold decrease, p=0.001), independent of the DNase activity.

CONCLUSIONS: cfDNA kinetics seem to be less dynamic in tumor patients, especially the depletion of ctDNA from the plasma seems to be impaired. This effect does not seem to be a result of circulating DNA originating from the Tumor.
Cardiorespiratory fitness, as measured by peak oxygen uptake (VO₂), was significantly improved with CR compared to 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 over 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.

CONCLUSIONS: This pilot study suggests the use of CR may be a viable option to attenuate the reduction in fitness that occurs in patients undergoing cardiotoxic chemotherapy. While trends were observed for improvements in both predictors of cardiology (GLS and troponin) with CR, these changes were not significant when compared to UC. The long-term effects of exercise on these predictors and left ventricular function warrants further investigation.

### Table: VO₂ Changes Between Groups

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Control</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise post test</td>
<td>17.5 ± 4.8</td>
<td>19.2 ± 5.9</td>
</tr>
<tr>
<td>Control baseline</td>
<td>16.7 ± 1.5</td>
<td>15.7 ± 1.4</td>
</tr>
<tr>
<td>Control post test</td>
<td>0.091</td>
<td>0.211</td>
</tr>
</tbody>
</table>

Peak VO₂ (mL·kg⁻¹·min⁻¹)

- **High sensitivity troponin** (ng·L⁻¹)
  - 24.9 ± 43.8
  - 13.9 ± 14.9
  - 15.6 ± 25.3
  - 27.1 ± 60.8
  - 0.556

FACT-G score

- 82.6 ± 11.6
- 86.2 ± 14.4
- 72.4 ± 13.6
- 79.6 ± 11.3
- 0.563

Relative global longitudinal strain (%)

- -14.7 ± 13.7
- 3.3 ± 9.0
- 20.7 ± 6.0
- 12.3 ± 10.7
- 0.091

Myoglobin (ng·mL⁻¹)

- 17.9 ± 5.7
- 21.5 ± 5.7
- 21.9 ± 11.4
- 31.2 ± 14.1
- 0.134

### Cardiac Rehabilitation Improves Fitness In Patients With Subclinical Markers Of Cardiotoxicity While Receiving Chemotherapy

Dennis J. Kerrigan, FACSMD, Madhulata Reddy, Eleanor Walker, Bernard Cook, Randa Loufji, James McCord, Jodi Baxter, Steven J. Ketyeyian, FACSMD. Henry Ford Heart and Vascular Institute. Detroit, MI. Email: dkerrig1@hfhs.org

(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 obtained 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 ± 12.8 years attended baseline testing and commenced exercise, however, a 50% withdrawal rate was observed during the intervention consisting of 9 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, 1RM Seated Row and 1RM 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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**G-43**

**Free Communication/Poster - Clinical Exercise Physiology - Other**

**Saturday, June 1, 2019, 7:30 AM - 11:00 AM**

**Room:** CC-Hall WA2

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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**

Rachel E. Bollaert1, Brian M. Sandroff2, Elizabeth Stine-Morrow2, Bradley P. Sutton2, Robert W. MotF2, Marquette University, Milwaukee, WI. 1University of Alabama at Birmingham, Birmingham, AL. 2University of Illinois, Urbana, IL.

Email: rachel.bollaert@marquette.edu

**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 25.4±0.6 kg/m²; VO₂max 41.6±2.7 ml/kg/min) completed two trials in a randomized order. Trials consisted of a progressive maximal treadmill exercise test to assess VO₂max or a non-exercise control. During each trial, participants were ambulatory ABP (ABP) 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 (SBP) (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 SBP, DBP, brachial pulse pressure, MAP, cSBP, and cDBP, were lower during nighttime compared to daytime, 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**


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**(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 (MU, 45.40±10.33 yrs.). Relative LTL was determined with qPCR analyses (T/S). Markers of inflammatory, oxidative and anti-oxidant status were assessed in plasma using commercial kits. A one-way ANOVA and Pearson’s moment correlation enabled for comparisons and correlations. **RESULTS:** The LTL (T/S) of YC (1.26±1.01) differ significantly from MU (0.48±0.52) (p<0.05) but did not differ from MA (0.99±0.67). MA and YC demonstrated a higher CAT, SOD activity, CAT/TBARS and SOD/TBARS ratios than MU, and the % body fat of MA was also lower than MU (p<0.05). The levels of inflammatory cytokines TNF, soluble TNF receptor (sTNF), IL6 and sIL6 were lower in the YC in comparison to MU and MA. Moreover, MA presented lower levels of sTNF, IL6 and sIL6 and higher IL10 and IL10/IL6 ratio compared to MU. Negative associations were found between body fat and antioxidant enzymes (CAT: r=-0.448 and SOD: r=-0.413) and IL10 (r=-0.285) and positively correlated with pro-inflammatory cytokines (TNF: r=0.278; sTNF: r=0.709; IL6: r=0.720; sIL6: r=0.430) (p<0.05). Further, CAT and SOD were negatively associated with inflammatory parameters (sTNF, IL6 and sIL6), while the LTL was negatively associated with inflammatory markers and positively associated with anti-inflammatory variables (p<0.05). **CONCLUSIONS:** Middle-aged master athletes presented lower markers of oxidative stress and inflammation, with improved antioxidant defense and longer LTL. Once inflammatory and oxidative stress were negatively associated to adiposity and LTL, the biological aging of MA is attenuated possibly due to a low adiposity, a better redox balance and reduced inflammatory markers.
Short-term Deteriorating Effects On Cardiorespiratory Fitness And Body Composition In Trained Older Adults


(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 versus electric resistance from bio-impedance analysis (BIA), may be of concern, as it 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), android fat mass (%AFM), and gynoide fat mass (%GFM) were estimated with dual-energy X-ray absorptiometry (DXA) and PhA was assessed with BIA. CRF was evaluated with a breath-by-breath gas analysis 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 - day 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), %FFM (p=0.953), %FFM (p=0.455), %AFM (p=0.138), %GFM (p=0.338), 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.

The Effects of Aerobic Exercise on Heart Rate Variability in People Living with HIV

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(No relevant relationships reported)

People living with HIV (PLWH) often present with lower heart rate variability (HRV) than healthy counterparts. This is problematic because lower HRV has been associated with cardiovascular morbidity and mortality. Aerobic exercise has been shown to improve HRV in the general population and in those with chronic diseases but its effectiveness in PLWH is unknown. PURPOSE: To evaluate the effects of 8-week aerobic exercise in PLWH on anti-retroviral therapy. METHODS: Twenty-six participants were randomly assigned to either a control group (no exercise) or an aerobic exercise group. Twenty-three participants completed the study. Resting HRV was measured for 5 minutes through an electrocardiogram. Measures included a 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 - day 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), %FFM (p=0.953), %FFM (p=0.455), %AFM (p=0.138), %GFM (p=0.338), 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.

Associations Between Cardiorespiratory Fitness and Brain-derived Neurotrophic Factor In Serum and Platelets-poor Plasma

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(No relevant relationships reported)

Chronically elevated intraocular pressure (IOP) scores are of consideration as main risk factor for the development of primary open angle glaucoma (POAG). It is known that aerobic and resistance training (RT) can promote reductions of IOP in individuals without diagnosis of the disease. However, there is still a need to understand the IOP behavior during RT in individuals with POAG. PURPOSE: To evaluate the IOP behavior in individuals with POAG during and after a RT session (RTS). METHODS: Six sedentary woman (64±8.2 y), with POAG, were submitted to RTS. After two familiarization sessions and seven days prior to RTS, participants were submitted to a maximum strength predictive test (1RM) in each of the exercises that comprised RTS (leg-press; chest press machine; leg curl machine; rower machine; calf machine; adduction machine; aduction machine; seated crunch machine and side lateral raise). Then, they performed the RTS composed of the nine exercises tested, 3 sets until the concentric muscle failure with 60%1RM and rest interval of 60sec among sets. IOP and lactacidemia (LAC) were measured at the pre-RTS (M1), after the fourth exercise (M2), immediately after the last exercise (M3) and after 5min of the RTS end (M4). The LAC was measured by blood lactate analyzer, while the IOP was measured by an ophthalmologist by Perkins tonometer. One-way ANOVA with Bonferroni’s post-hoc test was used to compare differences among the RTS moments; Pearson’s correlation was utilized to compare differences among the RTS moments; pearson’s correlation was used to verify possible correlations between IOP and LAC and; Effect Size was calculated by using Cohen d. RESULTS: There was a significant reduction in IOP at all moments evaluated in relation to M1 (M1:13±2.1 mmHg; M2: 8.33±2.6

3572 Board #260 June 1 9:30 AM - 11:00 AM
Associations Between Cardiorespiratory Fitness and Brain-derived Neurotrophic Factor In Serum and Platelets-poor Plasma

Anna K. Geijl1, Lars Bo Andersen2, Jakob Tarp3, Natascha Holbek Pedersen4, Niels Wedderkopp5, Lone Pej6, Anna Bugge7, 1University College Copenhagen, Copenhagen, Denmark 2Western Norway University of Applied Sciences, Sogndal, Norway. 3Norwegian School of Sport Sciences, Oslo, Norway. 4University of Southern Denmark, Odense, Denmark. 5University Hospital Copenhagen, Copenhagen, Denmark.

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3573 Board #261 June 1 9:30 AM - 11:00 AM
Effect of Resistance Training Session on Intraocular Pressure in Patients with Primary Open Angle Glaucoma

Luís Felipe Milano Teixeira1, Sidney Diyoo Tamura2, Henrique Malaquias Possebom1, Marcelo Conte1, 1 Universidade de Sorocaba, Sorocaba, Brazil. 2 NEPECE - HOSBOS, Sorocaba, Brazil. 3 HOSBOS, Sorocaba, Brazil. Escola Superior de Educação Física de Jundiaí, Jundiaí, Brazil.

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(No relevant relationships reported)
**Hippocampal Growth Factor and Myokine Cathepsin B Response to Aerobic and Resistance Training in 3xTg-AD Mice**

### Method:

- **Purpose:** The study examined the effects of aerobic (AT) and resistance (RT) training on hippocampal growth factor and myokine cathepsin B in mice with Alzheimer's disease (AD).
- **Participants:** Mice from the triple transgenic (3xTg-AD) model of AD were used.
- **Interventions:** Mice were assigned to sedentary (Tg), aerobic-trained (Tg AT, 9 weeks), or resistance-trained (Tg RT, 9 weeks) groups.
- **Outcomes:** RotaRod latency and grip strength were assessed pre- and post-training.

### Results:

- **Aerobic Training (AT):** Significant improvements in grip strength and RotaRod latency were observed post-training.
- **Resistance Training (RT):** Enhanced grip strength was observed post-training.

### Conclusion:

Aerobic and resistance training significantly improved grip strength and performance on the RotaRod, suggesting beneficial effects on brain health in AD.

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**Comparison of Work-induced Fatigue Responses Between One Versus Three 12-hour Shifts in Nurses**

### Method:

- **Purpose:** To examine the effects of one versus three 12-hour shifts on performance outcomes in nurses.
- **Participants:** 26 hospital working nurses and aides were recruited (age = 36.1 ± 13.3 years).
- **Interventions:** Performance variables were assessed post-shift one, shift two, and shift three.

### Results:

- **Performance Measures:** Changes in MGS (Pre = 1.10±0.21 m/s, Post = 1.14±0.28 m/s) were significantly positively correlated with leg press change (Pre = 166±51 psi, Post = 174±57 psi, r = 0.81, p < 0.01). There was no significant relationship between SGS and leg press change (Pre = 313±121 psi, r = 0.81, p < 0.01).

### Conclusion:

The decrease in gait speed is an important functional outcome to assess how people can function in their environment. With insufficient MGS individuals may lack the ability to adapt to sudden changes or dangerous situations. Therefore, inclusion of both training modalities may address central effects, as well as peripheral coexisting impairments in AD.

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**Self-selected gait speed (SGS) is an important indicator of current health. Maximal gait speed (MGS) is an important functional outcome to assess how people can function in their environment. With insufficient MGS individuals may lack the ability to adapt to sudden changes or dangerous situations. Muscle strength is related to both self-selected and maximal gait speed, however there is little known about the relationship between changes in lower extremity strength training and changes in both SGS and MGS.**

**PURPOSE:** To examine the effect of lower body strength training on changes in SGS and MGS.

**METHODS:** Eleven individuals (10 male, 72±8 years, BMI 36±7) with dyshypermobility (SGS below 1.0 m/s), however, strength training interventions had no significant effect on SGS or MGS.

**CONCLUSION:** The positive impact on student confidence and perceived knowledge highlights the influence of SBE in palliative care, suggesting a broader utility for this mode of learning in other emerging clinical domains for EP students.
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 PITI primary intervention only, and 19 CON: no intervention). Anthropometric data and blood samples were obtained before (PRE), after 8weeks of primary intervention (POST), and 1month telephone follow-up intervention (1YEAR) to measure levels of %body fat, tumor necrosis factor-alpha (TNF-α), C-reactive protein (CRP), and CRP (PI:2.95±.33mg/L→2.31±.47, P=.035; PI:2.87±.36→2.28±.49, P=.031) and elevated levels of adiponectin (PI:6.68±.69µg/mL→8.55±.85, P=.019; PI:6.48±.60→8.18±.85, P=.024), while CON showed an increase in %body fat (29.3±1.0%→30.7±1.1%, P=.028) with no differences in inflammatory cytokines. Results of 10month follow-up measurement (1YEAR) were retested back to PRE for the PI (1YEAR value and P value for PRE vs. 1YEAR: %body fat: 28.3±1.2, P=.89; TNF-α: 4.14±.51, P=.60; CRP: 2.66±.55, P=.75; adiponectin: 6.98±.79, P=.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=.016; TNF-α: 3.68±.52, P=.035; CRP: 2.48±.47, P=.043; adiponectin: 8.03±.80, P=.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.

**PURPOSE:** Strength measured with a novel HHD fixation system. **METHODS:** The study population was a group of 39 military soldiers (36M, 3F) who performed 4 maximal isometric contraction types, including lumbar extension, lumbar flexion, hip flexion, and knee extension. 3 trials of each contraction type were recorded during a pre-mission baseline, and 2 trials were recorded immediately following a 6-mi road march executed with an average load of 50% body weight. Measurements were recorded using the system developed, which also gained cultural awareness and valuable life-changing experiences by receiving opportunities such as volunteer work in a local community.

**PURPOSE:** Sports injury management program is a growing academic discipline. **METHODS:** Pima Community College Sports Injury Management (SIM) program offers an athletic training student internship. Students interns were not only preparing to become an athletic trainer (e.g., completion of an accredited athletic trainer program, hands-on experiences, etc.), but they also gained cultural awareness and valuable life-changing experiences by receiving opportunities such as volunteer work in a local community.
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=0.032), 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 HDD 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

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(No relationships reported)

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

Andrew Block. John R. Borman1, Brittany R. Hotaling2, Kevin A. Bigelman1, Dan A. Jaffe1, Jesse L. Germain1, Richard B. Westrick1, Nicholas H. Gist1. 1United States Military Academy, West Point, NY. 2United 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 9-week low volume HIIT intervention on aerobic and anaerobic fitness as well as MICT.

METHODS: 30 college-aged males at the United States Military Academy were randomized into a control or experimental group. The experimental group performed HIIT three times per week for 9 weeks, and the control group continued with their normal physical training. VO2max, Time to Anaerobic Threshold (TAT), Peak Anaerobic Power (PAP), and Peak VO2 were measured pre and post intervention.

RESULTS: VO2max increased in both groups, but the increase was significantly greater in the HIIT group (p<0.001). TAT did not change in either group. PAP increased in the HIIT group (p<0.01) but decreased in the control group (p<0.05). 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 VO2max. Both groups had a non-significant increase in average power.

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 Boutros2, William B. Benton3, Michael Moreno1, Patrick McCulloch1, Bradley S. Lambert1. 1Texas A&M University, College Station, TX. 2HOUSTON PLASTIC AND CRANIOFACIAL SURGERY, Houston, TX. 3PEEP Performance, LLC, Houston, TX. 4Houston Methodist Hospital, Houston, TX. 5Methodist 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 (3 hr between each test) to wear our PEEP mouthpiece or a Battle Oxygen Mouthguard® during cycle ergometer (Corival®) testing to maximal voluntary exhaustion (3 hr between each test).

RESULTS: 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.

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.

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

Cléton Libardi1, Vitor Angleri1, Carlos Ugrinowitsch2. 1Federal University of São Carlos (UFSCar), São Carlos, Brazil. 2University of São Paulo (USP), São Paulo, Brazil.

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(No relationships reported)

Abstract category: Fitness Assessment, Exercise Training, and Performance of Athletes and Healthy People - 102 Exercise Training 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% IRM) and the other to DS (3-5 sets of ~50-75% IRM 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 between TRAD vs 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 response 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.

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 sprints 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 between 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±1199 m reaching peak speeds of 29±2 km/h including 10±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 minute, respectively. Muscle lactate rose from 6.9±3 before the game to 38.2±20 and 20.1±12 mmol/kg·d.w during the first and third period, while blood lactate increased from 0.8±0.3 to baseline at 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±45 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.

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, measuring 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: 2.02% (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 enough to elicit cTn release and reduce E/A ratio. Future EICF studies should use echocardiographic techniques such as myocardial speckle tracking, measuring participant hydration, serial follow-up measures to assess symptom progression or recovery.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

PURPOSE: This project aims to determine the impact of arterial angulations (through sitting or standing), shear stress (through heating), or a combination of these factors affect vascular function. METHODS: 13 individuals (n = 4 male; n = 9 female) participated in a randomized crossover design study. Participants completed two experimental trials (one sitting and one standing). At the beginning of each experimental trial, participants laid supine for at least 20-minutes prior to baseline measurements of FMD at the superficial femoral artery (SFA). Participants then moved into a sitting or standing position. One leg was then passively heated through a water-perfused pant leg in order to increase shear rate. Participants maintained this position for 2-h. Participants then returned to a supine position and post measures of FMD were obtained. RESULTS: Overall, sitting led to an average of a 1.2% decline in FMD. Standing appeared to confer the greatest benefit independent of heating (p = .025). By the end of standing, participants FMD was 2.88% (p = .037) greater than after 2-h of sitting. However, there was no significant effect of local heating (0.75 % ± 1.90, p = .594) and no interaction between heating and body position (-0.17 % ± 2.70, p = .879). CONCLUSION: Standing was superior to sitting with regards to FMD while local heating had a non-significant effect. However, future studies need to examine modifiers such as biological sex.

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

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University of South Carolina, Columbia, SC.

Purpose: To determine associations of mid-pregnancy and current exercise with arterial stiffness 6 months-3 years after delivery in women.

Methods: This project aims to determine associations of mid-pregnancy and current exercise with arterial stiffness 6 months-3 years after delivery in women. Participants were included if they were pregnant at delivery and had no complications with delivery. All participants completed a questionnaire regarding current exercise habits. A randomized controlled design was used where women were randomized to a middle exercise group or a low exercise group. Exercise was defined as walking, swimming, yoga, or any other activity that increased heart rate. Questionnaires were completed at mid-pregnancy and current delivery. We used linear regression to determine associations of mid-pregnancy exercise, current exercise, and the interaction of mid-pregnancy and current exercise with arterial stiffness 6 months-3 years after delivery in women.

Results: Average exercise units were 39±6 (mid-pregnancy) and 43±7 (current).

Conclusion: This study did not find associations of mid-pregnancy and current exercise with arterial stiffness 6 months-3 years after delivery in women.

3591 Board #279 Jun. 1 9:30 AM - 11:00 AM

The Impact of Blood Flow Restrictive Exercise on Endothelial Function

Leryn Reynolds, Robbie Pittman, Hannah Twiddy. Old Dominion University, Norfolk, VA.
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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 (Goddin 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; mean PWV was 6.4±0.3 m/s. Mid-pregnancy exercise score (b=-0.02±0.01, p=0.051), but not current exercise score (b=-0.01±0.01, p=0.24), was associated with PWV after adjustment for age.

Conclusions: Mid-pregnancy exercise levels were significantly 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.

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. Knaer, FACSM. Southeastern Louisiana University, Hammond, LA.

No relationships reported

Purpose: The aim of this study was to examine the effects graded upper body exercise, lower body leg cycling, and combined upper and lower body exercise on oxygen consumption, heart rate, minute ventilation, respiratory exchange ratio, and blood pressure. Methods: Eight males, ages 18-28y, participated in three trials over several days. Subjects were divided into two groups. Session one included a 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 5kp and maintained a 60rpm cadence. Workload for each trial increased by 0.5kp every 2 min peaking at 95W. Results: Combined body ergometry produced significantly (p < .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 (156.3 ± 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

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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 (475M, 197F) Army trainees (20.4±3.4 yrs; 1.71±0.09m; 72.5±13.3kg) underwent high resolution peripheral quantitative computed tomography (HR-pQCT, XtremeCT2, Scanco Medical AG) scans of their non-dominant distal tibias at 4% of bone length 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) where a one-unit increase in normalized CSA (mm²/kg) resulted in a 5.856 ± 0.86 reduction in vBMD. Specifically, the lowest compared to the highest quartile of normalized CSA had 13% higher vBMD per unit body mass. CONCLUSION: These findings support the hypothesis that bone in the distal tibia...
metaphysis develops in a manner which balances the need to be adequately stiff against that of minimizing the mass of a metabolically costly tissue through maintaining lower bone density relative to larger bone size.

3594 Board #282 Jun. 1 9:30 AM - 11:00 AM Dynamic Changes Of Doppler Signal During Tendon Scraping Andrea Dockry, Michael Baria. Ohio State University Wexner Medical Center, Columbus, OH. Email: andrea.dockry@osumc.edu (No relationships reported)

Misdigestion Achilles tendinosis and patellar tendinosis are degenerative lesions that impede athletic performance and activities of daily living. Tendon scraping (TS) is a minimally invasive procedure to accelerate pain relief by disrupting neovascularity and neoinnervation hypothesized as responsible for pain. The original description uses color Doppler (CD) to identify the region with increased blood flow but does not comment on how CD changes during TS. Others propose that TS is complete when Doppler flow is absent. Our observation is that CD is absent after a small volume injection of local anesthesia, before scraping is begun. PURPOSE: This case series reports changes in CD during TS to better inform technical understanding of this procedure. METHODS: Six patients (male=4, female=2) with 5 cases of Achilles and 1 case of patellar tendinosis presented to the Sports Medicine Clinic. Ultrasound identified diseased tendon, and all patients had increased CD prior to the procedure. A 25-gauge 1.5-inch needle was advanced from lateral to medial to the tendon-fat pad interface. Doppler was left on during anesthetic administration. Once local anesthesia was administered, a stab incision was made with an 11 blade scalpel. A 14-gauge 2-inch needle was then advanced under ultrasound guidance in identical fashion. The bevel was turned to take a sample of the tendon surface. The fat pad was separated by pulling it away from the tendon in an anterior-posterior direction and then semi-circular, cranial-caudal sweeps were made to complete fat pad separation until the needle moved with unrestricted motion. RESULTS: In all six patients, CD was absent after injecting 1-3 mL of lidocaine. Though only 1 needle pass was made, CD was completely absent throughout the length of the tendon. No complications occurred. CONCLUSION: The most important finding of this work is that CD is absent after a small injection of local anesthetic, demonstrating that CD cannot be used to determine TS completion. CD is still a useful pre-procedure guide to identify the tendon region needing treatment, but it cannot be used as a marker of effective scraping/devascularization. A superior marker of procedure completion is freedom of needle motion demonstrating tendon separation from adjacent fat pad.

3595 Board #283 Jun. 1 9:30 AM - 11:00 AM Mesenchymal Stem Cells Injection As A Therapy In A Rat Model Of Collagenase-induced Tendinopathy Beatrice Deschenes St-Pierre1, Mathieu Boudrier-Reveret1, Shant Der Sarkissian1, Henry Acero2, Louis Gaboury3, Carl-Elie Majdalani4, Melanie Borie1, Nicolas Noisieux1, Martin Lamontagne1, 2Laval University, Quebec, QC, Canada. 3Université de Montréal, Montreal, QC, Canada. 4Centre Hospitalier Universitaire de Montreal (CHUM) Research Centre, Montreal, QC, Canada. Email: beatrice.deschenes-st-pierre.1@ulaval.ca (No relationships reported)

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 and/or Celastrol-conditioned MSC promote histopathological healing in a rodent Achilles tendinopathy model. METHODS: Eighteen Sprague-Dawley rats (36 Achilles tendons) were injected with collagenase type 1A (25 international units) in each Achilles tendons under echographic guidance. After one week, rats were randomly and equally assigned to receive a repeat injection, also under echographic guidance. 1) 60 μL of PB-saline compared to MSC and celastrol-conditioned MSC at 4 weeks. 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.

3596 Board #284 Jun. 1 9:30 AM - 11:00 AM Modeling Elbow Valgus Torque From Throwing Distance With 54,701 Collegiate Baseball Throws Ben Hansen, Brittany Dowling. Motus Global, Inc., Rockville Centre, NY. Email: ben@motusglobal.com (No relationships reported)

The scalability and usability of inertial measurement units (IMU’s) allows for biomechanical research to be conducted on datasets that are orders of magnitude larger than traditional motion-capture equipment allows for. From a clinical rehabilitation perspective, there is a large need to better understand the effects of throwing distance on elbow valgus torque in a real-world setting. PURPOSE: To develop a framework for the prediction of elbow valgus torque at specific long-toss distances in college baseball players. METHODS: 30 players from a NCAA baseball team were fitted with a motusTHROW sensor and sleeve (Rockville Centre, NY, USA) that measures peak elbow valgus torque. The sensor was worn during all training in 2018, resulting in a total of 238,611 anonymized throws captured. Of this, 54,701 throws were tagged with a long-toss distance (30-300 ft). A 3rd order polynomial regression and one-way ANOVA were performed to test for differences in elbow torque between throwing distances with Tukey post-hoc tests used to for-value calculation. RESULTS: A strong relationship was found between the throwing distance and elbow torque from the 3rd order polynomial (torque = 1.18*10^-7x3 + 8.90*10^-5x2 + 2.41*10^-5x + 0.001). The ANOVA showed all but 7 of 35 distance relationships had statistically significant differences: 80-90 ft, 210-240/270/300 ft, 240-270/300 ft, and 270-300 ft (p < 0.001). CONCLUSION: There was a strong cubic relationship between throwing distance and elbow torque. The cubic regression formula allows for clinicians to estimate peak valgus torque in the throwing arm from distance alone. This relationship can be used to better design return-to-throw programs.

The use of wearable physical activity (PA) monitors has increased rapidly over recent years and these devices are becoming more widely used in behavior change interventions. However, high rates of disengagement have been reported, with up to 70% stopping device use within 3 months. This trend is concerning, as these devices are unlikely to impact habitual PA behavior if they are not worn for a sustained length of time. Understanding which factors contribute to long-term engagement can support more effective use of this technology. PURPOSE: To assess whether the sharing of data from physical activity monitors (PAMs) via social media or directly with others (e.g. doctor, personal trainer/coach, family/friends) is related to sustained device use in a longitudinal survey study. METHODS: Current PAM users (n=418; mean age: 36.3 ± 12.6; 78% female) from across the United States were recruited online and completed a baseline web-based survey in 2015/2016. Participants were followed-up again in 2017. How respondents shared their device data (on social media, privately with family/friends, with their doctor, with coach/personal trainer [yes/no response items]) was queried. Sustained PAM engagement was defined as those who continued PAM use at follow-up. RESULTS: The median follow-up time was 15.5 (±17) months. Approximately, 11.5%, 55.7%, 43.2%, and 4.2% of respondents reported sharing their data via social media, with family/friends, with a doctor, or with a coach/personal trainer, respectively. At follow-up, 72.5% of participants were still using their PAM. Sharing data from the PAM publicly on social media (e.g. Facebook, Twitter) was significantly associated with long-term PAM engagement (OR: 4.45; 95% CI: 1.51-13.15, p = 0.007). Sharing PAM data privately with family/friends (OR: 1.21; 95% CI: 0.76-1.92, p = 0.418), with a doctor (OR: 1.38; 95% CI: 0.57-3.34, p = 0.477), or with a coach/personal trainer (OR: 0.91; 95% CI: 0.28-3.00, p = 0.881) were not significantly associated with sustained PAM use. CONCLUSION: Sharing PAM data on social media was associated with sustained device use of over median follow-up
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.

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 is needed to explore how to best use this technology as a behavior change tool. Encouraging users to share data may help to achieve better results.

BACKGROUND: Sedentary behavior is associated with a variety of health complications. Long bouts of sitting is becoming a recognized risk of workplace environments.

OBJECTIVE: 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±12 yrs) took part in a 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. Participants were randomly assigned to either the intervention or control group. In general results showed that students in the intervention group had a statistically significant increase in PA levels, lesson context, and teacher involvement. Implications for using SOFIT data gathered to inform the implementation of SPARK can influence the PA of Arab American youth in the PE context.

SOURCE: 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. Participants were randomly assigned to either the intervention or control group. In general results showed that students in the intervention group had a statistically significant increase in PA levels, lesson context, and teacher involvement. Implications for using SOFIT data gathered to inform the implementation of SPARK can influence the PA of Arab American youth in the PE context.

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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 Keadle. California Polytechnic State University, San Luis Obispo, San Luis Obispo, CA. Email: cchr17@calpoly.edu

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 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 MVPA 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, Nicholas E. P. Deutz. Texas A&M University, College Station, TX. Email: jgranados@tamu.edu

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; CHHS/HeJ) or high-active (HA; C57/LJ). METHODS: 12-week-old male LA (n=23) mice (body weight: 25.8 ± 1.2 g; lean body mass: 21.0 ± 1.1 g; fat mass: 2.5 ± 0.5 g) and HA (n=20) mice (27.5 ± 1.2; 22.5 ± 1.3; 2.5 ± 0.7 g) were used. Under anesthesia, a pulse of stable tracers (L-LEU/[13C6], L-ILE [1-13C], 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) by LC-MS/MS. Whole-body production (WBP) was calculated from fitted area under the curve (AUC) by LC-MS/MS. Whole-body production (WBP) was calculated from fitted area under the curve (AUC) by LC-MS/MS.

RESULTS: 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). The 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: 784±66 pg/mL vs. REx: 642±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 (r=0.49, p<0.01), increased hunger AUC (r=0.62, p<0.001), and decreased satiety AUC (r=-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.

3604 Board #292 Jun. 1 9:30 AM - 11:00 AM Ghrelin and PYY Are Differentially Altered Following An Acute Bout of Aerobic vs Resistance Exercise Tanya M. Halliday1, Mollie H. White1, Davis M. Bitton2, Allison K. Hill2, Jonathan R. Miller2, Edward L. Melanson, FACSM2, Marc-Andre Cornier1. 1University of Utah, Salt Lake City, UT; 2University of Colorado Anschutz Medical Campus, Aurora, CO. Email: tanya.halliday@uahutah.edu

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±17 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 libium energy intake at the lunch meal were also measured.

RESULTS: There was no difference in post-exercise ad libitum energy intake between conditions (AEx: 925±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: 784±66 pg/mL vs. REx: 642±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 (r=0.49, p<0.01), increased hunger AUC (r=0.62, p<0.001), and decreased satiety AUC (r=-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.

3605 Board #293 Jun. 1 9:30 AM - 11:00 AM Can A Polyphenol Supplement Improve Sports Vision And Reaction Time? A Pilot Investigational Study Neil E. Wolkodoff1, Gerald M. Haase2, Bethany Braunstein1. 1Colorado Center for Health & Sport Science, Denver, CO; 2University of Colorado, Aurora, CO. Email: neil@cochss.com

PURPOSE: Polyphenol supplements have emerged as positive influencers in lipid and metabolic regulation related to cardiovascular disease risk. Limited research has assessed their value in neurological function and sports reaction measures. A highly concentrated extract of citrus bergamot polyphenols was tested because of extensive publications demonstrating benefits in oxidative stress and dyslipidemia, and therefore might improve visual components.

METHODS: Nineteen (19) volunteers, aged 50-74 years old, were studied. Fourteen (14) subjects consumed BergaMet Sport, a high concentration polyphenol compound, and five (5) controls consumed a placebo. Subjects were randomly assigned to either the placebo or intervention groups. Weight, body composition, visually directed balance, sports vision reaction time and a seven-test sports vision battery were measured at time 0 and at 30 and 60 days.

RESULTS: The mean age for the control group was 58, + or - 9.42 yrs for the and for the intervention group was 57.1 + or - 6.42 yrs. 52% were female and 48% were male. The subjects who received the intervention improved to statistically significant levels in all sports vision and balance measures compared to the placebo group. The key measures of time to balance task (5.76 second increase Placebo (PL) vs. 15.51 second decrease/improvement Intervention (INT)), reaction time test (73.6 point improvement PL vs. 492.3 point improvement INT) and the sports vision ranking composite of seven measures (+4 percentile to normative (+454 point improvement in percentile ranking for PL vs. 6.33 point improvement for INT), were all significant (P<0.05), using paired student’s t-tests.

Abstracts were prepared by the authors and printed as submitted.
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 older adults with a short period of time 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 a family history of T2D (FH-) in response to a single bout of HIIE and 1 hour (H) and 48H after exercise. METHODS: Seventeen participants (9 FH+: 26 ± 6 years; 8 FH-: 27 ± 7 years) completed 1H post-HIIE. However, MF was improved to the level of FH- participants at 48H. Conclusion: This study indicated that MF was improved to the level of FH- participants at 48H.
to CON (AE: p<0.05 and p<0.01; BWT: p=0.05 and p=0.01, respectively). However, there was no effect of exercise on offspring mental stress levels, nor were there any differences observed between AE and BWT for any psychological health factors.

Mental stress was significantly correlated with depression (r=0.640, p<0.01) and self-esteem (r=−0.534, p<0.01). In addition, depression was negatively correlated with self-esteem (r=−0.689, p<0.01).

CONCLUSIONS: GPA had a positive influence on the psychological health of their offspring. Interestingly, no differences between types of physical activity, which should be recognized to benefit the mental health of their children regardless of modality. Therefore, implementation of GPA should be accepted as part of the healthy gestational regimen along with prenatal vitamins and a healthy balanced diet.

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 = -16.9366, p = 0.0218), log of hip circumference (β = -1.2972, p = 0.0196) and waist to hip ratio (β = 0.8243, p = 0.0071) were significantly associated with positive screen for depression on the PHQ-2. Variables of race (p = 0.0002), log of SBP (β = −3.3818, p = 0.0009), diastolic blood pressure (DBP) (β = 0.0168, p = 0.0035), log of waist circumference (β = -46.3330, p = 0.0100), log of hip circumference (β = 46.5107, p = 0.0010), and waist to hip ratio (β = 22.3890, p = 0.0078) were significantly associated with higher score on the feeling depressed question of the PHQ-2. Variables of 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.

Individuals with high stress jobs (e.g. law enforcement or military personnel) are often tasked with quickly interpreting ambiguous information in order to guide appropriate action. PURPOSE: To determine if ambiguity in social cues would change behavioral reactions in a group of football players. METHODS: Forty-two healthy young adults (19 men, 23 women, aged 18-35) who engaged in daily exercise, completed 45 minutes of continuous steady-state cycling at moderate (65% Heart Rate Reserve, HRR) and high (85% HRR) intensities on two separate days. They completed measures of perceived exertion, affect and around 30 minutes into exercise, then rated a series of ambiguous (surprised) faces as positive or negative. RESULTS: Heart rate, perceived exertion, negative affect and arousal were significantly higher under the high relative to moderate intensity conditions (p < 0.05). There was no significant difference in valence bias of surprised faces as a function of exercise intensity (p > 0.1). CONCLUSIONS: Understanding factors that influence interpretation of ambiguous social cues is important, as even slight shifts might alter if information is perceived as safe vs. threatening. This could have significant behavioral consequences for individuals operating in high-stakes environments. Results suggest that despite differences in participant’s emotional state between moderate and high levels of physical stress, interpretation of ambiguous social cues remains unaffected. Supported by the U.S. Army Combat Capabilities Development Command Soldier Center (CCDC, Natick, Massachusetts, USA) under award number W91QY1Y1300012.
ball carrier and a defender that were initiated by at least one of the players’ helmets. Regional or national championship level game-films from 2016 and later were obtained, from each age division, via open-source locations on the internet or a private subscriptions service for film review (NFHS 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 NFU and utilizing tests of trends.

RESULTS: A total of 2,912 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 increasing 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: IHC is relatively frequent among 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.

Previous measures of cardiovascular endurance after repeated dives on air and 100% oxygen at 1.35 atmospheres absolute (ATA) have shown reductions in performance that persist up to 3 days post-dive for the hypoxic group only. PURPOSE: To assess cerebral glucose uptake mice were fasted overnight and then exposed to hyperoxic conditions as a means of assessing the role of the endogenous opioid system on brain glucose uptake following an acute bout of exercise with and without administration of naltrexone. METHODS: To assess cerebral glucose uptake mice were fasted overnight and scanned using an in vivo microPET (in 4-air regions) under four assigned conditions: control (CON), exercise (EX), naltrexone injection (NTX) or exercise + naltrexone injection (EX+NTX). Mice were delivered a dose of 18F-fluorodeoxyglucose (FDG) 1 hour prior to scanning. Mice that underwent exercise performed 50 minutes of forced swimming (FS) following a week of familiarization, which consisted of 5-25 minutes of FS. NTX was given via intraperitoneal injection (4 mg/kg) 15 minutes prior to exercise or FDG administration. Data was imaged using VivoQuant software and analyzed using PMOD software by a technician blinded to the experimental conditions. Data was calculated as average standardized uptake values (SUV) for 19 regions of interest (ROI) and made relative to the SUV of the whole brain. RESULTS: Exercise increased the SUV of glucose in the cerebellum (EX=1.27 ± 0.14; p<0.05) relative to mice under CON (0.98 ± 0.07) or NTX (0.98 ± 0.03). conditions. The exercise mediated increase in activity in the cerebellum was abolished (P<0.05) with the addition of NTX (0.98 ± 0.10). The combination of EX+NTX increased the SUV of glucose in the hypothalamus regional relative to all groups (P<0.05). CONCLUSIONS: The cerebellum largely contributes to the regulation of voluntary muscular activity. Exercise appears to have a potent effect on brain activity specific to this region and may be at least partially mediated by endogenous opioids. Further, the endogenous opioid system may play a role in the attenuation of the hypothalamic-pituitary adrenal system during exercise.
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 iHIF1α and iHIF1. 

Methods: Using a randomized, cross-over study design, 10 men (mean ± SD; age: 25 ± 7 y; 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). iHIF1α and iHIF1-αa were measured from peripheral blood mononuclear cells. The percent change (%Δ) from BL to Pre- and PostSS was analyzed with 2 x 4 (%Δ BL to Pre- and PostSS x environment) RM ANOVA. Results: iHIF1α there was an effect of exercise (PreAAC 4.4 ± 7.6% vs PostSS: 17.5 ± 9.6%, p < 0.05), but no effect of environment (p > 0.05) or an exercise x environment interaction (p > 0.05). iHIF1-αa: 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 iHIF1α increased in response to SS exercise while iHIF1-αa 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 or higher exercise intensity (> 50% SL VO2peak) would result in elevated cellular response compared to a single environment. Funded by USAMRMC; authors views.

3619 Board #307

Jun. 1 9:30 AM - 11:00 AM

Body Composition Assessment in Athletes with Spinal Cord Injury

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(No relationships reported)

PURPOSE: To determine which anthropometric equation used to estimate body composition in athletes with chronic spinal cord injury (SCI) has better concordance with Dual X-ray absorptiometry. METHODS: Seventeen male athletes with chronic SCI AIS A, B or C participated in this study. Anthropometric composition was estimated using two anthropometric equations (Kerr Ross and Durnin Womersley). The evaluation was performed with the athlete in the supine/prone position and seating in their wheelchair. The same day a DEXA scan was performed. Shapiro Wilk test was used to determine normal distribution and parametric test were used for comparison between methods. Results: There was a significant difference between estimated and measured body fat. However, the estimated By anthropometric equation where superior for Kerr Ross method estimation for FM and FFM was: 0,84% (SD= 5,04) and -0,39 % (SD= 4,1) respectively. No difference was found when comparing anthropometric results with the athlete in the supine/prone position and seating in their wheelchair. 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 = 0,4) and -0,39 kilograms (SD= 0,49) respectively. Conclusion: While Durnin Womersley equation evaluation to estimate body composition in athletes with SCI, Kerr Ross method is superior to Durnin 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.

3620 Board #308

Jun. 1 9:30 AM - 11:00 AM

Wearable Technology To Reduce Sedentary Behavior And CVD Risk In Older Adults: A Pilot Trial

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(No relationships reported)

Older adults account for the vast majority of healthcare expenditures and deaths attributable to cardiovascular disease (CVD). Physical activity (i.e. exercise) is associated with decreased CVD risk, but recent large-scale trials suggest that exercise alone is insufficient to reduce CVD events in high-risk populations of older adults. PURPOSE: This pilot randomized clinical trial evaluated the impact of combining structured exercise with an intervention designed to enhance non-exercise physical activity (EX + NEPA) compared to EX alone. METHODS: Participants ≥ 60 years (n = 40) with moderate to high risk of coronary heart disease (CHD) events were randomly assigned to either the EX + NEPA or EX groups and followed for 20 weeks. Both groups underwent a twice weekly, eight-week center-based exercise intervention with aerobic and resistance exercises. The EX + NEPA group also received a mobile activity tracking device along with behavioral monitoring and feedback throughout the study. Outcomes evaluated at week 20 were: 1) physical activity patterns (steps/day and sedentary time), 2) blood pressure, and 3) circulating indices of cardiovascular risk (blood glucose and triglyceride levels). Linear mixed models estimating group differences were adjusted for age, sex, group, visit, and baseline level of the outcome. Data are presented as mean differences (EX + NEPA relative to EX) with 95% confidence intervals at week 20. RESULTS: Relative to EX, the change in steps/day at week 20 was 2,071 [61.07, 4081] for EX + NEPA. For sedentary time (minutes per day) the difference between groups was -31.21 [-168.18, 105.76]. The differences for systolic and diastolic blood pressure were -9.94 [-19.57, -0.31] and -1.77 [-6.89, 3.34] mm Hg, respectively. The difference was 0.70 [-15.90, 17.31] mg/dL for glucose and -5.53 [-58.63, 47.57] mg/dL for triglycerides. CONCLUSIONS: The addition of activity tracking technology appeared to positively influence daily activity patterns and directionally favored blood pressure and triglyceride levels. Wearable technology may impact daily habits of older adults and improve risk factors for CHD - although a fully-powered trial is needed to definitely test this hypothesis. Supported by AHA 16IRG27250237, NIA 2P30AG028740, NCMRR 1P2CHD086851, and the UAB Center for Exercise Medicine.

3621 Board #309

Jun. 1 9:30 AM - 11:00 AM

Identifying Specific Elements Necessary for a Pediatric Cardiac Rehabilitation Program: An e-Delphi Study

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(No relationships reported)

Encouraging children and adolescents with congenital heart disease (CHD) to participate in regular exercise is an essential component in helping them rise toward their full potential physically, socially, and emotionally. Identifying appropriate tools and resources that promote healthy and active lifestyles specifically for this population are currently lacking and must be developed. Cardiac rehabilitation programs are an effective modality with beneficial clinical outcomes for adult patients with coronary heart disease, however these programs are scarce for the CHD pediatric population and not well defined.

Abstracts were prepared by the authors and printed as submitted.
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% (HR=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 1.07-0.69) (Blondell et al., 2014); Alzheimer’s disease: Highest vs lowest level of PA:35% RR reduction (n=23,745, 70-80yrs, RR=0.65, 95% CI 0.56-0.74) (Sanzo-Lozano 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 vs highest vs lowest level of PA (RR=0.71, 95% CI 0.63-0.80) (Qu et al., 2022). 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.
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 braqui (BB), triceps braqui (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</th>
<th>ES</th>
<th>p value</th>
<th>p value</th>
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<tbody>
<tr>
<td>1RM biceps curl (kg)</td>
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<tr>
<td>3x10</td>
<td>29±10</td>
<td>38±11</td>
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<td>10x3</td>
<td>29±15</td>
<td>38±17</td>
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<td>0.60</td>
<td>0.001</td>
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<td>1RM squat (kg)</td>
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<tr>
<td>3x10</td>
<td>156±41</td>
<td>206±43</td>
<td>32.4</td>
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<td>152±73</td>
<td>206±85</td>
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<td>1RM elbow extension (kg)</td>
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<td>3x10</td>
<td>56±18</td>
<td>69±19</td>
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<td>66±23</td>
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<td>BB (mm)</td>
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<td>3x10</td>
<td>34.6±6.9</td>
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<td>39.4±6.4</td>
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<td>0.226</td>
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<td>TB (mm)</td>
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<td>3x10</td>
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<td>39.8±4.4</td>
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<td>1.01</td>
<td>0.001</td>
<td>0.775</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.)