Although most of the data linking physical fitness to cardiometabolic (CM) health explores assessments related to body composition and cardiopulmonary fitness, emerging evidence suggests muscular fitness also plays a key role in the pathogenesis and prevention of CM diseases. However, the majority of this research has focused on men and have used a handgrip test to assess muscular strength which tests small muscle groups. PURPOSE: Therefore, the purpose of this study was to examine the associations between individual CM risk factors and physical fitness in apparently healthy non-obese young adult females using barbell exercises involving large and small muscle groups to measure muscular strength. METHODS: A total of 19 non-obese [body mass index (BMI) < 30 kg/m2] females aged 22.9 ± 4.8 years participated in this cross-sectional study. After obtaining informed consent, each participant was assessed for: resting heart rate and blood pressure; fasting blood biomarkers [triglycerides, glucose, total cholesterol, high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C)]; muscular strength [1 repetition max (1RM) back squat, press, and deadlift]; muscular endurance, muscular power, and VO2max. A composite muscular strength index was calculated by dividing individual 1RM scores by bodyweight and then transformed into z-scores. The average of these three z-scores was computed to form a muscular strength index. Spearman’s rho (ρ) was used to examine bivariate correlation coefficients between physical fitness and CM risk variables. Statistical significance was set a priori at ρ ≤ 0.05. RESULTS: Significant correlations were observed between muscular strength and HDL-C (ρ = 0.542, P = 0.02), muscular power and LDL-C (ρ = 0.532, P = 0.02), and VO2max and resting heart rate (ρ = -0.664, P = 0.001). No significant associations were found between muscular endurance and CM risk variables. CONCLUSION: Muscular strength was positively associated with HDL-C, while muscular power and VO2max were negatively associated with LDL-C and resting heart rate, respectively. These findings support the inclusion of muscular strength and muscular power training in addition to cardiovascular fitness training in healthy women in the prevention of CM disease.

**Cardiometabolic Risk Factors, Muscular Fitness, and Cardiorespiratory Fitness in Apparently Healthy Young Adult Females**

Ryan Tyler, Timothy A. Rengers, Samantha C. Orr, Mary A. Elsesser, Evan Eschler, Tamara Hew-Butler, FACSM, Charles R.C. Marks, Myung D. Choi, Kristin R. Lands-Piwowar, Elise C. Brown, Oakland University, Rochester, MI.

(No relevant relationships reported)

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**Exercise Thresholds on Trial: Are They Really Equivalent?**

Kevin Caen. Ghent University, Ghent, Belgium.

(No relevant relationships reported)

**Purpose:** The interchangeable use of whole-body exercise thresholds and breakpoints (BPs) in local oxygenation responses, as measured via near-infrared spectroscopy (NIRS), has recently been questioned in scientific literature. Therefore, the present study aimed to longitudinally investigate the interrelationships of four commonly used exercise thresholds: critical power (CP), the respiratory compensation point (RCP) and BPs in muscle (m[HbO2]) and brain (c[HbO2]) oxygenation. **Methods:** Nine male participants (21.8 ± 1.2 years) completed six weeks of cycling interval training. Prior to and following the intervention period, subjects performed a ramp incremental (RI) exercise protocol to determine RCP, m[HbO2] and c[HbO2] and four constant work rate (WR) tests to calculate CP. **Results:** WRs associated with CP, RCP, m[HbO2] and c[HbO2] increased with 7.7 ± 4.2%, 13.6 ± 9.0%, 9.8 ± 5.7% and 11.3 ± 11.1%, respectively. CP was lower (pre: 260 ± 32W, post: 280 ± 41W) (P < 0.05) than the WRs associated with RCP (pre: 283 ± 36W, post: 313 ± 32W) which occurred concomitantly (P = 0.083). [m[HbO2]] occurred at the highest WR and differed from all others (pre: 313 ± 23W, post: 344 ± 32W) (P < 0.05). Training-induced WR differences did not contrast between thresholds and initial parameter differences were not affected by the intervention (P = 0.253). Thresholds were partly correlated before (R = 0.67-0.85, P < 0.05) and after (R = 0.83-0.96, P < 0.05) training, but AWK were not interrelated (P > 0.05).

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**2479 Board #3 June 1 1:00 PM - 3:00 PM**

**Altered Kinematics Over a 2-minute Continuous Push-up Assessment**

Jennifer Hewit. United States Military Academy, West Point, NY.

(No relevant relationships reported)

Push-ups are a common and fundamental muscular endurance exercise performed by individuals of all ages and abilities. Ensuring that the body maintains proper positioning throughout such an activity is crucial for both optimizing performance as well as minimizing the risk of injury.

**PURPOSE:** To investigate the changes in body positioning (i.e. hand positioning and torso angle) throughout a standardized 2-minute continuous push-up test. **METHODS:** Video of the entire 2-minute push-up bout was collected for a total of 26 males (23.3 ± 6.9 years old). Of interest to the researchers was 1) Hand Height (HH) – distance the hand was in relation to the shoulder, 2) Hand Width (HW) – distance between the 3rd metacarpophalangeal joint of each hand, and 3) Torso Angle (TOR) – angle of the torso to the horizontal axis. Three consecutive repetitions at the start and end of the bout were averaged and used for comparative analysis. Paired t-tests were used to compare the means of the beginning and ending repetitions. An alpha level of 0.05 was used throughout. **RESULTS:** Both HH and TOR significantly decreased by the end of the bout (HH: 10.8 ± 5.4 cm vs. 6.8 ± 5.6 cm, P < 0.05; TOR: 24.7 ± 6.5° vs. 17.8 ± 8.8°, P < 0.001), while HW significantly increased (0.54 ± 0.06 cm vs. 0.56 ± 0.05 cm, P = 0.001). **CONCLUSION:** As participants became tired, they assumed a body position that likely allowed for a greater percentage of their body weight to be supported by their lower body (i.e. hands wider and closer to the shoulder with greater hip flexion). While this adjustment allowed them to continue the exercise, compensational patterns like this should be identified and addressed in training in order to strengthen the primary muscles targeted by the exercise (e.g. pectorals, triceps brachii and abdominals).

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**Free Weight Bench Press Muscular Fitness Normative Data for Adults Aged 20-29 Years**

Young Sub Kwoun1, Robert A. Robers2, Hosung So2, Christine M. Mermier1. 1Humboldt State University, Arcata, CA. 2Queensland University of Technology, Brisbane, Australia. 3California State University, San Bernardino, CA. 4University of New Mexico, Albuquerque, NM. (Sponsor: Ann Gibson, FACSM)

(No relevant relationships reported)

The only available norms for the bench press muscular fitness tests for the general population are the norms developed by the Cooper Institute. These norms were developed using the Universal Gym DVR bench press equipment, which makes these values not directly applicable to free weight bench press. **PURPOSE:** The free weight bench press test is one of the most common tests used to evaluate muscular fitness and the effectiveness of resistance training programs for a variety of sports. However, its use and interpretation as an evaluative measurement for health-related physical fitness tests are limited because there are few published reference values derived for the general population. Therefore, the aims of the present study were to generate normative values for free weight bench press 1 repetition maximal (RM) and 4 sets of 65% of 1RM training volume (total repetitions × resistance) for 20- to 29-year-olds for men and women. **METHODS:** We recruited healthy 606 subjects for this study. 351 males (mean±SD, age=23.2± 2 yr, height= 177±7cm, body mass=83±16kg) and 255 females (age=23±3 yr, height=167±6cm, body mass=67±11 1.3kg) aged 20 to 29 years from different universities comprised the subject pool. Data collected from the bench press test included absolute (1RM) and relative (the ratio of 1RM to body weight) strength, and the total repetitions and absolute and relative total volume of the 1st set and 4 sets of 65% of 1RM bench press test with 30 second rest periods between sets. Percentile norms and descriptive statistics were generated. **RESULTS:** Table 1 reports the %tile rank values for the bench press exercise for men and women. **CONCLUSIONS:** Our results provide, for the first time, reference standards for the general population aged 20 to 29 years sex- and age-specific free weight bench press 1RM and training volumes of the 4 sets of 65% of bench press test with 30 second rest periods between sets.

<table>
<thead>
<tr>
<th>%tile rank</th>
<th>1RM (kg)</th>
<th>Total Training Volume (kg)</th>
</tr>
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<tbody>
<tr>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>75</td>
<td>119</td>
<td>54</td>
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<tr>
<td>50</td>
<td>98</td>
<td>49</td>
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<td>25</td>
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**Table 1. %tile rank for bench press muscular fitness for men and women**
A field measure of muscle function that can be used in recreational and educational settings to detect bone strength can be an important component in bone health programs and decrease the incidence of fracture as people age. Recent studies reporting significant correlations between muscle power and bone strength (Janz, 2015, Yingling, 2017) have focused on cortical bone sites, however trabecular bone is a common site of fracture. As well, bone’s response to mechanical loading is site specific and thus a loading stimulus to the lower limbs should not have an effect on the bones of the upper limbs. PURPOSE: To determine if relative grip strength or lower limb peak power is more predictive of trabecular bone strength. METHODS: Eighty-six Division II athletes, 56 females and 30 males (age yrs) 20.2 ± 1.7, height (m) 1.7 ± 0.1, body fat % 17.0 ± 7.4) performed a grip strength (RGS) test using a hand dynamometer and a maximum vertical jump using a Vertec. Peak Power (PP) was calculated from vertical jump height and combined relative grip strength was calculated. Trabecular Bone Mineral Content (vBMC), Trabecular Bone Mineral Density (vBMD), Total Area (TA), and Bone Strength in compression (BSC) were measured using peripheral Quantitative Computed Tomography (pQCT) at the 4% radial site. Linear regressions were run to relate muscle function and trabecular bone strength. RESULTS: PP and RGS were significantly related to each of the four bone strength variables. Yet, PP explained more of the variability in bone strength than RGS. PP had larger R² values for all measurements: vBMC [R²=0.1223] PP [R²=0.5085], vBMD [R²=0.1051] PP [R²=0.3812], TA [R²=0.0227] PP [R²=0.4162], BSC [R²=0.1713] PP [R²=0.5240]. CONCLUSION: PP using vertical jump and RGS using a hand dynamometer can be used to assess trabecular bone mass, geometry and architecture. Interestingly PP, a lower limb measurement explained more variance in bone strength of the distal radius. PP is a measure of power which may be a more predictive measure of trabecular bone strength than a muscle strength measure, even one specifically for the upper limb. Lower limb muscle power calculated by vertical jump assessment could provide a means to monitor trabecular bone strength parameters in the upper limb.

POURPOSE: Compare metabolic and hemodynamic responses between self-paced (SP) and ramp (RAMP) graded exercise testing (GXT) protocols. Given that SP is controlled for time while RAMP is not, similarities in physiological responses between protocols may support SP as a viable testing option from a time-management standpoint. METHODS: Sixteen recreationally trained men (23.7±3.0 yrs) completed two separate treadmill GXT protocols. SP consisted of five 2-min stages (10 min total) of increasing speed clamped by the Borg RPE scale. RAMP increased speed by 0.16 km/hr every 2 min by using paired samples t-tests (R Core Team (2017)) to compare SP and RAMP protocols. Calculation of the bias of both metabolic equations was also calculated. RESULTS: Calorie expenditure was [VO₂ (mL/kg/min) = -0.0021*C + 1.24*P + 15.4, where C = cadence]. The RMSE [95% CI] from the LOOCV of the cadence metabolic equation was 2.5 ± [1.0] mL/kg/min and its bias [95% CI] was 0.6 [10.3] mL/kg/min. The RMSE from applying the ACSM walking metabolic equation to this data was 3.1 ± [0.2] mL/kg/min. CONCLUSION: In the same way that speed is used in the ACSM metabolic equation, cadence may also be used in a walking metabolic equation with similar error and reduced bias. The greater sample size and sex distribution used herein to develop this cadence-based metabolic equation suggests greater potential to produce accurate and generalizable estimations. Further research should test this equation during overground walking and incorporate grade as an additional variable. Vertical jump has been widely used as a method to evaluate the neuromuscular performance of the lower limbs in several populations. Vertical jump is highly recommended for this purpose because its simplicity and rapid application in different settings. More specifically, vertical jump is a predictor of functional capacity, fall risk, and loss of anaerobic capacity in the elderly. Recently, the iPhone App “My Jump” has emerged as an interesting alternative to measure vertical jump height. This App has shown a similar precision as the contact mat, which is considered a reference method for jumping height evaluation. However, My Jump App has been validated only with a small homogeneous sample (n=3, trained men) used to derive a speed component of this equation calls into question its generalizability. Further, the equation’s free-living application is limited by the difficulty of measuring speed. Conversely, walking cadence (steps/min) is a practical and measurable metric that has been shown to be a reasonable proxy for walking intensity. PURPOSE: To develop a metabolic equation using cadence to predict oxygen consumption (VO₂; mL/kg/min) during level walking (and compare its predictive accuracy to that of the ACSM metabolic equation) in a large sample of men and women aged 21-40 years. METHODS: Sixty-nine adults (52% women, mean±SD age=30.0±5.6 years, BMI=24.6±3.3 kg/m²) performed 5-min treadmill bouts separated by 2-min rest at four speeds: 5.6, 6.7, 8.0, and 9.3 m/min (2.0, 2.5, 3.0, 3.5 mph). The cadence-VO₂ relationship was quantified with a quadratic model of best fit, producing the cadence metabolic equation. For an unbiased evaluation of this equation, leave one out cross-validation (LOOCV) was then performed and the root mean square error (RMSE) was calculated. The ACSM metabolic equation for walking was then applied to these data for comparison, and its predictive accuracy was evaluated by determining its RMSE. The bias of both metabolic equations was also calculated. RESULTS: The cadence metabolic equation was [VO₂ (mL/kg/min) = -0.0021*C + 1.24*C + 15.4, where C = cadence]. The RMSE [95% CI] from the LOOCV of the cadence metabolic equation was 2.5 ± [1.0] mL/kg/min and its bias [95% CI] was 0.6 [10.3] mL/kg/min. The RMSE from applying the ACSM walking metabolic equation to this data was 3.1 ± [0.2] mL/kg/min. CONCLUSION: In the same way that speed is used in the ACSM metabolic equation, cadence may also be used in a walking metabolic equation with similar error and reduced bias. The greater sample size and sex distribution used herein to develop this cadence-based metabolic equation suggests greater potential to produce accurate and generalizable estimations. Future research should test this equation during overground walking and incorporate grade as an additional variable.

Validity of My Jump App to Measure Vertical Jump Height of the Elderly

Ingrid Oliveira-Silva¹, Rejane M. Cruvinel-Cabra³, André R. Medeiros¹, Daniel A. Boullosa¹, ¹UnIVEx, Anápolis, Brasil. ¹UCB, Brasília, Brasil. (Sponsor: Carl Foster, FACSM) (No relevant relationships reported)

In the same way that speed is used in the ACSM metabolic equation, cadence may also be used in a walking metabolic equation with similar error and reduced bias. The greater sample size and sex distribution used herein to develop this cadence-based metabolic equation suggests greater potential to produce accurate and generalizable estimations. Future research should test this equation during overground walking and incorporate grade as an additional variable.
Intensive weight reduction has become popular in many performance and aesthetic sports. However, health effects of prolonged semi-starvation are scarcely studied in a longitudinal, systems biology setting. 

**PURPOSE:** The aim of our study was to examine how intensive weight loss with large amount of exercise affects system biological pathways and health biomarkers in female fitness/physique athletes aiming for low body fat while maintaining their lean mass.

**METHODS:** The study population consisted of healthy fitness/physique athletes divided in Diet (n=25) and Control (n=17) group. The study included three time point measurements: before the weight loss period (PRE), after the 19.8±3.6 weeks of weight loss period (MID) and after the recovery period (POST). The study population was characterized by high fitness level, weight loss was achieved through a combination of increased physical activity and decreased energy intake (~18 %) and increased total amount (MET) of exercise (~15 %). Energy loss was measured using indirect calorimetry and fat and fat-free mass were measured using dual-energy X-ray absorptiometry. 

**RESULTS:** Intensive weight loss in the Diet-group was composed of mainly large (~51 %) decreases in total body fat mass (p <0.001) and the android region (~70 %) reflecting visceral fat mass (p=0.001). This was accomplished by decreased energy intake (~18 %) and increased total amount (MET) of exercise (~15 %). Weight loss affected significantly on several inflammation related biomarkers such as –acid glycoprotein (p=2.47x10^-9) and various HDL-metabolites (p=8.22x10^-12). The reduction of visceral fat mass was significantly correlated with the observed changes in lipid and inflammation biomarker concentration after adjusting for confounding factors. All detected changes in metabolome were reversed back to baseline levels during the recovery period. No changes were observed in the controls.

**CONCLUSIONS:** Intensive weight reduction has positive, but temporary effects on inflammation related biomarkers in female fitness/physique athletes. Decrease in visceral fat mass seems to explain majority of these effects of weight reduction on lipid profile and inflammation related biomarkers.

Supported by Academy of Finland (grant No. 275922 to JH and No. 260517 to MP), Finnish Fitness Sports Association and Department of Biology of Physical Activity.

**F-06** Thematic Poster - Nutritional Status of Athletes II

**2486 Board #1** June 1 1:00 PM - 3:00 PM

The Effects Of Intensive Weight Loss On Metabolome In Female Fitness Competitors

Heikki Sarin
Anni Joensuu
Matti Jauhiainen
Katja Borodulin
Satu Männistö
Joseph Lee
Ville Isola
Juha Ahtialainen
Kjeo Häkkänen
Kati Kristiansson
Juha Huulmi
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National Institute for Health and Welfare, Helsinki, Finland.
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University of Jyväskylä, Jyväskylä, Finland.

(No relevant relationships reported)
eating, a component of the female athlete triad. Overall, female lacrosse players had a significant energy deficit of enough magnitude to suggest that performance may be impaired. Though bone health was not negatively affected in this study, prolonged energy deficit in a similar population could lead to reduced bone mineral density.

Among non-athletes, total energy expenditure (TEE) and physical activity energy expenditure (PAEE) increases over the low and middle range of physical activity, but resting energy expenditure (REE) does not (Ponterz, 2016). However, compensatory metabolic adaptation is found among highly trained athletes (Silva, 2017).

PURPOSE: To clarify the relationship between TEE and its components over a wide range of physical activity levels (PAL) among healthy female athletes. METHODS: Eighty-five healthy female college athletes (short, middle and long distance runners, jumpers, throwers, walkers, swimmers, rhythmic sportive gymnasts, judo players, and lacrosse players) were evaluated during the training season. TEE and REE were assessed by the doubly labelled water method and respirometry, respectively. Total energy intake (TEI) was assessed using 7-day dietary record. PAEE was determined as TEE-0.1(TEE+REE), and PAE was determined as TEE/REE. Among them, 41 athletes were measured for training induced energy expenditure (TIEE) using heart-rate monitoring. Adjusted TEE, REE, TIEE, and TEI were calculated using the residuals of regression analysis to eliminate the effects of fat free mass, fat mass, age and height. Estimated REE (eREE) was calculated using an equation used in Taguchi’s study (2011). RESULTS: Adjusted TEE, PAE, and TEE were significantly positively correlated with PAE (r=0.848, and 0.425, p<.001, and p<.001). Adjusted REE and the difference between TEE and eREE were significantly negatively correlated with PAL (r=-0.531 and -0.468, p<.001 for both). However, adjusted TEI did not correlate significantly with PAL (r=-0.198, p=0.069). CONCLUSIONS: Both higher energy expenditure related to physical activity and/or training and lower REE lead to higher PAL among female athletes. Lowered REE may be caused by insufficient energy intake in relation to high energy expenditure.

Male Athlete Triad (MT), composed of 1) low energy availability (LEA), 2) low bone mineral density (BMD) and 3) decreased reproductive hormones is novel and not established. The impact of LEA in males needs further examination. METHODS: A cross-sectional design of 14 endurance-trained male athletes. Secondary examine: energy intake (EI), exercise energy expenditure (EEE), and macronutrients (carbohydrates [CHO], protein [PRO], and fats). METHODS: A cross-sectional design of 14 endurance-trained male athletes (age: 25.9 ± 4.2 years; weight: 71.1 ± 6.5kg; height: 179.3 ± 4.6cm; VO2max of 63 ± 6mL/min/kg/min) was used. Inclusion criterion included participants training for competition, have >12% body fat and a V0max >24mL/kg/min. Data was collected across 2 training weeks (high volume [HV] and low volume [LV]) and included: dietary logs, exercise logs, and BMI via Dual-Energy X-Ray Absorptiometry. SenseWear Armbands calculated EEE and EI was calculated as EI = (EI-EEE)/FFM. Macronutrients were assessed using ACSM recommendations. LEA was defined as <20kcal/kg/kg FFM. RESULTS: Overall, EI = 2929.4 ± 244.4 kcal; EEE = 1263.4 ± 107.3 kcal; and EA = 25.6 ± 3.2 kcal/kg FFM. A 2 week X 7 days (ANOVA) ANOVA revealed a main effect between the weeks for EA F(1,3)=62.81 (p<.001, r=.833), EI F(1,3)=143.6 (p<.001, r=.923) and EEE F(1,3)=133.8 (p<.001, r=.933). A significant interaction was found between days and EA (p=0.01, r=.355), and EEE (p=0.01, r=.365), as well as between days and EEE p=0.02, r=.441. The average Z-score showed no decrease in BMD (2.3 ± 3.5). Overall, during both HV and LV weeks, participants did not meet the ACSM recommendations for macronutrients. Intakes of CHO were under-consumed (HV: 71.4%; LV: 85.7%), PRO and fats were over-consumed (PRO-HV: 35.7%; LV: 42.9% and fats-HV&LV: 42.9%). CONCLUSION: Overall, males presented with an average EA = 25 kcal/kg FFM and normal BMD. There is evidence (EEE and EI) similar to female research specifically, decreased intake of CHO and overconsumption of PRO and fats. Currently, there is limited knowledge on the physiological outcomes of males participating in high EEE activities with decreased EI intake and the corresponding physiological outcomes. Points for LEA need to be established in the future.

Participation in organized sport at a lower competitive level may protect against disordered eating (DE), whereas exercising in a gym context may increase DE risk. Use of supplements advertised as muscle enhancing is common in both contexts due to the expectancy of performance or appearance enhancement. However, how supplement use (SU) relates to DE is dependent on these two exercise contexts. Future studies should focus on adolescents. No effects were found for other covariates (income, physical activity level and immigration status). CONCLUSION: Boys who reported using protein and creatine supplements and girls who exercised in gyms had higher DE. Interestingly, lower DE in boys was related to both sport and/or gym exercise participation compared to boys not reporting participation in either of the two contexts. Attention and preventive actions should be aimed towards girls engaging in gym exercise, and towards boys who consume protein and creatine supplements, and who do not participate in any of the two exercise contexts. Future studies should however examine how other exercise contexts relates to SU and DE.

Due to the aesthetic demands, Equestrian athletes are at high risks for eating disorders (ED) and in turn may be more susceptible to Female Athlete Triad (Triad) characteristics: low energy availability (LEA) with or without an eating disorder (ED), menstrual cycle dysfunction, and low bone mineral density (BMD). PURPOSE: To examine Female Athlete Triad component risks in NCAAD Division I female equestrian athletes. A secondary purpose examined: resting metabolic rate (RMR) energy intake (EI), exercise energy expenditure (EEE), energy availability (EA) and macronutrient profile of carbohydrates (CHO), protein (PRO), and fats (PRO, CH, and fats). METHODS: Female NCAAD Division I Equestrian athletes (n = 28, age 19.4 ± 1.3 yrs, height 166.2 ± 5.1 cm, weight 61.7 ± 7.1 kg) participated in the study. Participants completed a demographic survey, menstrual cycle questionnaire, Eating Disorder Inventory-3, ED symptoms checklist, a 7 day online dietary and exercise log. Participants were measured for height, weight, DXA scan (BMD), and RMR through indirect calorimetry (Indirect). Exercise energy expenditure was calculated using time spent in activity and total energy expenditure was calculated by EA = (EI-EEE)/free fat mass. Macronutrients (CHO, PRO, and fats) were assessed using ACSM recommendations. RESULTS: Overall, Triad component risk showed 78.6% (n = 22) equestrian athletes had 1 component and 7.1% (n = 2) had 2 components. A 41% reduction in DE risk was observed. 82% of athletes who reported DE compared to those with LEA also presented with ED risk, while 17.8% (n = 5) reported LEA without ED risk. Energy assessment included: RMR = 1441.0 ± 227.9 kcal/day; EI = 1401.6 ± 421.8 kcal/day; EEE = 403.2 ± 161.9 kcal/day, and EA = 21.9 ± 9.9 kcal/kg FFM.
day. Regarding macronutrient profile, 96.2% (n = 26) athletes reported under the recommendations for CHO intake, 74.1% (n = 20) were under the recommended PRO intake, and 81.2% (n = 22) were within the recommendations for fat intake while 18.8% were over the fat recommendations. CONCLUSION: Majority of Equestrian athletes were at risk for at least 1 Triad component and LEA with ED risk was prevalent; thus raising concern for the at large population of Equestrian athletes. Recognition and intervention of Triad components can prevent long lasting health issues and protect the longevity of equestrian athlete’s careers and level of performance.

F-07 Thematic Poster - Physical Activity and Healthy Aging
Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100E

2494 Chair: Loretta DiPietro, FACSM. The George Washington University School of Public Health and Health Services, Washington, DC.
(No relevant relationships reported)

2495 Board #1
June 1 1:00 PM - 3:00 PM
Gender-Specific Effects in Cognition and Mobility Following Exercise in Older Adults at Risk for Dementia
Narlon C. Boa Sorte Silva, Dawn P. Gill, Ashleigh De Cruz, Robert J. Petrella, FACSM, FACSM, Western University, London, ON, Canada. (Sponsor: Robert J Petrella, FACSM)
(No relevant relationships reported)

Purpose: To investigate gender-specific adaptations following a 24-week multiple-modality exercise intervention with additional mind-motor training on cognition and mobility.

Methods: Older adults (n = 127, age = 67.5 ± 7.3 yr; 71% women) were randomized to a 45-min multiple-modality exercise intervention with additional 15 minutes of either mind-motor training (M4 group) or an active control intervention (15 minutes of balance, range of motion and breathing exercises, [M2 group]). Assessment occurred at baseline, 24 weeks (intervention endpoint), and 52 weeks (after a 28-week no-contact follow-up). The study outcomes were: cognition (global cognitive functioning [GCF], concentration, reasoning, planning, and memory), and mobility (usual and dual-task gait velocity, step length and variability). Mixed between-within subjects ANOVA was conducted to assess differences between treatment groups (M4 vs M2) and gender (men vs women); ii) interactions of time x intervention group, and time x gender.

RESULTS: At 24 vs, trends for greater improvements in GCF and memory favouring M4 (both p<.08) were observed, with no interaction effects for gender. For usual gait, M2 showed greater velocity (p=.001) and step length (p=.003), compared to M4. For dual-task gait, M2 showed greater improvements in velocity (p=.04), and trends for significant improvements in variability (p=.05). Gender-specific effects were observed for dual-task step length favouring women (p=.01). Results at 52 weeks: M4 showed greater improvements in GCF (p=.02) and memory (p=.03), compared to M2. As well, trends for gender-specific effects were observed in memory favouring women (p=.06). For usual gait, M2 retained improvements in velocity (p=.03), compared to M4. For dual-task gait, gender-specific effects were observed in dual-task step length favouring women (p=.03).

Conclusion: Additional mind-motor training compared to an active control intervention showed trends for greater benefits to cognition; however, it did not affect gait performance. Overall, gender-specific effects were seen for memory and dual-task step length across groups, suggesting that women benefited more from exercise compared to men, and were able to retain these improvements after a no-contact follow-up. Funding: CIHR MOP 130474

2496 Board #2
June 1 1:00 PM - 3:00 PM
Effects of Tai Chi on Beta Endorphin and Inflammatory Markers In Older Adults with Chronic Pain
(No relevant relationships reported)

Musculoskeletal pain is associated with dysfunction of the opioid analgesic system and elevated inflammation in older adults. PURPOSE: To examine the effects of Tai Chi on blood levels of beta endorphin and inflammatory markers in older adults with chronic pain. METHODS: Forty community-dwelling older adults (≥65 years) with multisite pain were randomly assigned to light physical exercise or Tai Chi, each offered twice weekly for 12 weeks. Plasma levels of beta endorphin, C-reactive protein (CRP), interleukin 6 (IL-6), and tumor necrosis factor alpha (TNF-α) were assessed at baseline and within 2 weeks after completing the intervention. Paired t-tests were used to assess changes of log-transformed beta endorphin and inflammatory markers within each group, and pairwise t-tests were used to assess differences between groups. RESULTS: Twenty-one participants in the light physical exercise group and nineteen participants in the Tai Chi group provided blood samples. Following the 12-week intervention, neither light physical exercise nor Tai Chi changed levels of beta endorphin and inflammatory markers. However, in older adults who completed 70% or more classes, Tai Chi significantly lowered beta endorphin (p<.05) from baseline to post-intervention, whereas light physical exercise did not change levels of beta endorphin. CONCLUSION: Tai Chi tended to reduce levels of beta endorphin but did not affect levels of inflammatory markers in older adults with chronic pain. Future studies need to focus on the role of the opioid analgesic system and immune system in regulating pain with aging and the long-term effects of Tai Chi on pain-related biomarkers. (Supported by National Institutes of Health R21 AG043383)

2497 Board #3
June 1 1:00 PM - 3:00 PM
A Comparison Of Two Community Based Exercise Interventions For Reducing Falls Risk In Older Adults
Jessica Pope1, Steven Morrison2, Amanda Estep1, Shane Caswell1, Jatin Ambegaonkar1, Kathryn Helwig1, Nelson Cortes1. 1George Mason University, Manassas, VA. 2Old Dominion University, Norfolk, VA.
(No relevant relationships reported)

Falls are a major health problem for older adults with a reported 1/3 people over the age of 65 likely to suffer a fall in a given year. Exercise interventions have improved muscle strength and reaction time in older adults. Many interventions have occurred in a controlled setting. Further research is needed to evaluate the impact of fall prevention programs conducted in community settings to improve falls risk factors.

PURPOSE: To compare the effects of two interventions (INT): The Lebed Method (TLM) and Staying Active and Independent for Life (SAIL) on right and left leg strength (RLS & LLS), foot and hand reaction time (FRT & HRT), and timed up and go (TUG) in older adults in community venues.

METHODS: 74 and 103 older adults participated in TLM and SAIL (73±8 years, 1.61±.1 m, 82±17.1 kg; 71±7 years, 1.61±.1 m, 80±19 kg, respectively). TLM, a dance therapy program, was implemented for 8 weeks, 1h, 2x/week. SAIL included aerobics, balance, strength, and stretching exercises and lasted 10 weeks, 1h, 3x/week. RLS & LLS (kg), FRT & HRT (ms), and TUG (s) were assessed pre & post INT (time). A 2-way factorial MANOVA was conducted to assess differences between time and INT.

RESULTS: A significant interaction was observed for LLS (p<.005). LLS improved from pre to post for TLM (pre=14.3±7, post=20±2.6±7) and SAIL (pre=20±6.2, post=18±2.6±3). Only main effects were attained for remaining variables (p>.05). All participants were faster (TUG, pre=1±4, post=8±2.3±1.1), improved FRT (pre=336±91, post=327±101) & HRT (pre=282±87, post=277±86). Faster HRT and FRT were seen for SAIL (319±96, 269±87) compared to TLM (356±90, 298±83). RLS & LLS increased from pre (16±4.7, 16±6.9) to post (20±7.1, 20±6.9). Leg strength was greater in SAIL (RLS=19±3.7, LLS=19±4.6±4) than TLM (RLS=16±6±1, LLS=16±9.8).

CONCLUSION: While both interventions were effective at improving leg strength and reaction time, SAIL had the greatest improvements. SAIL includes exercise and music like TLM but was developed for general population, yielding an attractive program while addressing specific modifiable risk factors. Future studies should investigate long-term retention of benefits following intervention, tracking changes in balance, activity level, and number of falls. Supported by grant from Potomac Health Foundation.

2498 Board #4
June 1 1:00 PM - 3:00 PM
Square-stepping Exercise For Older Adults With Chronic Disease To Improve Cognition and Mobility
(No relevant relationships reported)

Square-stepping exercise (SSE) is a visuospatial working memory task with a cued stepping response that improves mobility and cognition in older adults. PURPOSE: To examine the effects of SSE on blood levels of beta endorphin and inflammatory markers in older adults with chronic pain. METHODS: Forty community-dwelling older adults (≥65 years) with multisite pain were randomly assigned to light physical exercise or Tai Chi, each offered twice weekly for 12 weeks. Plasma levels of beta endorphin, C-reactive protein (CRP), interleukin 6 (IL-6), and tumor necrosis factor alpha (TNF-α) were assessed at baseline and within 2 weeks after completing the intervention. Paired t-tests were used to assess changes of log-transformed beta endorphin and inflammatory markers within each group, and pairwise t-tests were used to assess differences between groups. RESULTS: Twenty-one participants in the light physical exercise group and nineteen participants in the Tai Chi group provided blood samples. Following the 12-week intervention, neither light physical exercise nor Tai Chi changed levels of beta endorphin and inflammatory markers. However, in older adults who completed 70% or more classes, Tai Chi significantly lowered beta endorphin (p<.05) from baseline to post-intervention, whereas light physical exercise did not change levels of beta endorphin. CONCLUSION: Tai Chi tended to reduce levels of beta endorphin but did not affect levels of inflammatory markers in older adults with chronic pain. Future studies need to focus on the role of the opioid analgesic system and immune system in regulating pain with aging and the long-term effects of Tai Chi on pain-related biomarkers. (Supported by National Institutes of Health R21 AG043383)
Results: The average age of the 402 subjects read 74.5±6.0 years old. The 50 percentile of each physical fitness assessment were listed as such: body mass index 24.1 kg/m2, percent body fat 20.6%, percent fat-free mass 33.9%, 5.5 time sit and stand 11.2 sec, 3-s chair stand test 14 time, open-eye stand on right foot 19.6 sec, chair sit-and-reach test -1.2 cm, and 8-feet walking test 8.0 sec. All physical fitness performance was observed to decrease with aging.

Conclusions: Elderly males in different age groups demonstrate different levels of physical performance and this is indicated by the disparities in the normative physical fitness scores, and it seems sensible to adopt different normative physical fitness scores for elderly males living in rural and urban areas.

High-intensity interval training has been shown to improve health/fitness factors in adults. Evidence is limited in older adults with chronic disease and increased risk for exercise-related complications and for resistance training modes. PURPOSE: Assess the efficacy (aerobic and functional fitness) and safety of high-intensity resistance and sprint-cycle interval training in at-risk older adults. METHODS: Forty-eight participants (30 women; 69.6 years; 28.0±5.5 kg/m2; 60% with ≥2 chronic diseases) trained 3 days/week for 6 weeks. Participants were randomized to conditions: 1) high-intensity sprint interval cycle training (SIT; N=17); 2) high-intensity resistance training (HIRT; N=20); or 3) moderate-intensity continuous aerobic exercise (MICE; active control; N=11). Baseline and post-training measures included: maximal aerobic capacity (VO_2\text{max}); body density (BMD); body composition (BIA); and submaximal aerobic test performance (cycle ergometer, treadmill). RESULTS: VO_2\text{max} improved similarly in all groups (SIT: 1.78±0.66 ml/kg/min; HIRT: 1.86±0.69 ml/kg/min; MICE: 1.68±0.68 ml/kg/min; all p<0.01). Both high-intensity groups improved in FIT (HIRT: +17%; p<0.01; SIT: +12%; p<0.05) and FMS (HIRT: +17%; p<0.01; SIT: +10%; p<0.01). Only HIRT improved in TUG (10.6%) and balance (9%). Perceived satisfaction with physical performance improved in all groups (HIRT: +38%; SIT: +26%; MICE: +17%; all p<0.01) similarly high overall enjoyment (5.8-6.3 out of 7; p<0.05). No injuries or adverse events occurred with training. CONCLUSION: HIRT and SIT required less time (~28 minutes) than MICE guidelines, elicited equivalent gains in aerobic fitness, and appear to be safe for older adults with chronic disease. Additional functional fitness benefits (mobility and FMS) accompanied high-intensity training (SIT/HIRT). HIRT elicited improvements in mobility, balance, and 4 of 7 FMS measures compared to SIT (2 of 7 FMS measures). These HIRT specific gains are associated with enhanced independence and ability to perform activities of daily living. Future studies should confirm these findings and assess longer training durations.

PURPOSE: Endurance walk test performance is a powerful predictor of future mobility limitation and decline in older adults; whether other test parameters such as heart rate increase and post-test recovery provide useful metrics of resiliency has received limited attention. METHODS: Using data on 784 well-functioning (able to walk 400 m quickly without stopping, not taking beta blockers) men (47%) and women aged 60 to 94 years participating in the Baltimore Longitudinal Study of Aging, we examined heart rate increase (HR-I) from a resting state immediately after completing a fast-paced 400m walk and HR recovery (HR-R; HR decline 2-minutes post-test completion) in relation to 400m walk time, usual speed and reported ability to walk up to 1 mile at baseline and at follow-up an average of 2.1 years later. RESULTS: At baseline, independent of age, sex, race, height and reported exercise, HR-I (b~1.02; p<0.01) and HR-R (b~1.12; p<0.01) in separate models were negatively associated with 400m time; that is higher HR was associated with better performance; whereas, for a given 400m time, HR-I and HR-R were associated with worse baseline reported walking ability (b~0.07; p<0.01 and -0.01; p<0.02). Longitudinally, higher HR-I and HR-R predicted slower follow-up 400m time and poorer reported walking ability independent of baseline values (b~0.19; p<0.003 and b~0.24; p<0.007; b~0.10; p<0.007 and -0.01; p<0.01). No associations were observed between HR-I or HR-R and baseline or
follow-up usual gait speed. CONCLUSION: In well-functioning older adults, better heart rate response equates with better endurance walk performance, but for a given performance, higher heart rate response predicts worse concurrent reported walking ability and poorer future endurance walk performance and reported ability. Including heart rate response to endurance walk testing which is typically collected for safety monitoring may improve predictive models of future functional status.

PURPOSE: To determine if exercise intensity has a significant effect on the relation between regional (REG) sweat [Na+] and whole body (WB) sweat [Na+]. METHODS: Eleven recreational endurance athletes (7 men, 4 women; 71.5±8.4 kg; 28-40 yr) completed two randomized trials cycling for 90 min at 65% of HRmax (LOW, 109±20 Watts) or 85% of HRmax (HIGH, 169±27 Watts) in a plastic isolation chamber to determine WB sweat [Na+] using the washdown technique. REG sweat was collected from the dorsal and ventral forearm, dorsal and ventral wrists, triceps, upper chest, scapulas, lower back, ventral thighs, calves, and forehead using absorbent patches. REG and WB sweat [Na+] were measured via ion chromatography. An 11-site aggregate of REG sweat [Na+] was calculated from the surface area weighted mean of all sites. Room temperature (30.1±0.3°C vs. 30.1±0.2°C) and relative humidity (43.0±1.1% vs. 43.6±1.5%) were consistent between trials. Subjects consumed a standardized meal and drank 500 mL of water 2 h before trials. Paired t-tests were used to compare measures at LOW and HIGH intensity. Linear regression and Pearson correlation were used to compare REG and WB sweat [Na+]. RESULTS: WB sweat rate (0.516±0.077 g/min vs. 0.764±0.133 g/min; p<0.001) and WB sweat [Na+] (32.6±14.3 mmol/L vs. 52.7±14.6 mmol/L; p<0.001) increased from LOW to HIGH. REG sweat [Na+] increased (p<0.05) from LOW to HIGH at all sites except the thigh (p=0.13) and calf (p=0.18). The ratio between REG and WB sweat [Na+] was greater at LOW vs. HIGH for the thigh (1.03±0.20 vs. 0.83±0.17; p<0.02) and lower back (1.29±0.25 vs. 1.08±0.19; p<0.04), but there were no differences between intensities at any other site, including the 11-site aggregate (1.28±0.20 vs. 1.22±0.16; p=0.45). There was a significant correlation between REG and WB sweat [Na+] at each of the 11 sites for both LOW (r=0.70-0.92; p<0.003) and HIGH (r=0.68-0.93; p<0.05).

CONCLUSIONS: These findings suggest that for most sites REG and WB sweat [Na+] increase proportionally with an increase in exercise intensity. Thus, in general the relation between REG and WB sweat [Na+] is consistent across exercise intensities. While more research is needed, it seems that regression equations can be used to predict REG sweat [Na+] from most REG sites irrespective of intensity when exercising between 65 and 85% HRmax.

Sweating: These findings suggest that for most sites REG and WB sweat [Na+] increase proportionally with an increase in exercise intensity. Thus, in general the relation between REG and WB sweat [Na+] is consistent across exercise intensities. While more research is needed, it seems that regression equations can be used to predict REG sweat [Na+] from most REG sites irrespective of intensity when exercising between 65 and 85% HRmax.

PURPOSE: To investigate RSR and distribution at 35 sports, season, and intensity). There were still significant differences (ANOVA, Tukey’s post hoc; p<0.05) in the adjusted means for RSR and rate of sweat Na+ loss; endurance (1.2 L/h, 43.1 mmol/L), football (1.0 L/h, 38.2 mmol/L) and soccer (1.0 L/h, 35.4 mmol/L) were higher than basketball (0.8 L/h, 25.5 mmol/L), and endurance was higher than basketball (0.9 L/h, 32.0 mmol/L). CONCLUSION: This study suggests the potential for significant variation in the rate of sweat fluid and Na+ losses between sports, with highest values generally occurring in endurance and American football. There are already products targeted to meet the needs of endurance athletes to replace their higher sweat fluid and electrolyte losses; perhaps there is also a need for products and education specific to other sports.

Acrobatic training increases gross and regional sweating rates (RSR) allowing improved evaporative heat loss. Variation in RSR are widely recognized, but limited RSR data and implications for thermoregulation are available in untrained individuals. PURPOSE: Our aim was to investigate RSR and distribution at 35 sites in young, untrained males (UT) versus endurance-trained male athletes (TR) during exercise-induced hyperthermia in a moderate environment. METHODS: Six young, healthy, untrained males (UT; 42 ± 2 yrs, VO2 max 42 ± 9 mL/kg.min-1, 1.8 ± 0.3 m.s-1 running velocity) and acrobatically trained male athletes (23 ± 3 yrs, VO2 max 70 ± 2.3 L.min-1) ran for 60 minutes in 25.6 ± 4.5°C, 48.5 ± 0.5% relative humidity, and a 1 m.s-1 air velocity. RSR were measured at two exercise intensities (11%, 60% VO2 max; TR, 75% VO2 max) using a modified absorbent technique. RESULTS: Core temperature was similar between groups at all stages (P>0.05). GSL was significantly higher in TR versus UT at I1 and I2 (11: TR 365 ± 84, UT 157 ± 66 g.m-2.h-1, P<0.001; 12: TR 657 ± 119, UT 311 ± 93 g.m-2.h-1, P<0.001), reflecting a significantly higher absolute work rate in TR versus UT (p<0.01). Absolute RSR were significantly higher in TR versus UT at 28 of 35 regions at I1 and 31 of 35 regions at I2. Highest RSR were observed on the central regions (I1 UT 797 ± 250, I2 UT 777 ± 120 g.m-2.h-1, I2 TR 1319 ± 364, I3 1365 ± 448 g.m-2.h-1), with lowest values on the palms (I1 98 ± 58, I2 124 ± 53, g.m-2.h-1) and anterior upper arms in UT (I1 33 ± 24, I2 71 ± 30 g.m-2.h-1). Both groups showed a medial to lateral decrease in RSR on the posterior torso, and proximal to distal increase on the arms. Normalized ratio values were significantly different between groups at 4 and 6 sites out of 35 at I1 and I2, respectively, none of which were significant following Bonferroni correction. No correlation was observed between RSR and local skin temperature in either group. CONCLUSIONS: These data provide the most detailed exercise-induced RSR for untrained males, showing large RSR variation. Despite significant differences in GSL and absolute RSR, normalized data suggest no significant differences in distribution of sweat between groups. Male athletes demonstrated superior thermoregulation, with similar Tcore and Tsk values despite a higher absolute workload. Funded by the Adidas Innovation Team.
Previous research has measured the amount of sweat absorbed in basketball uniforms during exercise, but data are limited in other sports. **Purpose:** To determine the amount of trapped sweat (TS) in various sports uniforms during sport-specific, laboratory-based methods. **Methods:** Eleven male (30 ± 5 years, 75.7 ± 5.2 kg) and 6 female (29 ± 4 years, 59.9 ± 9.9 kg) moderately-trained athletes completed 3 trials consisting of 120 min intermittent sport-specific exercise in standard uniforms for various sports, including football (n=9 men), basketball (n=4 men, 5 women), soccer (n=4 men, 5 women), baseball/softball (n=4 men, 4 women), and endurance (n=5 men, 4 women) in a temperature-controlled laboratory (basketball: 25°C, 55% rh; all other sports: 30°C, 55% rh). Protocols were designed to simulate the demands of each sport (endurance: 82 ± 5% HRmax, RPE 13 ± 2; football: 75 ± 10% HRmax, RPE 13 ± 1; soccer: 77 ± 10% HRmax, RPE 12 ± 2; basketball: 66 ± 12% HRmax, RPE 10 ± 2; and baseball/softball: 59 ± 3% HRmax, RPE 9 ± 2). Sweat loss (SL) was determined from change in nude body mass corrected for fluid intake, urine loss, respiratory water loss, and metabolic mass loss. Nude and clothed body mass were measured pre- and post-exercise to determine TS. Analysis of variance followed by Tukey’s post hoc test was used to compare sports. Data are mean ± SD. **Results:** There were significant differences in SL between sports (football: 2.61 ± 0.36 kg, endurance: 2.18 ± 0.53 kg, and soccer: 1.99 ± 0.81 kg) > (basketball: 1.24 ± 0.37 kg) > (softball: 1.19 ± 0.38 kg). There were also significant differences in TS (p<0.001): football (0.58 ± 0.14 kg) > (endurance: 0.28 ± 0.16 kg) > soccer (0.24 ± 0.18 kg) > basketball (0.11 ± 0.08 kg) > softball (0.15 ± 0.12 kg), TS as a percentage of SL was: football (Ex3) (30.7% ± 0.5%); a higher in football (22.5 ± 3.8%) > than endurance (12.2 ± 4.7%); soccer (10.9 ± 3.4%); basketball (9.2 ± 4.5%); and baseball/softball (10.8 ± 6.2%). **Conclusion:** Sports with higher SL were associated with higher volumes of TS in uniforms. The football uniform (including full pads) led to the most TS and greatest underestimations in SL. Such high volumes of TS are also likely to have ramifications for evaporative heat loss capacity and therefore warrant future research investigating the effects of TS on thermoregulation.
Multiple Sclerosis (MS) is a demyelinating disease of the central nervous system (CNS). There are two major sub-types of MS: non-progressive (NP) and progressive (P). NP is characterized by intermittent exacerbations of symptoms, followed by a return to near baseline. P is characterized by a steadily worsening of symptoms. Many people who are diagnosed as NP will transition to P. Both NP and P result in sensorimotor impairments that can lead to poor mobility and decreased quality of life. PURPOSE: A sensitive, non-ambulatory measure of sensorimotor function that can predict the transition from NP to P could be useful in the clinical management of MS. METHODS: Sensorimotor function of 19 control (CON; 14 women, 55.6±13.9 yrs), 31 NP (28 women, 52.6±9.9), and 29 P (20 women, 59.4±9.1) participants was assessed. Vibration threshold was measured with a Biothesiometer at three locations on the plantar surface of the non-dominant (CON) or most-affected (NP, P) foot. Proprioception was measured at the ankle with a manipulandum, using a position-matching task. Mobility measures included the 25-foot-walk (25FWT) and the Timed-Up-and-Go (TUG). Data were analyzed across and between groups using a one-factor ANOVA and post-hoc pairwise t-tests, respectively, with significance established at p <0.05. RESULTS: There was a main effect of group for all outcome variables. Vibration threshold distinguished NP from P in that these differed across those groups. Neither mobility measure nor proprioception at the ankle distinguished the 2 MS sub-types.

<table>
<thead>
<tr>
<th></th>
<th>CON (n=19)</th>
<th>NP (n=31)</th>
<th>P (n=29)</th>
<th>ANOVA p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Toe (v)²</td>
<td>12.74±10.97</td>
<td>15.63±13.79</td>
<td>26.11±15.52</td>
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</tr>
<tr>
<td>5ⁿ Metatarsal (v)²</td>
<td>9.47±7.97</td>
<td>13.97±13.34</td>
<td>27.19±16.92</td>
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</tr>
<tr>
<td>Heel (v)²</td>
<td>12.16±11.85</td>
<td>15.45±12.70</td>
<td>28.07±16.39</td>
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<tr>
<td>Proprioception (αº)</td>
<td>1.85±1.20</td>
<td>4.53±4.48</td>
<td>5.11±3.76</td>
<td>0.001</td>
</tr>
<tr>
<td>25FWT (s)²</td>
<td>5.12±0.50</td>
<td>8.44±4.88</td>
<td>10.07±4.56</td>
<td>0.001</td>
</tr>
<tr>
<td>TUG (s)³</td>
<td>6.89±1.17</td>
<td>11.90±7.10</td>
<td>13.95±5.84</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 1. Data are mean±SD. Significant differences: *CON vs. NP; **CON vs. P; ***NP vs. P

CONCLUSION: Vibration threshold may be a promising outcome variable for discriminating among individuals with NP and P MS sub-types. This could be useful in a clinical setting for cross-sectional comparisons of NP and P, as well as to detect transitions from NP to P in longitudinal studies.

Supported by Department of Defense Grant W81XWH-16-1-0351

Hamstring injuries (HI) are the most common muscle injuries in both professional and amateur soccer. With the introduction of the effective Nordic hamstring exercise (NHE), a decrease of hamstring injuries was expected. Nevertheless, an annual increase of HI is seen in the last decade. This might be due to poor compliance. Arguments for non-compliance are among others, that the NHE is not soccer-specific enough. Therefore, we developed the Bounding Exercise Programme (BEP) as an alternative. It is a sport-specific exercise programme which includes concentric, eccentric and plyometric exercises. PURPOSE: To determine the preventive effect of the Bounding Exercise Programme on hamstring injury occurrence in adult amateur male soccer players.

METHODS: Soccer teams (N=32) competing on first class amateur level, were cluster-randomized to the intervention or control group. Both groups were instructed to perform their regular training programme, and the intervention group was also instructed to perform the BEP during the whole competition. At baseline, player characteristics were gathered from all participants. During the competition 2016-2017 all players weekly registered exposure (minutes) and HI occurrence. Compliance (number of BEP) was reported by all players in the intervention group.

RESULTS: 588 male soccer players (24.7±4.5 yrs old) participated in this study. A total of 65 HI were reported within one competition. The overall HI incidence was 1.39 per 1000 soccer hours for the control group and 1.12 per 1000 soccer hours for the intervention group.

Analysis of intention to treat showed no statistical significant difference between both groups in occurrence of HI (OR =0.89, 95% CI 0.459-1.747) and no significant difference in time to first HI (HR =0.90 ,CI = 0.478-1.695). There was also no effect found of adherence to BEP for the occurrence of HI and time to first HI.

CONCLUSIONS: Our study showed no benefit of BEP over regular soccer on preventing HI in amateur soccer players. Compliance for BEP was moderate (on average 71%). This study was supported by a grant from the Netherlands Organization for Health Research and Development and the Royal Netherlands Football Association, was approved by the Medical Ethics Committee of UMC Utrecht (16-332/C) and is registered in the Dutch Trial Registry (NTR6129).
BACKGROUND: Following anterior cruciate ligament reconstruction (ACLR) surgery, lower extremity recovery of the uninjured limb >90% is commonly recommended for clearance to return to sport (RTS). However, evidence regarding the timing of achieving such a recovery is lacking, especially in skeletally immature populations. PURPOSE: To examine the proportion of pediatric ACLR patients (<15 years) who achieve >90% of lower extremity recovery at 6-9 months following ACLR surgery. METHODS: Bilateral strength (quadriceps, hamstrings, hip abductor, and hip extensor), Y-balance (anterior, posterior-medial, and posterior-lateral reach), and hop (single, triple, cross-over, and 6-meter timed) tests were assessed. Descriptive statistics (%) were employed. Additionally, sub-groups were analyzed according to sex and technique/autograft type: males with transphyseal quadruplace hamstrings (Male-HS), females with transphyseal quadrupace hamstrings (Female-HS), and males with extra/ intra-compartmental physical-sparring iliotibial band (Male-ITB) using chi-square (χ²) test with p<0.05. RESULTS: A total of 93 pediatric ACLR patients (Male-HS: N=21, age=13.6±1.0, Female-HS: N=33, age=13.4±0.7, Male-ITB: N=39, age=12.5±1.3) were enrolled. Time from ACLR to RTP testing was 6.9±3.4 months. The proportion of pediatric ACLR patients, overall, achieving >90% of strength was: 76.3% in quadriceps, 19.1% in hamstrings, 79.6% in hip abductors, and 82.6% in hip extensors. Y-balance test resulted 82.6% in anterior reach, 83.9% in posterior-medial reach, and 89.1% in posterolateral reach. Hop test indicated 62.5% in single hop, 72.9% in triple hops, 56.5% in cross-over hops, and 71.4% in 6 meter timed hops. Y analysis identified a difference in hamstrings strength, which showed a lower proportion of >90% recovery in Male-HS (23.8%) and Female-HS (15.6%) compared to Male-ITB (66.7%, p=0.01). CONCLUSIONS: Approximately 7 months following ACLR, more than 3/4 of the patients achieved >90% of quadriceps, hip abductor, and hip extensor strength, but not hamstrings strength. While over 4/5 of the patients performed >90% in Y-balance, less than 3/4 achieve >90% on hop tests. graft type markedly influences hamstrings strength. Less than 1/5 (18.9%) of Male-HS and Female-HS reached >90% compared to 2/3 (66.7%) in Male-ITB patients.

INTRODUCTION: Degenerative hip osteoarthritis (OA) is a common progressive disorder causing disability. The injection of exogenous hyaluronic acid (HA), or viscosupplementation (VS), can potentially help restore the properties of synovial fluid. There is limited literature available evaluating the long-term efficacy and functional impact of VS in hip OA. PURPOSE: To determine if a single intra-articular injection of a high-molecular weight (HMW) VS would improve function and decrease pain in persons suffering from hip OA. METHODS: A double-blind randomized control trial was conducted at a University Hospital Center in Canada. Patients were randomly allocated to either the treatment group, an ultrasound guided single intra-articular injection of a HMW HA, or the placebo group, a single extra-articular injection of local anesthetic. Participants underwent evaluations at 2 weeks prior to the injection (T0), and at 1 month (T1), 3 months (T2) and 6 months (T3) post injection. Participants completed two questionnaires; the Hip Disability and Osteoarthritis Outcome Score (HOOS) and Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC). Hip gait mechanics were evaluated in a lab. RESULTS: Between May 2014 and September 2017, 38 participants were evaluated in this study over the course of 6 months. In the treatment group, N = 19 and in the placebo group, N = 18. The mean age at the time of injection was 55. On the HOOS symptom subscale, the placebo group worsened from T0 to T3 by 6.29% compared to the treatment group. The VS group improved their pain subtotal by 5.29% while the placebo group worsened by 5.15%. The most important change occurred in the sports and recreational subscale of the HOOS. Between T0 and T3, the placebo group worsened by 17.82%. The treatment group improved by 6.67%. CONCLUSION: Our preliminary results suggest that a HMW VS hip injection for degenerative OA, when compared to true placebo, may lead to long-term improvements in pain relief, increase in function and in activity participation. NIH Clinical Trials Registry: NCT02069674

Background: In young athletes, the prevalence (6%) of bronchial asthma among adolescent players which was more than 1-5% of the worldwide population suffer from OA, however the prevalence within athletes is largely unknown. PURPOSE: To characterize the prevalence of OA within a team of professional rugby league athletes. METHODS: 22 professional rugby league athletes underwent one night of home-based polysomnography, with apnea-hypopnea index (AHI) used to indicate the presence and severity of OA. Linear models were used to determine if playing position (back, forward), ethnicity (European-Australian, Polynesian) or body composition influenced the prevalence or severity of OA. RESULTS: 10 cases of OA were found. When considering ethnicity, a likely moderate difference was observed between Polynesians and European-Australians for AHI during rapid eye movement sleep (ES = 0.94; ±0.77, p<0.05). Differences between forwards and backs were unclear (ES = 0.44; ±0.77, p=0.05). Increased BMI (ES = 0.83; ±0.77, p≤0.05) and skinfold thickness (ES = 0.87; ±0.49, p≤0.05) were associated with increased AHI. CONCLUSION: Within professional rugby league athletes, Polynesians may be more susceptibility to OA than European-Australians. Furthermore, our data suggests that athletes with greater BMI and skinfold thickness may be predisposed to the existence of OA.

Undetected cardiovascular abnormalities are one of the major causes of sudden death in young athletes. Currently we lack data on this field in Sri Lanka. PURPOSE: To determine the prevalence of cardiovascular disease among the adolescent players and the cardiovascular risks for participating in marathon. METHODS: Research was conducted in three sports medicine clinics selected from the hospitals of three main provinces in the country including Western, Southern and Central provinces where sports medical officers’ conducted pre participation medical screening of players and documented in Pre participation Examination (PPE) forms. Study population consisted of adolescent players aged between 10 to 19y who attended previously mentioned clinics for medical clearance prior to the marathon run. Physically challenged players were excluded. Sample was selected from January 2015 to August 2015. The sample size was 900. Convenient cluster sampling method was incorporated. Pretesting was done which lead to the amendments in the Data extraction sheet. Secondary data were collected from the PPE forms from the clinics. A cross-sectional analytical study was conducted to determine the prevalence and the associated factors of cardiovascular disease: RESULTS: Prevalence of cardiovascular diseases among adolescent players in Sri Lanka according to our study was 2.3%. Most common cardiac abnormality was Mitral Valve Prolapse. Mitral Stenosis, Ventricular Septal Defect and Aortic Stenosis were the other cardiac abnormalities detected. Important incidental finding of our study was a higher prevalence (6%) of bronchial asthma among adolescent players which was more than the cardiovascular disease. CONCLUSION: Properly conducted Pre participation screening reveals underlying cardiovascular disease and it may be used as a tool to identify cardiovascular risks for participation in marathon among adolescent players and hence reduce sudden cardiac death incidents.
Increased carotid intima-media thickness (CIMT) is accepted as an early indicator for the development of atherothrombotic coronary artery disease (CAD). The presence of metabolic syndrome (MetS) in adults is shown to have a negative influence on CIMT and thus CAD. As obesity rates increase in children, which elevates the risk of MetS, it is unclear how this might alter a child’s CIMT.

**PURPOSE:** To determine if children with MetS are at a greater risk of an increased CIMT.

**METHODS:** Two hundred and twenty-one children had their CIMT assessed. In addition, all subjects completed a fasting blood lipid and glucose profile, waist circumference (WC) and resting blood pressure to evaluate MetS risk factors. A licensed sonographer completed scans on the right and left common carotid artery using the Terason 5200 ultrasound unit with a linear transducer probe. CIMT was measured using the software The Carotid Analyzer for Research Version 6. To evaluate the effect of MetS on CIMT, the students were categorized into three groups: 0 MetS Risk Factors (n=73), elevated WC (>90th, n=51) and only MetS (n=11). A random sample of 11 subjects were chosen from the first two groups.

**RESULTS:** A total of 33 students with an age of 10.5±0.51, height 150±0.80cm, and weight 55.7±16.1kg participated in the study. An increase in the right, left and combined CIMT’s were observed in children with MetS (0.554±0.023 (p<0.005), 0.552±0.019 (p<0.005), and 0.552±0.016 (p<0.0001), respectively) and elevated WC only (0.552±0.017, p<0.005, 0.551±0.023 (p<0.005), and 0.551±0.018 (p<0.005), respectively). Vs children with 0 risk factors (0.532±0.004, 0.531±0.009, and 0.531±0.005, respectively). When comparing the elevated WC only group to the MetS group, there was no difference in CIMT.

**CONCLUSIONS:** It appears MetS negatively impacts CIMT, however an elevated WC by itself negatively impacts CIMT. Early identification of children with an elevated WC may be beneficial in identifying children at risk for premature cardiovascular disease. Assessment of CIMT in children with an elevated WC may help motivate families to make positive lifestyle modifications.

Funding provided by Clark Charitable Foundation, Washington, DC & Department of Pharmaceutical Sciences, School of Pharmacy and Pharmaceutical Sciences, Binghamton University, Binghamton, NY.

F-10

**Free Communication/Slide - Cardiometabolic Health**

**PURPOSE:** To determine the effects of oral ingestion of BPA on glucose, insulin, and estrogen responses.

**METHODS:** After an overnight fast, ten healthy college students (7W, 3M; 40% Hispanic, 21.0±0.8 yrs; 24.2±3.9 kg/m²) were randomized to either 2-wks of a LCD (~1200 kcal/day) or an energy matched LCD+INT intervention (supervised: 60-min/d alternating 3-min at 90 and 50% VO2peak). VO2peak and body fat were assessed before and after interventions. After an overnight fasting, a 120-min 75% oral glucose tolerance test (OGTT) with blood samples every 30-min was performed, and glucose, insulin, and C-peptide were used to define glucose-stimulated insulin secretion (GISIS: Δinsulin/Δglucose), hepatic clearance (HC: ΔUCOS/ΔUCOG), and β-cell function (Disposition Index [DI: IGI x Matsuda Index]).

**RESULTS:** To examine the impact of a low-calorie diet (LCD), with and without INT, on β-cell function in obese adults.

**Background:** Obese adults have an increased risk of type 2 diabetes (T2D). Although insulin resistance is a key etiologic factor, the progressive loss of β-cell function causes T2D. Lifestyle therapies, such as caloric-restriction and interval exercise training (INT) have separately been shown to improve insulin secretion; however, the impact of these therapies combined on β-cell function prior to meaningful weight loss is unknown.

**Purpose:** To examine the impact of a low-calorie diet (LCD), with and without INT, on β-cell function in obese adults.

**Methods:** Twenty-two, middle-aged obese (Age: 46±12 y; BMI 38±6 kg/m²) adults were randomized to either 2-wks of a LCD (~1200 kcal/day) or an energy matched LCD+INT intervention (supervised: 60-min/d alternating 3-min at 90 and 50% HRpeak). VO2peak and body fat were assessed before and after interventions. After an overnight fasting, a 120-min 75% oral glucose tolerance test (OGTT) with blood samples every 30-min was performed, and glucose, insulin, and C-peptide were used to define glucose-stimulated insulin secretion (GISIS: Δinsulin/Δglucose), hepatic clearance (HC: ΔUCOS/ΔUCOG), and β-cell function (Disposition Index [DI: ΔIGI x Matsuda Index]) for early- (0-30 min) and total-phase (0-120 min) responses. GLP-1ΔMax was also measured during 0, 30 and 60 min of the OGTT to assess incretin effects.

**Results:** Neither intervention altered body fat % (Time: P=0.74), and only LCD+INT increased VO2peak (Interaction: P=0.03). LCD+INT reduced glucose total area under the curve (AUC) when compared with LCD (Interaction: P=0.05). While both interventions increased insulin sensitivity by ~13% (Time: P=0.04), only LCD+INT elevated early-phase GSIS (Interaction: P=0.05) with no change in HC (Time: P=0.11). LCD+INT tended to increase early-, but not total-phase, β-cell function to a greater extent when compared with LCD (Interaction: P=0.06). GLP-1ΔMax, aTUC increased similarly after LCD+INT and LCD (Time: P<0.05) by ~28%.
Several studies have reported improved glycemic control the day after a session of exercise, but it is unclear if this is a direct effect of exercise or an indirect effect of the exercise-induced energy deficit. To assess the impact that HIIE has on MF and blood flow in response to a mixed meal test (MMTT), we monitored the ability to suppress FATox at the 60-min time-point of the MMTT was significantly compared to BL (1.31 ± 0.39 mg/kg/min vs. 0.96 ± 0.32 mg/kg/min, p=0.04). The inability to switching between fuel sources (fat and carbohydrates), termed mitochondrial biogenesis/content (TFAM, OX PHOS-Complex II) were significantly increased in female vs. male offspring. mitophagy (ATG12:5, BNIP3, P62, LC3 II/I), and investigations should confirm this relationship in heterogenous populations and investigate the utility of exercise training as medium to promote beneficial changes in gut microbiota.

**Conclusions:** Independent of insulin sensitivity and GLP-1, INT combined with LCD improved early-phase pancreatic function in obese adults when compared to an energy deficit (ED). Although maternal exercise did not attenuate maternal HFD-induced hepatic steatosis in young adult rats. Methods: Female Wistar rats (7-8 weeks of age) were randomized into one of four groups: HFD (42% fat, 10% sucrose) or ND (basal diet) with or without exercise (RUN) for 16 weeks. Male offspring were sacrificed at 12 weeks of age. Results: Male offspring had increased liver weight compared to ND. Male offspring RUN increased (p<0.05) hepatic markers of mitochondrial biogenesis and mitophagy (TFAM, PPARα, NRF2) in all offspring and the mitophagy marker Bnip3 in HFD-RUN offspring. Gastrointestinal (GI) tract function in male offspring was also improved (p<0.05).

**Introduction:** Maternal high fat diets (HFD) result in excess fat accumulation in the liver of offspring, known as hepatic steatosis. Maternal exercise during this crucial period of fetal development can be protective against hepatic steatosis in offspring. However, it is uncertain whether hepatic steatosis can be seen in younger offspring. Here we sought to determine whether maternal exercise would attenuate maternal HFD-induced hepatic steatosis in adult young rats. Methods: Female Wistar rats (7-8 weeks of age) were randomized into one of four groups: HFD (42% fat, 10% sucrose) or ND (basal diet) with or without exercise (RUN) for 16 weeks. Male offspring were sacrificed at 12 weeks of age. Results: Male offspring had increased liver weight compared to ND. Male offspring RUN increased (p<0.05) hepatic markers of mitochondrial biogenesis and mitophagy (TFAM, PPARα, NRF2) in all offspring and the mitophagy marker Bnip3 in HFD-RUN offspring. Gastrointestinal (GI) tract function in male offspring was also improved (p<0.05).

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Exercise is an effective therapy for numerous pathological conditions that are associated with elevated metabolites and inflammatory factors. These chemicals can activate receptors on peripheral sensory neurons, such as Acid Sensing Ion Channels (ASICs). A Transient Receptor Potential Vanilloid 1 (TRPV1). High-intensity exercise can induce release of protons, metabolites, and inflammatory factors, which are known to activate ASICs and TRPV1 and elicit reflex-mediated changes in hemodynamics and respiration, as well as pain perception and fatigue.

**Purpose:** Does exercise training alter the expression of ASICs and TRPV1 in skeletal muscle afferents and carotid body (CB)?

**Methods:** Mice were divided into sedentary (SED), high-intensity training (HIIT) groups. HIIT was trained every other day for 4 weeks (4 bouts of 6 min intervals at 80-90% of maximum velocity (V_{max}) with 4 min of active rest), whereas SED trained at 40-50% of V_{max} for the same time. SED mice were placed on the treadmill for similar periods of time. After 4 weeks, all groups underwent an incremental treadmill test for maximal exercise performance. Lumbar dorsal root ganglia (DRG) and CB were collected 48 hrs after maximal exercise, and mRNA levels of ASICs and TRPV1 were determined.

**Results:** HIIT showed higher exercise performance (V_{max}) in comparison to sedentary (p ≤ 0.05) while there was no significant difference between SED and DRG. Body composition, as measured by NMR, did not change significantly between groups after 4 weeks of training. HIIT showed reductions (p ≤ 0.05) of ASIC1b, ASIC2, ASIC3, TRPV1 mRNA levels in DRG, as well as reductions (p ≤ 0.05) in ASIC1b, ASIC2 in CB compared to SED. Paradoxically, SED showed an upregulation (p ≤ 0.05) of ASIC3 and ASIC1a in DRG and CB.

**Conclusion:** HIIT improves exercise performance and lowers ASICs and TRPV1 mRNA in sensory pathways. We suggest that ASICs and TRPV1 downregulation could contribute to enhanced exercise performance by diminishing sensations of pain and fatigue. Diminishment of these sensory pathways might contribute to the benefits of exercise in disease conditions by reducing deleterious sympathoexcitation and associated inflammation.

Supported by the Department of Veterans Affairs.
METHODS: 12 males participated in the collection of a Hoffman reflex (H-reflex) recruitment curve and underwent either a randomized STIM (noise applied) trial or SHAM (control). The H-reflex recruitment curve was obtained from the median nerve of the subject’s dominant arm. The intensity that elicited the onset of the M-wave was used to standardize the H-reflex stimulation intensity. The STIM trial was performed by introducing a random imperceptible vibratory noise 3 seconds before the collection of the H-reflex. The test was repeated for a total of 10 stimulations with six seconds of rest between stimulations. The resulting H-reflex amplitudes were then normalized to the maximal M-wave (Mmax) found during the H-reflex recruitment curve. Data were assessed with a generalized estimating equation, clustering for multiple observations.

RESULTS: The H-reflex was 19.1% (SE±2.42) of Mmax in the STIM trials and 17.4% (SE±2.66) in the SHAM trials, showing a significant increase of 1.73% with STIM (p = 0.0016).

CONCLUSIONS: Subjects showed an increase in spinal excitability while undergoing STIM. The results demonstrate that the spinal reflex plays a role in the motor adaptation response to imperceptible vibration. This increase in spinal excitability suggests that the performance benefits of imperceptible noise stimulation may have a rapid onset, on the order of 10-20 milliseconds, in contrast to cortical mechanisms which are greater than 100 milliseconds. Determining which motor centers mediate the behavioral response to noise stimulation, and to what degree, will help define the optimal parameters for the application of noise stimulation.

Cerebral white matter (WM) represents the structural substrate of neuronal communications and is damaged in dementia patients. Aerobic exercise training (AET) may improve cerebral WM integrity in healthy older adults, but its effect in populations at risk for dementia remains unclear. PURPOSE: To determine the effect of AET on cerebral WM integrity in patients with amnestic mild cognitive impairment (MCI). METHODS: We conducted a 1-year, single-blinded, parallel randomized controlled trial of AET and stretching intervention programs in patients with MCI. At baseline and post intervention, diffusion tensor images (DTI) were acquired to estimate fractional anisotropy and mean diffusivity (MD) that are analyzed by tract-based spatial statistics (TBSS) and compared among the major WM fiber tracts. High-resolution T1-weighted images were also acquired to measure the volumes of cerebral WM and WM hypointensities. Maximal oxygen consumption (VO_{max}) was measured at pre and post intervention. RESULTS: Thirty-six MCI patients completed AET (n=16) or stretching (n=20) program with the baseline and post-intervention MRI scans. After intervention, participants in AET program improved VO_{max} while those in stretching group showed slight declines (time × treatment: F=0.008). The volumes of WM and WM hypointensities did not show treatment effects over time (time × treatment: P=0.05). However, TBSS analysis demonstrated that improvements of VO_{max} with AET are correlated with the reductions of MD among the major WM fiber tracts (Figure). CONCLUSIONS: In patients with amnestic MCI, AET did not improve cerebral WM volume and integrity between the intervention and control groups. However, individual improvements of VO_{max} were associated with the reductions of MD. These findings suggest that benefits of AET on cerebral WM integrity depend on the magnitude of cardiorespiratory fitness gains. This study was supported by the NIH (RO1AG053106 and K99HL115449).

Mood and anxiety disorders are the most prevalent mental disorders among older adults and are associated with poor health outcomes. Exercise may be a useful means of treating or preventing these disorders, but the mechanism by which it does so is unclear. The salience network (SN), which connects the prefrontal cortex with several limbic brain regions, plays a primary role in emotion regulation. While several cross-sectional studies have demonstrated a link between increased SN resting-state functional connectivity (SN-RSFC) and mood and anxiety symptoms, none have examined the effect of acute aerobic exercise on SN-RSFC and affective measures in a sample of healthy older adults. PURPOSE: To determine the effect of acute aerobic exercise on self-reported affect and SN-RSFC among healthy older adults. We hypothesized that exercise would enhance positive affect and decrease negative affect and SN-RSFC.

METHODS: Using a crossover repeated measures design, 21 participants (mean ±SD = 65.6 ±8.0; range 55-85) completed two study visits with 30-min of moderate-intensity bicycle exercise or seated rest, immediately followed by a resting-state fMRI scan. They completed the Positive and Negative Affect Schedule before and after each condition. We performed a seed-based analysis (AFNI v.17.3.01; seeds = L and R insula; 34, 22, -2) to determine changes in SN-RSFC. RESULTS: Compared to rest, 30-min of moderate-intensity exercise increased positive affect (p = 0.015) and led to notable, but non-significant, decreases in negative affect (p = 0.059). Exercise also significantly decreased SN-RSFC in three limbic brain regions: L hippocampus, L amygdala, and L middle temporal gyrus (p = 0.01).

CONCLUSIONS: Acute aerobic exercise enhanced positive affect and decreased SN-RSFC in healthy older adults. Results suggest that exercise-induced changes in functional connectivity within the brain’s salience network may drive the effects of exercise on mood and anxiety in this population. Further studies are needed to test different doses of acute and chronic exercise on these outcomes.

Abstracts were prepared by the authors and printed as submitted.
Background: Traumatic anterior cruciate ligament (ACL) rupture can lead to bilateral deficits in balance, skilled movement, and force production. Such deficits persist for years independent of knee muscle/joint or tarsal injury. Recent reports suggest that the anterior cruciate ligament can be replaced by other ligaments, possibly due to changes in the microarchitecture of the ligament. This change can affect the mechanical properties of the ligament, leading to altered biomechanical behavior.

**Conclusions:** The findings of this study have important implications for the rehabilitation of knee injuries. The authors recommend further research to understand the mechanisms underlying the changes in ligament structure and mechanical properties after ACL rupture. They also suggest the development of novel treatment strategies that target the microarchitecture of the ligament to improve functional outcomes.
thicker LC cartilage (r=0.26, p=0.08) and thicker IC cartilage (r=0.28, p=0.07). Larger KFE was associated with thicker MC cartilage (r=0.34, p=0.04), thicker LC cartilage (r=0.39, p=0.02), and thicker IC cartilage (r=0.38, p=0.02). Larger KFA was associated with thicker MC cartilage (r=0.29, p=0.05) and thicker IC cartilage (r=0.36, p=0.03). No relationships were found between cartilage thickness measures and KFHC or KFM.

CONCLUSIONS: These data suggest that sagittal plane knee mechanics during gait are associated with thicker femoral cartilage in individuals with ACLR. Knee flexion is used to attenuate ground reaction force during gait. As such improving sagittal plane knee mechanics during gait may alleviate knee OA risk in individuals with ACLR.

2541 June 1 1:30 PM - 1:45 PM

Intrinsic and Extrinsic Muscle Function in Rearfoot Strikers During Barefoot and Shoe Treadmill Running

Summer Neborsky, Monika Patel, Nathan Ratner, Kahleigh Quinn, Thomas Martin, Juan C. Garbalosa. Quinnipiac University, Hamden, CT.

(Barefoot or without supportive footwear.)

Barefoot/minimalist running is theorized to cause an increase in the activity of intrinsic and extrinsic foot muscles. Although studies have shown an increase in the activity of extrinsic foot muscles during barefoot running very little data exists documenting the effects of barefoot running on intrinsic foot muscles. PURPOSE: To compare the activity of select extrinsic and intrinsic muscles during barefoot and shod running in rearfoot strikers.

METHODS: A convenience sample of 21 recreational runners were assigned to run both shod and barefoot in a random order. Electrodes were placed on the subjects’ dominant lower extremity over the peroneus longus (PL), tibialis anterior (TA), and abductor hallucis (AH) muscles. Subjects participated in a treadmill running protocol consisting of running at 8.0 and 9.7 kph while lower extremity kinematics and electromyographic (EMG) activity of the muscles were recorded using an 8 camera motion analysis system in both footwear conditions. The EMG data were filtered with a fourth order, band pass filter with 10 and 350 Hz cutoffs. Using a 250 ms window, the root mean square (RMS) of the filtered data was obtained. The RMS was normalized to the peak EMG activity of the 8.0 kmh barefoot trials. Using the marker displacement data, the stance phases of the amplitude normalized 9.7 kmh trials were extracted. The average RMS value of the PL, TA, and AH during the stance phase of these trials were obtained and grouped according to running speed and muscle. A two factor, fixed effects ANOVA model was used to determine the effect of footwear condition and muscle on the mean RMS values.

RESULTS: The mean (± 1 S.E.) amplitude normalized RMS value during the barefoot condition for the TA, PL, and AH was 50 (± 4.7), 109 (± 17.9), and 123 (± 18.4) percent, respectively. During the shod condition the mean (± 1 S.E.) amplitude normalized RMS value for the TA, PL, and AH was 52 (± 6.1), 103 (± 17.3), and 130 (± 16.8). A significant effect was noted only for muscle (p < .001). Both the PL and the AH exhibited significantly greater activity than the TA in both the shod and barefoot conditions. A significant effect of footwear condition was not present (p = .923).

CONCLUSIONS: In rearfoot strikers, footwear does not appear to affect the EMG activity of the TA, PL, or AH.

2542 June 1 1:45 PM - 2:00 PM

Barefoot Gait Adaptations Remain With Use of the Barefoot Orthotic

Melissa Thompson1, Christopher Bent1, Kelsey Pryor1, Kristine Hoffman1, 2. 1. Fort Lewis College, Durango, CO. 2. Denver Health Medical Center, Denver, CO.

(No relevant relationships reported)

Orthotics are used to treat a number of foot and ankle pathologies, but require the use of supportive footwear. Alternatively, the barefoot condition enhances sensation from the plantar foot leading to gait adaptations that may influence injury prognosis and incidence. Recently, a barefoot orthotic (Horizon Balance Reef(R)) was designed to adhere to the plantar surface rather than being flipped inside footwear, thus potentially allowing for the benefits of the barefoot gait, while also providing the stability of an orthotic. PURPOSE: To determine if the commonly observed barefoot gait adaptations were found when walking and running with the barefoot orthotic.

METHODS: 12 healthy habitually shoe runners (7 men and 5 women, age: 25 ± 3.8 yr; height: 1.58 ± 0.15 m; mass: 68.1 ± 8.9 kg) participated in this study. Gait kinematics and kinetics were analyzed as participants performed 10 over-ground trials of running and walking in running shoes (SHOD), barefoot (BF), and while wearing the barefoot orthotics (BF ORTHO). Kinematic data was obtained via 3D motion analysis and ground reaction force (GRF) data were captured as subjects ran across a runway using an embedded force plate. Kinematic and kinetic differences between the SHOD, BF, and BF ORTHO condition were analyzed using repeated measures ANOVA tests. RESULTS: There were no significant differences between the BF and BF ORTHO conditions in terms of gait kinematics or kinetics in either walking or running, indicating that the barefoot orthotic does not interfere with the natural barefoot gait. Consistent with previous research, subjects exhibited decreased stride lengths in the BF and BF ORTHO conditions when walking (BF: 1.38 ± 0.20 m, BF ORTHO: 1.43 ± 0.19 m, SHOD: 1.54 ±0.17 m, p=.05 compared to SHOD) and running (BF: 1.98 ±0.27 m, BF ORTHO: 2.06 ±0.30 m, SHOD: 2.16 ±0.31 m, p<0.05 compared to SHOD). Additionally, the BF and BF ORTHO conditions were associated with reduced peak vertical GRFs in walking (BF: 1.16 ±0.10 m, BF ORTHO: 1.19 ±0.12 m, SHOD: 1.29 ±0.11 m, p<0.05 compared to SHOD) and running (BF: 2.29 ±0.26 m, BF ORTHO: 2.27 ±0.21 m, SHOD: 2.48 ±0.22 m, p<0.05 compared to SHOD). CONCLUSION: The barefoot orthotic does not interfere with the natural barefoot gait, indicating the potential for clinical use while barefoot or without supportive footwear.

2543 June 1 2:00 PM - 2:15 PM

The Influence of Maximal Running Shoes on Biomechanics Prior to and Following a 5K Run

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(No relevant relationships reported)

While several studies have compared muscle activity in minimalist and traditional running shoes, to date it is unknown how muscle activity changes when running in ultra-cushioning shoes. PURPOSE: To evaluate differences in kinematics and muscle activity while running in minimalistic (Min), traditional (Tra), and ultra-cushioning (Ultra) shoes. METHODS: Participants included 13 runners (sex: 5 M; 8 F; age: 22 ± 5.4 years). Whole body kinematics were recorded using a 12-camera motion capture system while participants ran in each shoe. Ankle, knee, and hip range of motion (ROM) during stance phase were calculated in all three planes. Muscle activity was recorded from seven lower extremity muscles. Differences in kinematics and average root mean square (RMS) amplitude during stance were evaluated using one-way repeated measures ANOVAs. RESULTS: Mean values for variables with significant differences are shown in Table 1. Post hoc comparisons revealed hip internal rotation ROM was higher in the Ultra shoes than in either the Tra (p=0.03) or Min (p=0.047) shoes. Ankle dorsiflexion ROM was lower in the Ultra shoes than in either the Tra (p=0.07) or Min (p=0.038) shoes. Mean gluteus medius RMS was higher in the Ultra shoes than in either the Tra (p=0.013) or Min (p=0.017). Mean RMS for the tibialis anterior was also higher in the Ultra shoes than in either the Tra (p=0.03) or Min (p=0.029). Finally, mean RMS for the peroneus longus was higher in the Ultra shoes than the Tra shoes (p=0.046). CONCLUSION: The differences in kinematics suggest individuals maintained their preferred movement path in all three shoes. However, the increased muscle activity may indicate the neuromuscular system was working harder to maintain the preferred path in the Ultra shoes.

2544 June 1 2:15 PM - 2:30 PM

Kinematics And Muscle Activity While Running In Minimalist, Neutral, And Ultra-cushioning Shoes

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(No relevant relationships reported)

FRIDAY, JUNE 1, 2018

Abstracts were prepared by the authors and printed as submitted.
Frontal plane mechanics, such as hip adduction angle and base of gait (BOG), have been implicated as causes for running-related injuries such as iliotibial band syndrome and patellofemoral pain. While modification of frontal plane variables may be a way to alter injury risk, the effect of speed and sex on frontal plane mechanics has not been investigated. Describing these effects may facilitate more appropriate prescription of gait retraining to reduce injury risk. **PURPOSE:** To determine the influence of sex and speed on frontal plane kinematics during running. **METHODS:** Whole body kinematics and ground reaction forces were collected for 99 NCAA Division I collegiate athletes (52 males) during treadmill running at 2.68, 3.35, and 4.47 m/s. Athletes were healthy at time of testing and had no history of lower extremity surgery. BOG at midstance (cm), hip adduction at initial contact (ADD, deg), peak hip adduction (ADDpeak, deg), and peak contralateral pelvic drop (PELpeak, deg) for the right limb were compared between sex and speed using 2-way repeated measures ANOVAs. **RESULTS:** A significant sex by speed interaction (p < 0.01) for BOG was observed. BOG decreased significantly (p < 0.01) with speed for both sexes. Females exhibited larger BOG than males at 3.35 and 4.47 m/s (females: 0.6 ± 1.5 cm and -0.1 ± 1.5 cm, males: 0.2 ± 2.4 cm and -0.9 ± 2.5 cm for 3.35 and 4.47 m/s, respectively). No significant interactions (p ≥ 0.40) were observed for ADDpeak, ADDmean, or PELpeak. There was a significant speed main effect for ADDpeak, ADDmean, and PELpeak. ADDmean increased significantly with speed (p < 0.01). PELpeak at 2.68m/s was significantly less than 3.35 and 4.47m/s (p < 0.01, mean difference = 0.5 deg). Females demonstrated greater ADDmean and ADDpeak than males (p < 0.01, mean difference = 2.0 deg for both ADDmean and ADDpeak). **CONCLUSIONS:** Females demonstrate a wider BOG than men at faster running speeds. Females also demonstrate greater hip adduction than men at the same running speed. As a result, both sex and speed must be considered when assessing frontal plane kinematic variables, particularly with regard to identifying excessive motion which may be related to injury.

**METHODS:** 7 healthy subjects (25±2.5 years, 1.77±0.12 m, 65.2±19.9 kg) volunteered for this study. Subjects ran on a motorized treadmill for an average of 44.3±1.9 minutes at a self-selected training pace. 3D kinematic data were collected after 5 minutes of running and again at the end of the run at 200Hz using reflective markers placed on the lower body with 6 infrared cameras. Variables of interest included ankle, knee and hip sagittal, frontal and transverse planes of motion before and after the run using a handheld dynamometer. Each subject performed 3 maximum voluntary isometric contractions (MVCs) for each motion. The highest number for each motion was recorded.

**RESULTS:** Approximately 26% of premature deaths in the United States can be attributed to excessive sitting and physical inactivity. In addition to the health hazards associated with lack of moderate-to-vigorous physical activity (MVPA), sedentary behavior (i.e. sitting) has recently been identified as a potential risk factor for premature mortality. **PURPOSE:** To estimate the population attributable fraction (PAF%) for all-cause mortality in the United States associated with combined categories of sedentary behavior and MVPA. **METHODS:** Data on the prevalence [P] of combined sedentary behavior and MVPA categories were obtained from self-report questionnaires in the 2013-14 U.S. National Health and Nutrition Examination Survey [N = 5,926 non-pregnant adults 18+ y of age]. Sedentary behavior was operationalized as daily sitting time in the following categories (h/day): <4, 4-5.9, 6-8, and >8. Total MET-h per week of MVPA was computed and categorized into 4 groups: ≤2.5, 2.5-16, 16-30.4, and ≥34.5. Hazard ratios (HRs) for all-cause mortality associated with the combined sedentary behavior and MVPA categories were obtained from a published pooled analysis of 1,005,791 adults [Ekelund et al. The Lancet 2016;388:1302-10]. The PAF% [(P[HR-1])/(P[HR-1]+1)]X100 for all 16 combinations of sedentary behavior and MVPA were computed and summed across groups to determine the overall PAF% associated with sedentary behavior and physical inactivity. **RESULTS:** Population prevalence in the combined categories sitting and MVPA ranged from 2.3% to 19%, with the highest prevalence observed in the low MVPA high sitting groups. The overall PAF% associated with sitting and physical inactivity was 25.8%. **CONCLUSION:** Approximately 26% of premature deaths in the United States can be attributed to excessive sitting and physical inactivity.
RESULTS: The mean number of accumulated years of health care expenditures was 6.2 years, and the average annual total health care cost was $7,813/person/year. After adjustment, average annual expenditures were lower for adults who were consistently active (i.e., 7 hrs/week MVPA throughout adulthood), aggressive improvers (i.e., very little activity during adolescent but consistent 7 hrs/week during adulthood), and with a lull in 20-30s (i.e., very active during adolescent, moderately active in 20-30s, very active in mid-life) when compared to those who did no MVPA in any life-period (i.e., consistently inactive). Detailed sensitivity analyses did not reveal evidence of confounding or effect modification.

CONCLUSION: Adults that are consistently active or show substantial MVPA improvement throughout adulthood have lower health care expenditures after age 65. Strategies that promote physical activity throughout adulthood may help reduce Medicare expenditures.

Table: Medicare expenditures based on MVPA trajectory throughout adulthood

<table>
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<tr>
<th>Trajectory (N)</th>
<th>Average marginal decrease (per person/year)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age-adjusted</td>
<td>Multivariable</td>
</tr>
<tr>
<td>Consistently inactive (743)</td>
<td>-$1,116 ($-1,215, $-1,047)</td>
<td>-$818 (-$2,061, $425)</td>
</tr>
<tr>
<td>Moderate improver (1,988)</td>
<td>-$1,044 ($-1,122, $-863)</td>
<td>-$510 (-$1,375, $1,155)</td>
</tr>
<tr>
<td>Aggressive improver (1,168)</td>
<td>-$2,310 ($-2,382, -$2,237)</td>
<td>-$1,896 (-$3,178, -$616)</td>
</tr>
<tr>
<td>Early improver &amp; late decliner (1,128)</td>
<td>-$1,044 ($-1,122, $-863)</td>
<td>-$510 (-$1,375, $1,155)</td>
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<tr>
<td>Fast decliner (1,676)</td>
<td>-$319 ($-393, $-247)</td>
<td>-$250 (-$1,518, $1,018)</td>
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<tr>
<td>Consistently active (5,220)</td>
<td>-$1,421 ($-1,488, $-1,354)</td>
<td>-$1,165 (-$2,299, -$31)</td>
</tr>
<tr>
<td>Steady decliner (1,802)</td>
<td>$57 ($+144, $+39)</td>
<td>$115 ($+1,389, $+1,160)</td>
</tr>
<tr>
<td>Lull in 20-30s (2,724)</td>
<td>-$1,607 ($-1,675, $-1,540)</td>
<td>-$1,423 (-$2,602, -$244)</td>
</tr>
</tbody>
</table>

PURPOSE: Describe the 10-year race/sex specific changes in accelerometer-determined physical activity (PA) and sedentary time in a midlife cohort.

METHODS: Data are from 881 Coronary Artery Risk Development in Young Adults (CARDIA) participants aged 18 to 30 years at baseline (1985-86) who wore the accelerometer and had valid wear (>4 of 7 days, ≥10 hrs per day) at the Year 20 (2005-06; ages 38-50) and Year 30 (2015-16; ages 48-60) exams. At Year 20, accelerometer measures were first collected using the ActiGraph 7164; at Year 30 the ActiGraph wGT3X-BT model was used. A calibration factor (counts divided by 1,088, based on a subset who simultaneously wore both devices at Year 30) was applied to Year 30 data to account for differences in models. All 10-year change estimates are expressed as median (25th, 75th percentiles). Wilcoxon Rank Sum tests were used to examine 10-year changes overall and within the four race/sex groups.

RESULTS: Over 10 years, participants experienced significant reductions in average accelerometer counts [46.7 (-122.7, 31.1) cm d$^{-1}$; p<0.001]. This reduction was shown within each race/sex group, with the greatest decline observed in black men (all p<0.001). Sedentary time significantly increased overall (32.9 min d$^{-1}$), with the largest increases shown in black women (56.9 min d$^{-1}$) followed by black men (50.2 min d$^{-1}$), white women (28.9 min d$^{-1}$) and men (19.0 min d$^{-1}$); all p<0.001. Light intensity PA decreased (-29.2 min d$^{-1}$), with black men having the greatest reductions (-38.3 min d$^{-1}$), followed by white (-35.3 min d$^{-1}$) and black (-26.6 min d$^{-1}$) women, then white men (-25.6 min d$^{-1}$); all p<0.001. Moderate to vigorous intensity PA (MVPA) also declined (-5.5 min d$^{-1}$) with the largest reductions shown in black men (-7.3 min d$^{-1}$), then white men (-6.9 min d$^{-1}$), and white (-4.9 min d$^{-1}$) and black (-4.3 min d$^{-1}$) women; all p<0.001. Of note, black women had the lowest accumulated MVPA at Year 20. Finally, median time spent in MVPA bouts lasting ≥8 of 10 consecutive minutes slightly increased in white men and women (2.3 and 0.60 min d$^{-1}$, respectively; both p<0.01), which was not shown in black participants.

CONCLUSIONS: We found a decline in overall PA during the midlife transition. This reduction was largely attributable to increases in sedentary time and reductions in light intensity PA.

Evidence suggests that prolonged, uninterrupted sedentary bouts (e.g. sitting for hours at a time) may be the most harmful manner in which to accumulate sedentary behavior. Little is known concerning the type of activity that should be substituted for prolonged, uninterrupted sedentary bouts to impart health benefit. For example, does substituting longer sedentary bouts with shorter sedentary bouts reduce mortality risk, or is physical activity needed? PURPOSE: Using isotemporal substitution techniques, the purpose of this study was to examine whether replacing prolonged sedentary bouts with (1) shorter sedentary bouts, (2) light-intensity physical activity (LIPA), or (3) moderate-vigorous intensity physical activity (MVPA) is associated with reductions in all-cause mortality risk. METHODS: Participants (n=7,999) from the REasons for Geographic Differences in Stroke (REGARDS) Study, a national cohort consisting of black and white U.S. adults ≥45 years, were studied. Sedentary time was measured using a hip-mounted accelerometer worn for 7 consecutive days. In isotemporal substitution models, short sedentary bout time (bouts <30 min), LIPA, MVPA, and accelerometer wear time (each expressed in 30 minute units per day) were included in a single Cox regression model that included adjustment for covariates. Resultant hazard ratios (HR) estimated associations for replacing 30 min of prolonged sedentary bout time (bouts...
RESULTS: Over a median follow-up of 5.5 years, there were 647 deaths. There was an association for replacing prolonged, uninterrupted sedentary bout time with both LPA (per 30-minute HR: 0.85; 95% CI: 0.80-0.90) and MVPA (per 30-minute HR: 0.69; 95% CI: 0.52-0.90) on all-cause mortality risk, but no association for replacement with shorter sedentary bouts (per 30-minute HR: 0.99; 95% CI: 0.96-1.03). CONCLUSIONS: In this national cohort study of middle-aged and older adults, replacing prolonged, uninterrupted sedentary bouts with shorter sedentary bouts was not associated with a reduction in all-cause mortality risk. Instead the all-cause mortality risk incurred by prolonged, uninterrupted sedentary bouts was only reduced by LPA or MVPA.

2555 June 1 2:45 PM - 3:00 PM
Strong Evidence from the 2018 Physical Activity Guidelines Advisory Committee

CONCLUSIONS: Among well-functioning, community-dwelling adults, declining energy reserves are linked to poorer cognitive performance over time. This evidence indicates that combining measures of energy capacity and energy cost to assess physiologic reserve may serve as an early indicator of cognitive decline and convey evidence of those at risk of poorer cognitive outcomes over time.

The U.S. Department of Health and Human Services (HHS) charged an external federal advisory committee to review the scientific literature and provide independent recommendations to the government to inform the development of the second edition of the Physical Activity Guidelines for Americans.
Purpose To present a selection of conclusions with evidence graded as ‘strong’ from the 2018 Physical Activity Guidelines Advisory Committee (Committee) systematic literature review.
Methods The Committee asked 38 questions on relationships between physical activity and health outcomes in systematic literature reviews. A grading rubric was used to evaluate the strength of evidence - Strong, Moderate, Limited, or Grade Not Assignable (insufficient evidence). A grade of ‘strong’ indicated that evidence from the literature directly applied to the systematic review question; was free from serious doubts about generalizability; limited the risk of bias; showed consistency in the direction and approximate size of the effect across studies; and provided considerable confidence in the accuracy of the findings. The Committee presented its conclusions in several meetings.
Results The Committee concluded there was strong evidence that physical activity has a beneficial effect on many health outcomes, including improvements in weight and bone health in children under age six, physical function in older adults, and incidence of seven types of cancer. Examples are provided in Table 1.
Conclusion The Committee’s systematic reviews will be compiled into a Scientific Report and submitted to the HHS Secretary. The Department will use the Committee’s evidence-based recommendations, as well as public and federal agency comments, to develop the second edition of the Physical Activity Guidelines for Americans. The Committee’s work firmly grounds the second edition of the Physical Activity Guidelines for Americans in the current science on physical activity and health.
PURPOSE: Attenuated stroke volume and ventricular remodeling adaptations to endurance exercise in older women. The present study tested the hypothesis that diminished stroke volume and ventricular remodeling adaptations to endurance exercise (i.e., supine hypervolemia) are associated with a reduced risk of developing dementia.

METHODS: Female Sprague-Dawley rats were randomized to control (CON; n = 4) or HF (n = 5) groups. HF was induced via surgical myocardial infarction and the rats were given ≥ 15 ml/kg per minute of normovolemic saline. Echocardiography was performed at resting and exercise conditions. Cardiac remodeling and function were measured using echocardiography.

RESULTS: HF reduced FS by 50% (HF: 24 ± 2%, CON: 48 ± 3%; p < 0.001); indicative of moderate severity HF. CS was reduced by ~15% in HF rats compared to CON (38 ± 1 vs 45 ± 1 m/min; p < 0.001). D′ was not different (HF: 79 ± 13 m, CON: 61 ± 13 m; p = 0.34). CS was positively correlated following CS and D′ determination. D′ can be resolved in an animal model of moderate HF where CS is reduced but D′ is not different (HF: 79 ± 13 m, CON: 61 ± 13 m; p = 0.34). CS was positively correlated with resting heart rate and in combination accurately predict exhaustion. Elucidating the determining mechanisms of CS and D′ in HF will allow for development of more efficacious therapies.

CONCLUSION: Establish the power-duration relationship in a validated model of HF and elucidate the mechanism(s) that determine CS and D′. Specifically, we tested the hypotheses that: 1) CS (but not D′) would be reduced in HF; and 2) measurements of heart function would correlate with CS. METHODS: Nine adult female Sprague-Dawley rats were randomized to control (CON; n = 4) or HF (n = 5) groups. HF was induced via surgical myocardial infarction and the rats were given ≥ 21 days to recover. Multiple constant speed treadmill runs to exhaustion were used to determine CS and D′ in both groups. Doppler echocardiography was used to evaluate heart function (i.e., fractional shortening (FS) which approximates ejection fraction) following CS and D′ determination. RESULTS: HF reduced FS by 50% (HF: 24 ± 2%, CON: 48 ± 3%; p < 0.001); indicative of moderate severity HF. CS was reduced by ~15% in HF rats compared to CON (38 ± 1 vs 45 ± 1 m/min; p < 0.001). D′ was not different (HF: 79 ± 13 m, CON: 61 ± 13 m; p = 0.34). CS was positively correlated with FS (r = 0.9, p = 0.002); D′ was not (r = 0.33, p = 0.42). CONCLUSION: CS and D′ can be resolved in an animal model of moderate HF where CS is reduced but D′ is not. Crucially, this HF model is free from the prescription therapeutics that confound interpretation of the mechanistic relationship between HF and CS or D′ in humans. That FS was correlated with CS has important mechanistic and clinical implications.

A hallmark symptom of heart failure (HF) is exercise intolerance. The power-duration relationship for high intensity exercise is a powerful phenomenon that integrates multiple physiological systems to define the framework of tolerance within and across species in health and disease. The parameters of this relationship, critical speed (CS) and D′ represent the aerobic and ‘anaerobic’ capacities of the animal and in combination accurately predict exhaustion. Elucidating the determining mechanisms of CS and D′ in HF will allow for development of more efficacious therapies. PURPOSE: To establish the power-duration relationship in a validated model of HF and elucidate the mechanism(s) that determine CS and D′. Specifically, we tested the hypotheses that: 1) CS (but not D′) would be reduced in HF; and 2) measurements of heart function would correlate with CS. METHODS: Nine adult female Sprague-Dawley rats were randomized to control (CON; n = 4) or HF (n = 5) groups. HF was induced via surgical myocardial infarction and the rats were given ≥ 21 days to recover. Multiple constant speed treadmill runs to exhaustion were used to determine CS and D′ in both groups. Doppler echocardiography was used to evaluate heart function (i.e., fractional shortening (FS) which approximates ejection fraction) following CS and D′ determination. RESULTS: HF reduced FS by 50% (HF: 24 ± 2%, CON: 48 ± 3%; p < 0.001); indicative of moderate severity HF. CS was reduced by ~15% in HF rats compared to CON (38 ± 1 vs 45 ± 1 m/min; p < 0.001). D′ was not different (HF: 79 ± 13 m, CON: 61 ± 13 m; p = 0.34). CS was positively correlated with FS (r = 0.9, p = 0.002); D′ was not (r = 0.33, p = 0.42). CONCLUSION: CS and D′ can be resolved in an animal model of moderate HF where CS is reduced but D′ is not. Crucially, this HF model is free from the prescription therapeutics that confound interpretation of the mechanistic relationship between HF and CS or D′ in humans. That FS was correlated with CS has important mechanistic and clinical implications.

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Gravity changes along the z-axis (posGz) influence right and left ventricular cardiac output (CO_{RV}, CO_{LV}). This is important in many sports after changes in posture or in phases of accelerations. PURPOSE: This study aimed to compare estimates of cardiac output by gas exchange and continuous blood pressure (cBP) measurements to assess transient differences in CO_{RV} and CO_{LV}. METHODS: Nine healthy male subjects (age: 31 ± 3 y, BMI: 24 ± 2 kg·m²) participated in experiments on a long-arm human centrifuge (laHC; base line: 1.7 g), in parabolic flights (PF) and on a tilt seat (TS; initial position 65°). Three consecutive posGz changes for 22 s intervals (I, I, I) were performed (laHC: 2.1 g - 1.2 g - 2.1 g; PF: 1.8 g - 0 g - 1.8 g; TS: 90° - 6° - 90°). Breath-by-breath VO_{2}, heart rate and cBP were measured. Left ventricular stroke volume was determined from cBP allowing to estimate CO_{LV}. Arterio-venous O_{2} concentration difference was calculated as average for 30 s before the first posGz change (I). This allows calculating CO_{LV} for the following periods (I1, I2, I3) according to Fick’s principle. RESULTS: Differences between CO_{RV}, CO_{LV} are shown in Fig. 1. The highest difference (9.26 L·min⁻¹) was found in TS after the change from the 90° to -6° position. CONCLUSION: The combination of VO_{2} and cBP measurements allows to assess differences in CO_{RV} and CO_{LV}. The differences in I₁ after a reduction in posGz indicate a blood volume shift into the pulmonary veins which has an impact on CO_{RV}, which decreases during the following posGz increase (I). Further influences from breathing must be studied.

![Fig. 1: Difference of CORV and COLV](image)

Acknowledgement: This study was funded by German Ministry of Education and Research (50WB1426)

Previous studies suggested that long-term exposure to repeated bouts of high-intensity exercise may have detrimental effects on the right ventricle (RV), potentially causing an ‘exercise-induced’ cardiomyopathy. PURPOSE: We aimed to evaluate the effects of 8 years of intensive exercise training on cardiac adaptations in Olympic athletes. METHODS: We selected Italian athletes who qualified consecutively for the 2008, 2012 and 2016 Summer Olympic Games. Athletes underwent a complete echocardiographic examination. Athletes were categorized as either endurance or non-endurance athletes. We aimed to compare estimates of cardiac output by gas exchange and continuous blood pressure (cBP) measurements to assess transient differences in CO_{RV} and CO_{LV}. A ‘hypertrophy’ of the aortic root while maintaining intensive exercise training over 8 years follow-up. However, cardiac RV and LV remodeling appears to plateau and no signs of reduced RV or LV cardiac function occurred over time. Therefore, our data does not support the hypothesis that exercise alone may cause detrimental effects on cardiac morphology and function in Olympic athletes. V.L.A is financially supported by a grant from the Radboud Institute for Health Sciences.

The mechanisms of the diving reflex involve the simultaneous activation of the sympathetic and parasympathetic nervous systems (PNS). The enhanced PNS capabilities as achieved through aerobic training has been assumed to improve the diving reflex, specifically vagally-mediated bradycardia, and the research remains controversial. PURPOSE: The current study was conducted to evaluate heart rate responses associated with the diving reflex in aerobically trained and untrained men. METHODS: Using 2 x 3 mixed factorial ANOVA, lowest heart rate achieved, percent heart rate reduction, and time course of heart rate reduction were compared between aerobically untrained (n = 7) and trained (n = 9) men while breath holding in air, water at 15 °C, and water at 0 °C. RESULTS: Results showed that trained men did not differ in percent heart rate reduction or lowest heart rate achieved, although there was a tendency for lower heart rate achieved in the trained group (p = .06). A significant interaction was found for time course (p < .01), where trained men took significantly longer to reach a plateau in heart rate in the air compared to untrained men. No differences in training status were found for time course in the two water conditions. However, a linear increase in time course for untrained men in the water conditions indicated a potentially delayed response by the PNS with the diving reflex. CO_{LV}: No additional clarification on the impact of training status on the diving reflex has been made except that an effect may lie in the timing of the response of the PNS.

The menopause is generally associated with lower cardiovascular function. Exercise training is known to improve cardiovascular function, but whether it attenuates the effects of the menopause is unclear. PURPOSE: To investigate the effects of exercise training on left ventricular (LV) function and mechanics in post-menopausal women. METHODS: Eleven pre-menopausal and 14 post-menopausal healthy untrained middle-aged women (age 45-58 years) were included in this retrospective study. Peak aerobic capacity was assessed on an upright cycle ergometer. Resting LV function and basal and apical mechanics were assessed using echocardiography. Post-menopausal women were reassessed after 12 weeks of exercise training (3 sessions/week consisting of 40 min intervals at 90-121% of heart rate reserve) in the water (n=3) and in the air (n=3); and non-exercised (n=3) for comparison. LV mechanics are reported for 11 pre- and 12 post-menopausal women. The Bayes factor (BF_{pH}) from the Bayesian independent samples t-test was used to assess the differences in LV mechanics between pre-trained untrained post-menopausal women and post-menopausal women before and after exercise training (H_{1}). A BF_{pH} >1 indicates equal evidence for both the null (H_{0}) and alternative hypotheses, while smaller values indicate increasing strength of evidence for the null hypothesis and larger values favour H_{1}. RESULTS: We found weak evidence for similar peak aerobic capacity, cardiac output, heart rate, systemic vascular resistance, LV volumes and most measures of LV function and mechanics between untrained pre- and post-menopausal women (BF_{pH} range 0.37-0.77). The key exception to this was a lower peak septal wall velocity during early diastole (E') in untrained post-menopausal women, compared with pre-menopausal women (mean:SD: 0.09±0.02 vs. 0.11±0.02 m/s; BF_{pH} = 3.56). After exercise training, peak aerobic capacity was higher in post-menopausal women (34±5 vs. 29±5 mL/min/kg; BF_{pH} = 2.58), while strength of evidence for menopause-reduced differences in E' decreased (BF_{pH} 1.80).
CONCLUSION: Short-term high-intensity aerobic interval training improves peak aerobic capacity in middle-aged post-menopausal women, and reduces the extent of menopause-related differences in LV function. Amanda Nio is the beneficiary of a doctoral grant from the AXA Research Fund.

PURPOSE: Optimizing exercise as therapy for pulmonary arterial hypertension (PAH) requires an understanding of which approaches maximize benefit and minimize detriments, particularly in more advanced disease. Therefore, in rats with severe, angioproliferative PAH, we examined cardiopulmonary effects of three distinct training approaches: 1) high-intensity interval training (HIIT), 2) low-intensity continuous exercise training (CET), or 3) voluntary wheel running (VWR).

METHODS: SD rats (~200 g) with Sugen-Hypoxia-induced PAH (SuHx) underwent 6 wk of training as either HIIT (2 min at ~85% VO2 max, 4-5 times/wk, n=12) or CET (45-60 min at 30%VO2max, n=11) performed 5 days/wk on a treadmill, or were housed with computer-monitored wheels (n=14). Additional SuHx rats were untreated (SED, n=15). Healthy, unexercised animals were controls (CON, n=14). Echocardiography was performed at pre- and post-training; all other measures were post-training.

RESULTS: Mortality in SuHx was highest for SED (5 deaths at days 65, 66, 72, 77, and 81) and HIIT (4 deaths at days 56, 60, 68, and 71), and lowest for CET (2 deaths at days 60 and 73) and VWR (2 deaths at days 59, 68). While all animals exhibited similar baseline RV function, SuHx rats that died prematurely (n=13) had worse (p<0.05) cardiac output (CO, 148±12mL/min) and stroke volume (SV, 466±39mL/min) at pre-training compared to surviving SuHx (n=39, 216±19mL/min, 933±30mL/min). SuHx-induced elevation in RV systolic pressure (RVSP) and RV hypertrophy were not ameliorated by training with any approach (p>0.05 vs. SuHx-SED). However, final RV function in surviving SuHx was higher for all 3 training approaches (p<0.05 vs. SuHx-SED). Final RV function in surviving SuHx was higher for all 3 training approaches (p<0.05 vs. SuHx-SED). Final RV function in surviving SuHx was higher for all 3 training approaches (p<0.05 vs. SuHx-SED). Final RV function in surviving SuHx was higher for all 3 training approaches (p<0.05 vs. SuHx-SED). Final RV function in surviving SuHx was higher for all 3 training approaches (p<0.05 vs. SuHx-SED).

CONCLUSION: In a rat model of severe, angioproliferative PAH, 3 different training approaches achieved gain in RV function despite no amelioration of RV hypertrophy and elevated RVSP. However, in contrast to previous findings in a model of mild PAH, HIIT resulted in increased mortality for animals with poorer RV function prior to training onset and suggests that it may not be appropriate in the presence of more advanced disease. FUNDING: NIH-NHLBI R-15 (MB Brown).
PURPOSE: To examine the efficacy of the Pandolf equation [1] to predict EE of male and female Soldiers while carrying light to heavy loads.

METHODS: Twenty (10 male and 10 female) OCs (mean ± SD: age 22 ± 1 years, 1.73 ± 0.08 m, body mass 77.0 ± 9.3 kg) wore one research-grade accelerometer, worn during weeks 9 (base) and 22 (field exercise) of training on base and 5 days on a field exercise in Officer Cadets (OCs). METHODS: Twenty-nine (12 Female, 17 Male, mean ± SD: age 24 ± 2 y, 1.76 ± 0.10 m, body weight 76.7 ± 9.1 kg) OCs volunteered. Energy expenditure was assessed using a wrist-mounted research grade accelerometer, worn during weeks 9 (base) and 22 (field exercise) of the 42-week British Army Regular Commissioning Course. Energy intake was quantified from researcher-led dietary weighing and food diaries for a sub-set of OCs (n=16), which was compared to daily energy expenditure to calculate energy balance.

RESULTS: Time spent in physical activity zones were similar during training on base and on field exercise, although less time was spent in the vigorous intensity zone during the latter. However, OCs had less sleep and a greater energy deficit during field exercise, which has potential implications for their ability to sustain the level of activity required; therefore, impacting physical performance and potentially increasing fatigue-related injury risk.

REFERENCES

rate. Shipboard work spaces present an extremely challenging work environment known as Physiological Heat Exposure Limit (PHEL) curves, relies on metabolic guidance. A large component of the U.S. Navy's shipboard heat exposure guidance, in addition to heat exposure guidance, in military and civilian work environments. Results from this pilot evaluation will lead to an effort to revise the U.S. Navy's shipboard PHEL curve guidance.

**Comparison Of Daily Energy Expenditure And Weekly Physical Activity Exposure Estimated Using Consumer And Research-grade Physical Activity Monitors During Officer Cadet Initial Military Training**

Steven D. Powell1, Andrew G. Siddall1, Jane E. S Thompson2, Victoria C. Edwards3, Sarah Jackson3, Julie P. Creeves4, Sophie Wardle5, Sam D. Blacker5, Steve D. Myers6.

1University of Chichester, Chichester, United Kingdom. 2Army HQ, Andover, United Kingdom.

**PURPOSE:** Wearable physical activity monitors provide a cheaper and more practical method for estimating free-living TEE than DLW, and could be useful for military populations. However, this study suggests a consumer monitor may underperform, by underestimating TEE during physically demanding situations in comparison to a research-grade device.

**RESULTS:** Mean daily estimated TEE from the CN and RG were 13.9 ± 2.5 and 15.7 ± 1.8 MJday−1, respectively. Mean daily EE ranged from 8.6 ± 2.8 (day 35) to 22.4 ± 6.7 MJday−1 (day 49) in CN and from 10.7 ± 4.5 (day 55) to 21.3 ± 8.1 MJday−1 (day 49) in RG. There was a strong correlation between EE in CN and RG over 14 weeks (r = 0.761, p<0.001). However, the LoA indicated that CN underestimated EE (mean bias [95% CI]) by -1.4 [-16.3 - 3.2] MJday−1, p<0.001) compared to the RG.

Mean daily estimates from CN were 1089 ± 86 sedentary minutes, 221 ± 44 light minutes, 40 ± 14 moderate minutes and 56 ± 16 vigorous minutes. RG estimated 543 ± 53 sedentary minutes, 90 ± 16 light minutes, 249 ± 52 moderate minutes and 33 ± 14 vigorous minutes. All intensities were significantly different between CN and RG (p<0.05). The CN overestimated on sedentary minutes (526 mins day−1 [319 - 734 mins day−1]), light minutes (131 [39 - 224 mins day−1]), and vigorous minutes (24 [15 - 62 mins day−1]) in comparison to RG but underestimated moderate minutes (208 [295 - 122 mins day−1]).

**CONCLUSION:** Consumer grade physical activity monitors provide an easily accessible tool for monitoring military training but more research is required to improve their accuracy before they can be used to inform training practices.

**Comparison Of Daily Energy Expenditure And Weekly Physical Activity Exposure Estimated Using Consumer And Research-grade Physical Activity Monitors During Officer Cadet Initial Military Training**

**F-33 Thematic Poster - Movement Biomechanics in People with Obesity**

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100E

**Board #7**

**Board #8**

**The Use of Modern Technology to Evaluate Shipboard Metabolic Rate Aboard a U.S. Navy Ship While Deployed in the Persian Gulf**


Physiological data are often used to develop work/rest cycles and thermal exposure guidance. A large component of the U.S. Navy’s shipboard heat exposure guidance, known as Physiological Heat Exposure Limit (PHEL) curves, relies on metabolic rate. Shipboard work spaces present an extremely challenging work environment

with respect to the impact of high heat and humidity on the integrity of obtaining digital data. Data collections conducted on an aircraft carrier have an increased potential for signal disruption due to the potential for electromagnetic interference and previous attempts have been unsuccessful. With the availability and technological advancement of more robust commercial, wireless physiological data devices, it is now possible to evaluate if existing exposure guidance accurately reflects the work rate performed within the shipboard environment.

**PURPOSE:** To obtain actual shipboard metabolic rates of various personnel aboard an aircraft carrier deployed in the Persian Gulf.

**METHODS:** Twenty-nine personnel (age: 23 ± 3 yrs, height: 169 ± 10 cm, weight: 79.4 ± 14.3 kg) had their VO₂, HR, and Tcore measured while performing actual shipboard duties for approximately three hours on two separate days (T1 and T2). Personnel were from the following work spaces: Flight Deck, Hangar Bay, Scullery, Galley, Waste Management, Catapult, and Reactor Room.

**RESULTS:** From a possible total collection time of 12,771 min, there were 9,248 min (72%) of usable data for VO₂, HR, and Tcore data, can be obtained using current technology in extreme work place i.e., field environments. This sophisticated technology can have a significant impact on developing new work/rest guidance, in addition to heat exposure guidance, in military and civilian work environments. Results from this pilot evaluation will lead to an effort to revise the U.S. Navy’s shipboard PHEL curve guidance.

**Differences in Jump Landing Mechanics, Strength, and Vertical Jump Height Between Obese and Non-Obese Children**

Bradley Bowser, Claire V. Sylvester, Christopher Kaddatz. South Dakota State University, Brookings, SD. (Sponsor: Matt Vukovich, FACSM)

**PURPOSE:** To compare jumping mechanics, strength, and max vertical jump between healthy weight children and children classified as overweight or obese.

**METHODS:** 42 children (22 males, ages 11.1±1.6 yrs; 20 females, ages10.9±1.3 yrs) were divided into 2 groups based on the CDCP’s BMI percentile for children. 24 children were classified as healthy weight (HW) (n=13 males, 11 females; BMI percentile 44.8±25.8) and 18 children were classified as overweight/obese (OW/OB) (n=9 males, 9 females; BMI percentile 95.6±3.9). Participants completed 2 testing session approximately 1 week apart. During the first session age, height, mass, and leg strength were collected. Max torque created during isokinetic knee extensions at 90 degrees/s was used to determine leg strength. For the second visit participants completed a max vertical jump test and 5-10 drop jump trials. For jump trials, potential for signal disruption due to the potential for electromagnetic interference and previous attempts have been unsuccessful. With the availability and technological advancement of more robust commercial, wireless physiological data devices, it is now possible to evaluate if existing exposure guidance accurately reflects the work rate performed within the shipboard environment.

**RESULTS:** Results can be found in Table 1. There appear to be no group differences in leg strength, max vertical jump height, or max landing force. However, similar to other studies, HW children displayed greater ROM during landings than children classified as OW/OB. Increased joint ROM while landing from a jump has typically been thought to decrease vertical loading, however our data suggests significantly greater ROM does not always result in increased vertical loading.
Table 1. Summary of means, p-values and effect sizes for variables of interest

<table>
<thead>
<tr>
<th>Variable</th>
<th>HW (Mean±SD)</th>
<th>OW/OB (Mean±SD)</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg Strength (N/m/BW)</td>
<td>223.8(41.0)</td>
<td>221.3(57.7)</td>
<td>0.87(0.05)</td>
</tr>
<tr>
<td>Max vertical jump (cm)</td>
<td>33.6(7.34)</td>
<td>30.8(7.44)</td>
<td>0.22(0.38)</td>
</tr>
<tr>
<td>Max landing force (BW)</td>
<td>2.02(0.38)</td>
<td>1.96(0.47)</td>
<td>0.64(0.14)</td>
</tr>
<tr>
<td>Average load rate (BW/s)</td>
<td>34.1(12.6)</td>
<td>26.5(10.0)</td>
<td>0.04(0.67)*</td>
</tr>
<tr>
<td>Instantaneous Load rate (BW/s)</td>
<td>110.4(24.1)</td>
<td>82.9(20.3)</td>
<td>0.003(1.23)*</td>
</tr>
<tr>
<td>Dorsiflexion excursion (degrees)</td>
<td>48.6(5.07)</td>
<td>42.6(7.92)</td>
<td>0.008(0.90)*</td>
</tr>
<tr>
<td>Knee flexion excursion (degrees)</td>
<td>43.4(3.32)</td>
<td>35.3(8.20)</td>
<td>0.007(0.92)*</td>
</tr>
<tr>
<td>Hip flexion excursion (degrees)</td>
<td>21.3(9.83)</td>
<td>14.8(6.10)</td>
<td>0.026(0.79)*</td>
</tr>
</tbody>
</table>

*indicates p<0.05

Persons with Chronic Obstructive Pulmonary Disease (COPD) experience a greater fall risk than healthy individuals of the same age. Obesity has been associated to an even greater fall risk in persons with COPD. Gait abnormalities such as an increasing step width has also been associated with severity of COPD. Recent research has shown that a high intensity intervention decreases step width in persons with COPD. However, no research has been done to investigate possible difference in gait pattern between persons with COPD who have obesity and those who have a healthy body mass index (BMI). PURPOSE: To investigate differences in gait pattern between people with COPD who have obesity and those who have a healthy BMI. METHODS: 9 persons with COPD who have a BMI in the Obese category (OBMI) and 5 persons with COPD who have a BMI in the Healthy category (HBM) participated. Participants completed 5 trials of walking forward at a comfortable pace on pressure-sensor walkway. Velocity, cadence, step width, stride length, and task duration were measured as average of 5 trials and compared between groups using a 2-tailed independent samples t-tests or a Mann-Whitney U test depending on normality. Hedges’ effect size was also calculated. RESULTS: OBMI group walked with wider steps showing a trend towards statistical significance (OBMI: 15.7±4.9cm; HBM: 9.9±2.5cm; p=0.053). No other variables were significantly different between the groups. Effect sizes ranged from trivial (0.05 for cadence) to large (1.08 for step width). CONCLUSION: A wider step gait in OBMI may be related to increased risk of falling. Research with greater sample size must be done to further investigate the how obesity affects gait patterns in persons with COPD.

Food intake and body weight may be affected by their recent history of lower extremity injury among runners of different body sizes are not clear. PURPOSE: To determine the relationship between lower extremity skeletal muscle strength and biomechanics during sit-to-stand. METHODS: Nine obese (BMI 32.5 ± 2.5 kg/m²) young adults (age: 28.4 ± 5.7 y) completed sit-to-stand task three times from a chair (seat height: 52 cm). Ten high speed cameras were used to track retraceable coordinate data through 3D motion analysis at a rate of 200Hz. Significant outcomes of interest included: peak trunk flexion velocity (deg/s), peak trunk flexion angle (deg), and task duration (s). Maximal voluntary isometric contractions (MVICs) of the knee extensors and flexors were measured via a previously validated handheld dynamometer (Hoggan MicroFET2) and normalized to body mass. Linear regression was used to determine relationships between body mass and relative muscle strength with independent variables. Results: Body mass index was positively associated with peak trunk flexion velocity (y = 4.458x - 57.208, r² = 0.506; p = 0.032), but not peak trunk flexion angle (p = 0.127) or task duration (p = 0.924). Conversely, relative knee extensor and knee flexor strength were inversely related to peak trunk flexion velocity and angle (r = 0.541 - 0.786; p < 0.05). The ratio of relative knee extensor to knee flexor strength during the task was inversely related to task duration (y = 777.4 - 4.784x; r² = 0.553; p = 0.022). Conclusions: Excess body mass induces greater trunk flexion velocity, likely to generate sufficient momentum to stand. High levels of knee extensor and flexor strength may decrease peak trunk flexion angle and velocity reduce sit-to-stand time in obesity.

Fatigability of the Dorsiflexor Muscles in People with Type 2 Diabetes and Controls

Kevin Ryan, Jonathon Seneff, Sarah D’Astice, Bonnie Schlinder-Delaney, Sandra Hunter, FACSM, Mariquette University, Milwaukee, WI. (Sponsor: Dr. Sandra Hunter, FACSM)

No relevant relationships reported

People with type 2 diabetes (T2D) and diabetic polyneuropathy are more fatigable for the dorsiflexor muscles during isometric fatiguing contractions; however, it is unknown if the greater fatigability is observed in people with T2D and no signs of neuropathy. PURPOSE: To determine the neural and muscular mechanisms of dorsiflexor muscle fatigability for an intermittent isometric contraction task in people with T2D and healthy controls. METHODS: 8 people with T2D (65±6 yrs; 29±5 kg·m²; 8.37±2.71 daily steps; 2 women) with no signs of diabetic neuropathy were matched based on age, BMI, and physical activity with 5 healthy controls (64±6 yrs; 26±2 kg·m²; 9,400±282 daily steps; 2 women). Fatigability was assessed with an intermittent isometric protocol using 6-s contractions at 50% of maximal voluntary contraction (MVC), followed by a 4-s rest until task failure. MVCs were performed every 60s. Task failure was defined as MVC ≤ 50% baseline MVC. Electrically-evoked twitch contractions were elicited during and after each MVC to estimate voluntary activation and contractile properties of the dorsiflexor muscles. RESULTS: Time to task failure of the fatiguing task was 42% briefer in people with T2D compared with controls (6.62±4.17 vs. 11.60±6.58 min, respectively; p=0.065). Voluntary activation was similar between T2D and control group at baseline (96.8±6.7 vs. 98.2±1.4%, P=0.43) and declined similarly during the fatiguing task (task end; 94.9±6.4 vs. 92.6±4.8%, p=0.39). The electrically-evoked twitch amplitude was significantly attenuated in people with T2D and controls before the fatiguing task (5.3±3.8 vs. 5.4±2.3 mm, P=0.96) and declined similarly during the fatiguing task (51.1±28.0 vs. 55.0±43.3% reduction, P=0.13). CONCLUSIONS: Both muscular and neural mechanisms contributed to fatigability of the dorsiflexor muscles for an intermittent isometric fatiguing task in people with T2D and age- and BMI-matched controls; although, T2D muscles played a greater role than the reduction in neural drive. These findings that suggest people with T2D who have no signs of diabetic polyneuropathy are more
Obesity is a preventable risk factor for osteoarthritis (OA), a leading cause of pain and physical disability. Prior studies have linked altered gait biomechanics and quadriceps strength deficits to OA development in clinical populations, but data are lacking in young obese individuals without OA.

PURPOSE: To compare quadriceps strength and gait biomechanics between obese (OB) and normal weight (NW) young adults. A secondary purpose was to examine the relationship between quadriceps function and gait biomechanics.

METHODS: 47 participants were recruited and classified by body mass index (BMI), 24 NW (BMI = 21.9±1.7; 54% female) and 23 OB (BMI = 33.7±2.4; 48% female). Fat and fat-free mass (FFM) were obtained via air displacement plethysmography. Quadriceps strength was assessed using a maximal voluntary isometric knee extension (m.v.i.e.m.) by the Thomas lab, since their binding site on SERCA was unknown. ATPase assays indicate that SMA1163 stimulates both ATPase activity and calcium transport by SERCA. Tryptophan (TRP) residues of SERCA exhibit a potentiating effect on TRP-dependent fluorescence quenching by SMA1163. Mice lacking both TRP and SERCA exhibit a profound loss of function, indicating that SMA1163 retains its normal ligand-binding effects. An atomic structure of SERCA + SMA1163, determined by x-ray crystallography, indicates a transmembrane domain binding site for SMA1163 on SERCA, consistent with TRP fluorescence. Furthermore, the binding site of SMA1163 is located on the energy transduction segment of SERCA, consistent with the kinetic mechanisms of activation detected by FITC fluorescence.

CONCLUSIONS: We propose that SMA1163 may be a useful activator of SERCA calcium transport to help alleviate MD, as an alternative approach to SERCA gene therapy.

Mice lacking dystrophin (mdx) exhibit skeletal muscle weakness and susceptibility to contraction-induced injury. Because dystrophin mediates radial force transmission and skeletal muscle membrane integrity, the debate continues regarding the practicality and ethical implications of prescribing exercise training for patients with Duchenne muscular dystrophy (DMD).

PURPOSE: To determine if isometric contractions improve skeletal muscle strength and morphology of mdx mice. METHODS: Mice at 60° of knee flexion. Gait biomechanics were collected at a standardized (ST) (1 m/s) and self-selected (SS) gait speed. A 2 group by 2 condition ANOVA was used to evaluate peak kne flexion angle (PKF), knee flexion excursion (PKE), peak internal knee extension moment (KEM), peak vertical ground reaction force (vGRF), vertical landing rate (vLR), isometric peak torque (PT), and rate of torque development (RTD). Pearson correlations were calculated between quadriceps strength and gait biomechanics at ST and SS speed.

RESULTS: OB had lower PT (3.52 [95%CI: 3.11, 3.93]) vs. 4.11 [95%CI: 3.67, 4.55] Nm/FFM, p<0.03), and late RTD (7.6 [95%CI: 6.1, 9.1]) vs. 10.0 [95%CI: 8.8, 11.2] Nm/FFM/sec, p<0.02) compared to NW. NW had a faster SS gait speed compared to OB (1.30 [95%CI: 1.29, 1.31] vs. 1.19 [95%CI: 1.11, 1.21] m/s, p<0.02). Post hoc analyses reveal that at SS gait speed, NW had greater vGRF (p<0.002), vLR (p<0.009), and KEM (p<0.01). No differences between groups were found at ST gait speeds. Partial correlation adjusted for SS walking speed revealed a moderate relationship between early RTD and KEM (r=0.42, p<0.01).

CONCLUSIONS: OB have deficits in quadriceps strength relative to FFM, and walk slower compared to NW. RTD was moderately associated with KEM, and KEM was lesser in OB compared to NW. Smaller KEM suggests that OB walk with a quadriceps avoidance gait, which may contribute to knee OA development. Exercise interventions targeting RTD may be useful for improving walking mechanics in OB.

PURPOSE: Dystrophin, a subsarcolemmal protein, plays a role in maintaining membrane integrity of muscle fibers. A key feature of skeletal muscle that lacks dystrophin, mdx, is increased sarcotubular instability and increased calcium influx, leading to myocyte damage and death. Increasing SERCA activity by gene therapy reverses MD in cell culture and animal models. We continue the characterization of recently-discovered small-molecule activators (SMA) of SERCA by the Thomas lab, since their binding site on SERCA was unknown. METHODS: Small-molecule activation of SERCA was characterized by three techniques: enzyme assays, fluorescence spectroscopy, and x-ray crystallography, with particular focus on the potent SMA1163. Results: ATPase assays indicate that SMA1163 stimulates SERCA activity by 36 ± 11%, with an EC₅₀ of 3 ± 1 µM (n=6). SMA1163 activated both ATPase activity and calcium transport by SERCA. Tryptophan (TRP) residues of SERCA exhibit a potent effect on TRP-dependent fluorescence quenching by SMA1163, with particular focus on the transmembrane binding site for SMA1163 on SERCA, consistent with TRP fluorescence. Furthermore, the binding site of SMA1163 is located on the energy transduction segment of SERCA, consistent with the kinetic mechanisms of activation detected by FITC fluorescence. Conclusions: We propose that SMA1163 may be a useful activator of SERCA calcium transport to help alleviate MD, as an alternative approach to SERCA gene therapy.

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compared to pre-injury (p < 0.001). By day 2, the low M-wave RMS recovered to pre-injury (1.37 vs. 1.18 mN p = 0.34) and coincided with a large improvement in isometric torque (1.10 to 1.85 mNp, p = 0.001), which fully recovered by day 9 (2.87 vs. 2.90 mNp, p = 0.82). CONCLUSIONS: These data substantiate that a main contributor to ECC contraction-induced strength loss in dystrophic muscle is membrane excitability. Moreover, acute recovery of strength in the days after the ECC protocol occurred in conjunction with the restoration of membrane excitability. Our results provide a mechanistic explanation for why dystrophic muscle is more prone to ECC contractions and gives insight into how the muscle recovers post-injury. Importantly, these findings may aid in the development of therapeutic treatments for patients with DMD, particularly in regards to establishing safe and effective exercise programs.

2639 Board #5 June 1 3:15 PM - 5:15 PM The Effect of Exercise Interventions on Muscle Fiber Type in mdx Mice
Matthew C. Kostick, FACSM, Kailey Omstead. Duquesne University, Pittsburgh, PA. (No relevant relationships reported)

 Duchenne Muscular Dystrophy (DMD) is the most common lethal genetic disease in boys. There is no cure and few treatments. A gene mutation (dystrophin) causes the disease and the pathology is exacerbated by chronic inflammation. Our previous studies have shown exercise interventions affect the pathology of dystrophic muscle. In the current study we sought to examine the effect of two different exercise protocols and contraction types on muscle fiber type. PURPOSE: The goal of our study is to determine the effect of exercise and contraction type on muscle fiber type changes in dystrophic mouse muscle. METHODS: 36 male mdx mice and 7 control (healthy) mice, approximately 5 weeks of age were randomized to four groups: voluntary wheel running exercise, concentric-only, or eccentric-only exercise for 4 or 8 weeks. At study conclusion, skeletal muscle tissue was extracted and preserved for analysis. Fiber typing was conducted with standard immunohistochemistry techniques. All dependent variables were analyzed with a one-way ANOVA to examine differences between treatment groups. A p-value of < 0.05 was considered significant. RESULTS: All mice completed the study. Fiber type of dystrophin muscle demonstrated an increase in the percentage of type I fibers (5.2 ± 3.6%, p = 0.04). No differences were noted between concentric and eccentric-only exercise muscle contractions. A standard histologic analysis of the gastrocnemius revealed a decrease in fiber necrosis due to exercise interventions (p < 0.05). Exercise was able to modify muscle fiber type in mdx mice. (p < 0.05). CONCLUSION: Exercise may have a role in improving the oxidative capacity and muscle fiber characteristics in muscular dystrophy and is dependent on the type of exercise.

2640 Board #6 June 1 3:15 PM - 5:15 PM Effect of Resistance Training on Contractile Force Production during Doxorubicin-Treatment
Mikayla Kaufenberg, Allison Tigner, Sarah Hook, MacKenzie Twaddell, Meghan Wagner, Eric Bredahl, Jake Siedlik, Joan Eckerson, FACSM, Kristen Drescher, Creighton University, Omaha, NE. Creighton University School of Medicine, Omaha, NE. (No relevant relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent that is associated with a number of deleterious side effects including skeletal muscle dysfunction and atrophy. Although the exact mechanisms behind the observed myotoxicity are not fully understood, DOX treatment has been shown to result in the generation of reactive oxygen species and changes in short-term energy metabolism. Conversely, creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by muscle atrophy, which is a hallmark of DOX treatment. PURPOSE: To examine the ability of Cr and CN to attenuate the decline in Cr metabolism and minimize DOX-induced apoptosis and necrosis in skeletal muscle myoblasts. METHODS: Rat skeletal muscle myoblasts were cultured until they reached 85-90% confluency and were treated with DOX+Cr or DOX+CrN. These findings suggest that Cr and CN may attenuate the degree of skeletal muscle dysfunction and atrophy during chemotherapy with DOX.

2641 Board #7 June 1 3:15 PM - 5:15 PM Cancer Environments Effect on Skeletal Muscle mTORC1 Regulation by Physical Activity and Feeding in Mice
Brittany Counts, Brandon VanderVeen, Justin Hardee, Dennis Fix, Ryan Montalvo, James Carson, FACSM. University of South Carolina, Columbia, SC. (No relevant relationships reported)

Physical activity and feeding behaviors exert continuous regulation on daily skeletal muscle anabolic signaling. Mice exhibit diurnal variation in physical activity levels and food intake, which are significantly elevated during the dark cycle and negligible during the light cycle. The mechanistic target of rapamycin complex 1 (mTORC1) signaling axis serves to integrate feeding and activity behaviors to regulate muscle anabolism. The Apcmin/+ (MIN) mouse is an established preclinical model of cancer cachexia. While cachexia suppresses basal mTORC1 signaling, there are significant gaps in our understanding of how the cancer environment effects diurnal mTORC1 fluctuations to feeding and activity. PURPOSE: We examined the cancer environment’s effect on diurnal mTORC1 flux in skeletal muscle. METHODS: Body weight, food consumption, physical activity, and plasma glucose were monitored for 4 consecutive days at the end of the light (SEDENTARY [SED]) and dark (ACTIVE [ACT]) cycles in male C57BL/6 (B6; N=16) and MIN (N=14) mice. Mice had free access to food and water, and were sacrificed at the end of either the SED or ACT state. Gastrocnemius muscle was used for analysis. SED and ACT states for B6 and MIN exhibited significant differences in physical activity, food consumption and plasma glucose between SED and ACT states; the cancer environment disrupted this response. MIN activity was reduced 50% (p=0.002) during the ACT state compared to B6. MIN did not have a diurnal variation in circulating glucose (p=0.186), and food intake was increased 12% (p=0.001) fold during the SED state. B6 muscle 4EBP1 phosphorylation, a marker of mTORC1 signaling, was induced by the ACT state compared to SED state (p=0.003). Muscle 4EBP1 phosphorylation flux (ACT / SED ratio) was suppressed (p=0.002) in the MIN compared to B6. CONCLUSION: Daily muscle anabolic flux changes in short-term energy metabolism. Conversely, creatine (Cr) supplementation.
is disrupted in MIN mice. Moreover, this suppressed anabolism, which may be driven by decreased feeding and reduced physical activity behaviors. Future studies should examine if targeting these behaviors can improve skeletal muscle anabolic flux in the presence of the cancer environment. Supported by NCI R01-CA121249

2642 Board #8 June 1 3:15 PM - 5:15 PM Effect Of Aerobic Physical Training On The Expression Of Muscular Myomirs In Experimental Models Of Cancer.

João LP Gomes, Gabriel C. Tobias, Tiago Fernandes, Andre C. Silveira, Patricia C. Brum, Roger Chammas, Edilamar M. Oliveira. University of Sao Paulo, Sao Paulo, Brazil. (No relevant relationships reported)

PURPOSE: There are several comorbidities associated with cancer as muscle cachexia. MicroRNAs (miR) in skeletal muscle (myomiRs) has been highly investigated for being related to several physiological and pathological factors. Aerobic physical exercise plays an important role in the regulation of the expression of several microRNAs.METHODS: We analyzed the expression of myomiRs using two mice models MMTV-PyMT (breast cancer, non-cachectic) and CT26 (colon cancer, cachectic). Animals were running trained and divided into 4 groups: SH-Sedentary Trained; CS-Cancer Sedentary; CT-Cancer Trained. Body and skeletal muscles were weights. Skeletal muscle function was analyzed by grip strength. We analyzed microRNAs expression by RT-PCR and proteins levels by Western blot. The tumor volume was determined by macroscopic caliber measure.RESULTS: Exercise training prevented the tumor progression. MMTV non-cachectic animals showed no loss of muscle mass and function. Mir-206 expression increased CS and mir-486 was decreased and it was not prevented in CT group. We also evaluated the same parameters in the CT26 model. The body mass, gastrocnemius and anterior tibial weight were decreased in CS and it was not prevented in CT group. Cancer increased the expression of mir-206 in skeletal muscle and aerobic training does not prevent these effects. The expression of mir-486 was decreased in CS group and PTEN levels was increased (p<0.05), decreasing PI3K-AKT-mTOR pathway and decreased synthesis pathways. While mir-206, that is a skeletal muscle specific, was increased and the target genes tested were not modified. Thus, these two microRNAs can be markers of the skeletal muscle damage in cancer cachexia, regulating the protein synthesis pathways.

F-35 Thematic Poster - Protein Metabolism

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-Mezzanine M100C

2643 Chair: Nancy R. Rodriguez, FACSM. University of Connecticut, Storrs, CT. (No relevant relationships reported)

2644 Board #1 June 1 3:15 PM - 5:15 PM Evaluation Of Lean Body Mass As A Predictor Of Dietary Protein Intake

Joseph R. Stanzione, Joseph I. Boullata, Michael Bruneau, Jr., Stella L. Volpe, FACSM. Drexel University, Philadelphia, PA. (Sponsor: Stella L. Volpe, FACSM) (No relevant relationships reported)

Protein is of increasing concern with respect to intake recommendations. Presently, most predictive calculations for protein recommendations are based on either actual body weight (ABW) or a calculated ideal body weight (IBW). It has been proposed that, when calculating protein needs, dosing may be better predicted using lean body mass (LBM) rather than ABW or IBW. PURPOSE: To determine the impact of blood flow restriction with and without concomitant low-load resistance-type exercise on in vivo myofibrillar protein synthesis rates in healthy young males.

METHODS: Twenty young healthy men (age: 24±1 y, BMI: 22.9±0.6 kg/m²) were randomly subjected to two 5-min cycles of single leg blood flow restriction combined with (L-LRE-BFR; n=10) or without (REST-BFR; n=10) low-load resistance-type exercise (20%-1RM). Myofibrillar protein synthesis rates were assessed by combining a primed continuous L-[ring-13C]phenylalanine infusion with the collection of blood samples and muscle biopsies from both the blood flow restricted and control leg in each participant. RESULTS: In resting conditions, blood flow restriction (REST-BFR) did not increase myofibrillar protein synthesis rates when compared to the control leg (0.0455±0.0037 vs 0.0432±0.0038 %/h, respectively; P=0.683). In contrast, when combined with low-load resistance-type exercise, blood flow restriction (L-LRE-BFR) increased post-exercise myofibrillar protein synthesis by 10.55% when compared to the control leg (0.0475±0.0047 vs 0.0433±0.0042 %/h, respectively; P=0.042). CONCLUSIONS: Blood flow restriction does not increase myofibrillar protein synthesis rates in healthy young men. When combined with low-load resistance-type exercise, blood flow restriction increases post-exercise myofibrillar protein synthesis rates. Supported by the Dutch Technology Foundation STW

2645 Board #2 June 1 3:15 PM - 5:15 PM Blood Flow Restriction Combined With Low-load Resistance-type Exercise Increases Myofibrillar Protein Synthesis Rates

Jean Nyakayiru, Cas J. Fuchs, Joey S.J. Smeets, Anemie P. Gijsen, Joy P.B. Goossens, Luc J.C. van Loon, Lex B. Verdijk. Maastricht University, Maastricht, Netherlands. (Sponsor: Professor Janice L. Thompson, PhD, FACSM) (No relevant relationships reported)

Blood flow restriction (BFR) with or without resistance type exercise training has been suggested to increase muscle mass and strength. However, there is limited data on the acute effects of blood flow restriction in combination with or without low-load resistance-type exercise on muscle protein synthesis rates. PURPOSE: To determine the impact of blood flow restriction with and without concomitant low-load resistance-type exercise on in vivo myofibrillar protein synthesis rates in healthy young males.

METHODS: Twenty young healthy men (age: 24±1 y, BMI: 22.9±0.6 kg/m²) were randomly subjected to two 5-min cycles of single leg blood flow restriction combined with (L-LRE-BFR; n=10) or without (REST-BFR; n=10) low-load resistance-type exercise (20%-1RM). Myofibrillar protein synthesis rates were assessed by combining a primed continuous L-[ring-13C]phenylalanine infusion with the collection of blood samples and muscle biopsies from both the blood flow restricted and control leg in each participant. RESULTS: In resting conditions, blood flow restriction (REST-BFR) did not increase myofibrillar protein synthesis rates when compared to the control leg (0.0455±0.0037 vs 0.0432±0.0038 %/h, respectively; P=0.683). In contrast, when combined with low-load resistance-type exercise, blood flow restriction (L-LRE-BFR) increased post-exercise myofibrillar protein synthesis by 10.55% when compared to the control leg (0.0475±0.0047 vs 0.0433±0.0042 %/h, respectively; P=0.042). CONCLUSIONS: Blood flow restriction does not increase myofibrillar protein synthesis rates in healthy young men. When combined with low-load resistance-type exercise, blood flow restriction increases post-exercise myofibrillar protein synthesis rates. Supported by the Dutch Technology Foundation STW

During traditional (TRD) resistance exercise, there is a decrease in the velocity and power output achieved over the course of a set consisting of multiple repetitions. Reconfiguration of an exercise set into a cluster set (CLU), which includes a brief intra-set rest period, has been shown to counteract this performance decline. However, the effect of intra-set rest manipulations during resistance exercise on changes in postexercise myofibrillar protein synthesis rates (MPS) is not clear. PURPOSE: We determined if any differences exist in the stimulation of postexercise MPS to acute bouts of CLU and TRD paradigms of barbell back squats. METHODS: In crossover trials, 5 resistance trained men and women (23.5±2 y; BMI: 60.5±8 kg; 1RM back squat: 143±13 kg) performed CLU or TRD configurations of barbell back squats and ingested 20 g whey protein before and immediately after exercise. Blood and muscle biopsy samples were collected at rest and after exercise during primed continuous L-[ring-13C]phenylalanine infusions. The TRD condition consisted of 4 sets × 10 repetitions with 120 seconds inter-set rest. CLU condition consisted of 4 sets × (2 × 5) repetitions with 90 seconds inter-set rest. CLU condition tended to allow for greater mean velocities versus TRD condition over the 4 sets (0.52±0.02 m/s and 0.47±0.02 m/s, respectively). The cumulative (0.5-9 h) MPS were increased (P<0.05) above basal in both TRD (237%) and CLU conditions (215%) with no difference between conditions (P=0.72).
However, the temporal pattern of change in MPS tended to be greater in the TRD conditions versus CLU condition (P<0.10). **CONCLUSION:** These data showed that both TRD and CLU configurations of barbell back squat augment postexercise MPS throughout 0-5 h of recovery in trained young men and women. These data indicate that the intra-set rest manipulations present in CLU do not induce differences in muscle anabolism from TRD-style of resistance exercise trained in young men and women.

**2647 Board #4 June 1 3:15 PM - 5:15 PM Dose Effect of Whey Protein on Gut Hormone Responses in Pre-Diabetes and Type 2 Diabetics**

Chris Irvine1, Todd Castleberry1, Michael Oldham1, Matthew Brisebois1, Sarah Deemer1, Ryan Gordon1, Aubri Benderson1, Vic Ben-Ezra1. 1Texas Woman’s University, Denton, TX. 2University of Alabama Birmingham, Birmingham, AL. (Sponsor: Dr. David Nichols, FACSM)

**No relevant relationships reported**

**BACKGROUND:** GLP-1 and GIP have been shown to increase following a 50 g dose of whey protein prior to a high glycemic load in type 2 diabetics. However, this increase is reduced in diabetics compared to healthy individuals. Pancreatic polypeptide (PP) and peptide tyrosine tyrosine (PYY) also increase, while ghrelin decreases after the consumption of whey protein; however, it is not known if a similar hormone response occurs with a lower dose of whey protein consumption prior to a glycemic load or if there is a dose effect. Our hypothesis was that 20 g and 30 g of whey protein would elicit an increase in GLP-1, GIP, PP, and PYY and decrease ghrelin in a dose dependent manner.

**PURPOSE:** The purpose of this study was to examine the effect of two different doses of whey protein ingested 30 min prior to a 50 g OGTT on gut hormone and incretin responses.

**METHODS:** Nine diabetic and pre-diabetic participants (n=9, mean ± SD; age: 64.3 ± 8.1 yrs; BMI: 29.4 ± 6.0 kg/m²; HbA1c: 6.4 ± 0.6%) completed three trials. The randomly assigned trials consisted of: ingestion of 250ml of water (CON); 250 ml of water + 20 g whey (20g); 250ml of water + 30 g whey (30g), prior to completing a 50 g OGTT. Blood was collected at -30, 0, 15, 30, 60, 90, 120, and 150 min for the measurement of GIP, GLP-1, ghrelin, PP, and PYY. The whey protein mixture was administered immediately following the -30 min and the 50 g OGTT began immediately after the 0 min blood draw. Metabolites were measured using multiplex fluorescent detection. One-way repeated measure ANOVA was used for statistical analysis for each dependent variable (P < 0.05).

**RESULTS:** 20g and 30g of whey protein significantly increased integrated area under the curve (AUC) of GIP 32% and 38% compared to CON. 30g significantly increased gherelin AUC -13.9% and -20% compared to 20g and CON. 30g significantly increased PP AUC 28% compared to CON only. There were no differences in ghrelin and PP AUC between 20g and CON. There were no significant differences for GLP-1 and PYY between all trials.

**CONCLUSION:** 30g of whey protein prior to a glucose challenge increased the secretion of GIP and PP and decreased ghrelin in type 2 and pre-diabetics. There seems to be a dose affect relationship between whey, ghrelin, and PP. 30 g of whey preload may induce insulinosuppressive and satiety effects stemming from GIP, PP, and ghrelin responses in type 2 and pre-diabetics.**
Dietary amino acids are important for both the repair and rebuilding of body proteins and the replenishment of exercise-induced oxidative losses. Current athlete recommendations are based primarily on the protein intake required to maintain nitrogen (i.e. protein) balance rather than one that optimizes whole body protein metabolism and maintains exercise performance. PURPOSE: To determine how a range of protein intakes, including a new tracer-derived safe intake, altered protein metabolism and exercise performance during a period of controlled training.

METHODS: Using a double blind randomized crossover design, 10 male endurance-trained runners (32±65 ml/kg/min; 62 km/wk) completed 3 trials, each consisting of 4 days of controlled training (20±5, 10, 20km days 1-4, respectively). Controlled diets provided 6-9 g/kg/d of carbohydrate and 0.80 g/kg/d from whole foods that was supplemented with 0.12 (LOW), 0.40 (MOD), and 1.03 (HIGH) g of crystalline amino acids/kg modelled after egg protein. Oral [15N] glycine was ingested on the 1st and 4th day to determine whole body protein synthesis (S), breakdown (B), and net balance (NB). Maximum voluntary isometric contraction (MVC), 5-km Time Trial (5kTT) and peak force (Jump) were tested 2 days before and immediately after the controlled diet and training. RESULTS: S and B were not altered by training or protein intake. NB was negative in LOW and positive in HIGH with a dose-response between conditions (HIGH > MOD > LOW, p<0.05). Inertial statistics revealed that for MVC, HIGH likely (probability 87%) had a moderate benefit over LOW (ES=0.57) and likely (probability 77%) a small benefit over MOD (ES=0.42). For the 5kTT, HIGH likely (probability 79%) had a moderate benefit over LOW (ES=0.57) and likely (probability 77%) a small benefit over MOD (ES=0.26). No differences were found for Jump performance. CONCLUSION: Endurance trained males consuming adequate carbohydrate maintained exercise performance and enhanced whole body protein metabolism when consuming >1.2g/kg/d of dietary protein. Our data suggest that training quality and post-exercise recovery would be optimized in endurance-trained runners who consume dietary protein towards the higher end of current ACSM recommendations (i.e. 1.2-2.2g/kg).

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CONCLUSIONS: Understanding correlates of PA lapse-recovery cycles in AA women who maintain PA can aid in developing strategic interventions to foster long-term PA behaviors among this important population. Our findings suggest that motivation, social support, weight and positive affect might be ideal intervention targets. Future studies should explore the impact of targeted strategies to address lapse-recovery cycles.
There are approximately 13 million cancer survivors in the U.S.; fewer than 10% meet the exercise recommendations outlined by the American College of Sports Medicine. Poor adherence is likely explained by a variety of factors. If we can identify these factors, we may be able to tailor the prescription, monitoring, and encouragement of exercise more effectively. PURPOSE: To determine variables that influence retention in an exercise trial on cancer survivors.

METHODS: We enrolled 157 cancer survivors in an exercise program lasting 10 weeks and consisting of biweekly cardiovascular, strengthening, and flexibility components. At baseline and following the intervention, we assessed anthropometric and cardiovascular profiles, health and cancer history, and physical functioning. Chi-square and logistic regression analyses tested variables associated with program completion. RESULTS: We retained 37.7% of patients through follow-up. Women were more likely to complete the trial (43.2%) than men (19.4%; p=0.010). Differences between cancer type were minimal. Adherence was better among breast cancer patients (p=0.016) but this was attributable to sex; there was no difference among patients with multiple cancers (p=0.583) or patients who had a previous heart attack (p=0.681) or stroke (p=0.528), had diagnosed hypertension (p=0.513) or pulmonary disease (p=0.199), were obese (p=0.893), or smoked (p=0.333). Fatigue (p=0.696) and mode of treatment (surgery, chemotherapy, radiation; p=0.225) did not affect completion. There was a difference among patients with hyperplasia (30.0% retained) compared to patients without hyperplasia (32.4%; p=0.040). Patients with poor sit-and-reach scores were also more likely to drop out: 53.5% of patients who could reach their toes completed the program compared to 26.5% who could not reach their toes (p=0.016). CONCLUSION: Exercise adherence is low among cancer survivors; in our sample, fewer than 40% of patients were retained through follow-up. Several factors predicted retention, but sex had the strongest association. Further efforts must be made to identify risk factors for attrition in this population. The differences observed in retention by sex suggest other cohorts may need to be stratified by sex to verify our findings.

PERSPECTIVE: Considering the high prevalence of cancer and the increasing numbers of survivors, interventions promoting regular exercise may be beneficial. Further work will focus on duration and intensity of support required to increase long-term behaviour change and target men with PC who are not meeting exercise oncology guidelines.

PURPOSE: To examine the effectiveness of a three-stages physical training program on ADL-related functional fitness and daily physical activity for community-dwelling older-old Japanese women.

METHODS: After giving written informed consent, the subjects, unable to stand on one leg for more than 20 seconds with eyes open, were divided into a 3 times/week group (HFG, 13 females, 81.5±2.7 yrs, BMI 22.8±1.6) and a 1time/week group (LFG, 10 females, 81.7±3.2 yrs, BMI 21.9±1.3). The program was composed of three stages for 16 weeks. First, participants learned about management skill for their physical soreness and asked to stand on one-leg with eyes open for one minute, 3 times a day for each leg at class and at home. Second, they learned to strengthen their core and lower leg muscle using an elastic band. The last stage was to learn a three-minute arm and leg combined exercise program with music: ADL-related functional fitness (sitting & standing time, zigzag walking time), one-leg standing time with eyes open, and knee extension strength were obtained. Balance ability was measured by the area covering and total length of the center of gravity sway (COP). Each measurement item was assessed before and after the intervention period. Daily physical activity was measured by pedometer in the first and last 7 days during the intervention period. Student’s T-test and two-way repeated measures ANOVA were used to test the effectiveness.

RESULTS: The class participation were 82.4% and 81.8% respectively. Sitting & standing time (HFG: 18.4±5.6 to 16.3±5.1 sec, LFG: 17.4±5.9 to 17.7±3.6 sec, F=3.573, P=0.073), zigzag walking time (HFG: 19.2±2.9 to 17.2±4.2 sec, LFG: 16.6±3.1 to 16.8±2.2 sec, F=11.888,P=0.002), one-leg standing time with eyes open (HFG: 6.1±3.1 to 13.7±4.2 sec, LFG: 5.9±2.3 to 6.1±1.8 sec, F=30.69,P<0.000), knee extension strength (P=0.040), and balance ability (area covering of COP, F=13.58, P=0.001, total length of COP, F=21.00, P=0.022) daily steps (HFG: 3861±474 to 4454±632 steps, LFG: 3831±832 to 4001±860 steps, F=5.28, P=0.032) also improved significantly in HFG.

CONCLUSIONS: Three-stage physical training program was effective for functional fitness and daily physical activity by old-old Japanese females.
Lifestyle Strategies to Support Sustained Physical Activity after Intentional Weight Loss: Results from MAINTAIN-pc Trial

Molly B. Conroy, FACSM1, Bethany B. Gibbs2, Margaret P. Lott1, Rachel Hess3, Cindy Bryce7, Gary S. Fischer2, Dana Tudorascu4, Diane Comer5, Laureye Simink-Silverman6, Kimberly Hubert7, Kathleen M. McTigue2, University of Utah, Salt Lake City, UT. University of Pittsburgh, Pittsburgh, PA. University of Miami, Miami, FL.

NO RELATIONSHIP DECLARED

PURPOSE: Weight maintenance after intentional loss is challenging, and sustained physical activity (PA) levels can help. Less is known about lifestyle strategies that may promote sustained PA levels after intentional weight loss.

METHODS: We analyzed baseline and 24-month data from the Maintaining Activity and Nutrition through Technology-Assisted Innovation in Primary Care (MAINTAIN-pc) trial. MAINTAIN-pc recruited adults who had intentionally lost ≥5% body weight in past 2 years and were randomized to tracking tools with tailored coaching (CC) or tracking tools alone (TO). At assessments, participants reported lifestyle strategies used in the past six months, including self-monitoring, group support, behavioral skills, and professional support. PA levels were assessed with Omron pedometer HJ-720FTC with blinded feedback screen. Wilcoxon rank sum or t tests compared PA levels between strategy use vs. no use.

RESULTS: At baseline, the 194 participants were 53.8 (SD 12.2) years old, 74% female, and 88% White. Median baseline PA level was 5998 steps/day. At baseline, 69% used self-monitoring, 73% group support, 100% behavioral skills, and 68% professional support in past 6 months; at 24 months, these rates were 75%, 60%, 98%, and 61%, respectively. Recordings (PA) (53% baseline; 57% 24 months) and calories (52% baseline; 43% 24 months) were the most common self-monitoring strategies. There were no differences in strategies between CC and TO groups at either baseline or 24 months. Participants who used self-monitoring strategies at 24 months had greater PA levels at baseline (6473 vs. 4730 steps; p = 0.045) and 24 months (6103 vs. 5251 steps; p = 0.084), respectively. Participants with group support at 24 months also had higher baseline PA compared to those who did not (6779 vs. 5752; p = 0.03). No differences were found in PA levels at baseline or 24 months based on behavioral skills or professional support.

CONCLUSION: Participants reported frequent use of a variety of lifestyle strategies at baseline and 24 months. Self-monitoring, especially recording daily steps, may be particularly important in sustaining PA levels after intentional weight loss.

Comparison of the Firefighter Candidate Physical Ability Test to Weight Lifting Exercises in Firefighters.


NO RELATIONSHIP DECLARED

PURPOSE: We examined the impact of a community health care worker delivered healthy aging and behavioral weight management intervention on perceived physical fatigability among community-dwelling elders with obesity enrolled in the 13-month Mobility and Vitality Lifestyle Program (MOVE UP).

METHODS: This analysis examined the effects of the first 5 months of intervention, which included the 10 Keys™ to Healthy Aging (month 1) and Diet, Weight, Activity Behavioral Induction (months 2-5) phases. We measured physical fatigability (perceived whole-body fatigue anchored to activities of fixed intensity and duration) using the validated 10-item Pittsburgh Fatigability Scale (PFS, range 0-50 with lower score = less fatigability); self-reported PA using the Community Healthy Activities Model Program for Seniors Survey (CHAMPS) questionnaire; and weight. RESULTS: At baseline, participants (N=115) were age 68±4.0 years, 83.5% female, 37.8% African American, with Body Mass Index of 34.4±4.5 kg/m². Baseline PFS score was 18.6±8.3 with 70.4% (N=81) having higher fatigability (PFS score = ≥215). After 5 months, participants lost 10.7 lbs (5.2% of body weight) and increased total physical activity by 0.8 hours/week. Concurrently, PFS scores significantly decreased by 2.5 points (13.4%) to 16.1±9.0 (p=0.001); the number of participants classified with higher fatigability after the 5 month intervention also declined to 53% (N=61). Preliminary results from the 13-month data (N=93) indicate that mean PFS scores continue to decline to 15.6±8.2 (p=0.0003 for difference between baseline and 13-months). CONCLUSION: Moderate weight loss and modest gains in PA were accompanied by notable improvement in perceived physical fatigability. Thus, lifestyle interventions may be effective at reducing fatigability, which is an important component in the age-related disability pathway. Supported by CDC Cooperative Agreement #5U48DP005001.

Comparison of the Firefighter Candidate Physical Ability Test to Weight Lifting Exercises in Firefighters.


NO RELATIONSHIP DECLARED
The usage of pre-workout supplementation has increased substantially in recent years, as research has shown pre-workout supplements can significantly enhance performance in all populations.

**PURPOSE:** To compare and determine the effectiveness of a caffeine-free pre-workout and a caffeine-pre-workout on repetitions to failure in bench press and squat.

**METHODS:** Subjects completed a total of four trials. The first trial was done to find the subject’s one-repetition maximum (1RM) for squat and bench press. A cross-over design was used to determine the order of the final three trials in which the subject would drink eight ounces of a caffeinated pre-workout out (CA), a caffeine-free pre-workout (NC), or water (C). 20 minutes post consumption of fluid, the subjects did a standardized warm-up before each measurement day. Paired/independent samples t-tests were conducted using SPSS 24.

**RESULTS:** An ANOVA was utilized to determine if significant differences occurred in repetitions to failure in the control trial, with caffeinated pre-workout, and with non-caffeinated pre-workout. There was a statistically significant difference in squat (F(1,304, 7.823) = 5.543, p = 0.041) and bench press (F(1,857, 11.141) = 5.484, p = 0.024) repetitions to failure. Post hoc analysis revealed that squat repetitions to failure were significantly greater in CA and NC when compared to C (p = 0.028; p = 0.044). There was no significant difference between repetitions to failure when comparing CA and NC (p = 0.99). Post hoc analysis also revealed that bench press repetitions to failure were significantly greater in CA when compared to C and NC (p = 0.05; p = 0.234).

**CONCLUSIONS:** The use of CA significantly increased repetitions to failure for both squat and bench press when compared to a control trial. The use of NC resulted in a significant increase in repetitions to failure for squats, but no significant improvement in repetitions to failure in the bench press. The use of CA and NC have an ergogenic effect on resistance training performance.

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2665 June 1 4:00 PM - 4:15 PM

**Developing And Validating The Sit-to-stand As A Muscular Power Measure In Older Adults**

Jennifer J. Sherwood, Cathy Inouye, Shannon L. Webb, Pavel V. Romanovski, Trenton Ashizawa, Tori Coleman, John W. Adams, Michel Mintsa Osse. California State University, East Bay, Hayward, CA.

(No relevant relationships reported)

**Purpose:** Here, we tested the validity and reliability of velocity and power measurements performed with a GYMaware linear position transducer (LPT) during a sit-to-stand (STS).

**Methods:** Fifty-one asymptomatic men (n = 14) and women (n = 37) (ages 60-95 yrs., 79.5 ± 9.9, mean ± SD) were recruited from California State University, East Bay (CSUEB) campus, and local independent-living senior populations. Sit-to-stand performance velocity and power was assessed with an LPT connected to a waist belt and base, and video recorded simultaneously and analyzed with Dartfish. Maximum hand-grip strength was assessed with a Jamar dynamometer. Results: The Pearson correlation coefficients of STS velocity and power were r = 0.9702 and r = 0.9651, providing evidence that the LPT and cinematography measurements were similar. The trial-to-trial reliability of the STS measured by the LPT gave an intraclass correlation
coefficient of 0.916-0.966 for velocity and 0.860-0.940 for power. The Pearson correlation between STS performance measured with the LPT and maximum hand-grip strength was r = 0.651.

Conclusion: Our findings show that the calculations derived from the LPT were very similar to those of cinematography and provide evidence for the validity of this method. The data from the LPT were shown to be reliable. Sit-to-stand power showed a good association with maximal hand-grip strength in older adults. These results suggest that power measures during the STS may be a safe and cost-effective method of assessing muscular fitness in older adults.

2668 June 1 4:45 PM - 5:00 PM
Bilateral Training Results in Superior Strength Improvements to Unilateral Despite Similar Changes in Fat-Free Mass

(Purpose: To determine if strength increases differ between bilateral and unilateral training; to determine whether differences, if any, were mediated by muscle hypertrophy. METHODS: College-aged men and women (n=67; age=19.7 ± 0.9 yr; height=168.7 ± 9.8 cm; body fat = 22.14 ± 10.23%) provided written informed consent to participate. Subjects were randomized to a unilateral or a bilateral training group for eight weeks. Strength testing (chest press and leg press) was performed at pre, mid, and post, with body composition (air displacement plethysmography) at pre and post. Statistics included a repeated measures ANOVA with LSD post-hocs and planned contrasts. RESULTS: As shown in Figure 1 (leg press), strength increased (significant linear trend for chest press and leg press: p<0.000) across all three time points. While there were no significant differences in strength at any time point, within-subjects contrasts displayed a significant linear trend interaction between time and training group for both leg press (0.049) and chest press (p=0.029) strength, the slopes of the two lines were therefore significantly different in favor of the bilateral trend. Although both groups increased FFM, the increase was comparable (mean kilogram change from pre to post: 1.6 ± 0.5, p=0.001 bilateral, 1.4 ± 0.4, p=0.001 unilateral). CONCLUSION: Bilateral training results in superior strength improvements over eight weeks as compared to unilateral despite similar changes in fat-free mass.

Table 1. Change in Leg Press Strength

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<td>Pre</td>
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<tr>
<td>Mid</td>
<td>19.3 ± 32.1</td>
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2669 June 1 5:00 PM - 5:15 PM
Early Pubertal Children Perceive High Intensity Interval Exercise as Less Strenuous than Young Adults
Ronen Bar-Yoseph, Pearl Law, Dan M. Cooper, Shlomit Radom-Aizik. UCIrvine, Irvine, CA.

(Purpose: To assess the clinical presentation of dancers without dysplasia, labral tear or bony deformity in order to understand the movement factors associated with onset and cessation of anterior hip pain. METHODS: 250 student and elite classical dancers (24.1 ± 5.7 years; 72 men, 178 women) were assessed in our physical therapy clinic for strength, flexibility, balance, motor control and joint mobility. RESULTS: 82% of dancers had lower extremity strength asymmetry; 71% had talar or subtalar joint hypomobility on the ipsilateral side and 32% on the contralateral side relative to the side of hip pain. On the hip pain side, 100% had a positive Romberg test, 82% had a positive Airplane test and 70% a positive FADIR test. CONCLUSION: Because of the repetitive and movement biased fashion of dance training over many years, it is important for clinicians to understand the presentation of classical dancer hip pain as that of a multi-factorial, postural-behavioral movement impairment syndrome which entails skilled regional interdependent examination and defies a single common diagnostic label.

2670 June 1 3:15 PM - 3:35 PM
Epidemiology and Clinical Presentation of Anterior Hip Pain among Elite Classical Dancers
Marijeanne Liederbach. NYU Langone Orthopedic Hospital, New York, NY. (Sponsor: Malachy P. McHugh, FACSM)

(Purpose: To assess the clinical presentation of dancers without dysplasia, labral tear or bony deformity in order to understand the movement factors associated with onset and cessation of anterior hip pain. METHODS: 250 student and elite classical dancers (24.1 ± 5.7 years; 72 men, 178 women) were assessed in our physical therapy clinic for strength, flexibility, balance, motor control and joint mobility. RESULTS: 82% of dancers had lower extremity strength asymmetry; 71% had talar or subtalar joint hypomobility on the ipsilateral side and 32% on the contralateral side relative to the side of hip pain. On the hip pain side, 100% had a positive Romberg test, 82% had a positive Airplane test and 70% a positive FADIR test. CONCLUSION: Because of the repetitive and movement biased fashion of dance training over many years, it is important for clinicians to understand the presentation of classical dancer hip pain as that of a multi-factorial, postural-behavioral movement impairment syndrome which entails skilled regional interdependent examination and defies a single common diagnostic label.

2671 June 1 3:35 PM - 3:55 PM
Hip Pain - Equestrian

(Purpose: To assess the clinical presentation of dancers without dysplasia, labral tear or bony deformity in order to understand the movement factors associated with onset and cessation of anterior hip pain. METHODS: 250 student and elite classical dancers (24.1 ± 5.7 years; 72 men, 178 women) were assessed in our physical therapy clinic for strength, flexibility, balance, motor control and joint mobility. RESULTS: 82% of dancers had lower extremity strength asymmetry; 71% had talar or subtalar joint hypomobility on the ipsilateral side and 32% on the contralateral side relative to the side of hip pain. On the hip pain side, 100% had a positive Romberg test, 82% had a positive Airplane test and 70% a positive FADIR test. CONCLUSION: Because of the repetitive and movement biased fashion of dance training over many years, it is important for clinicians to understand the presentation of classical dancer hip pain as that of a multi-factorial, postural-behavioral movement impairment syndrome which entails skilled regional interdependent examination and defies a single common diagnostic label.

HISTORY
A 61 year old horseback rider with severe OA and labral tear of the left hip underwent her 3rd fluoroscopically-guided triamcinolone injection for pain relief during competition season. She immediately experienced gradual worsening of left groin pain but was able to continue training.

Ten days post-injection, she returned with severe groin pain limiting weight bearing. She planned to leave the following day for a trip. She had no fever, chills, swelling, bruising or rash. She had mild pain with hip ROM testing. CRP was elevated without leukocytosis. MRI showed a small effusion with mild synovial inflammation. In the absence of systemic signs of infection, findings were consistent with reactive synovitis with low suspicion for infection. Upon discussion, the patient elected to proceed with her trip, monitor her symptoms closely, and present to a local ED if symptoms worsened.

PHYSICAL EXAMINATION
Left hip exam demonstrated full passive internal and external rotation. Focal groin pain was reproduced by both active and passive ROM. No neurological deficits.

DIFFERENTIAL DIAGNOSIS
1. Septic arthritis
2. Avascular necrosis
A 20 year old Division I varsity swimmer who specializes in breast stroke presented for evaluation of worsening right groin pain over the past several months. Her pain was worse with breast stroke kick and increased intensity of training. The pain was located in right proximal adductor area. Her pain had continued despite working with a physical therapist and relative rest for at least 3 months. X-ray and MRI of pelvis including athletic pubalgia protocol was negative for any pathology. She denied any weakness or numbness/tingling.

**Physical Examination:**
Examination of her right leg revealed focal tenderness to palpation of proximal adductor tendon attachment on pubic symphysis without any swelling or deformity. She had pain with resisted adduction in all planes and resisted abdominal crunch. Active straight leg raise, pubic symphysis spring test were positive. Negative FADIR and log roll.

**Differential Diagnosis:**
1. Adductor strain
2. Adductor tendinopathy not seen on MRI
3. Athletic pubalgia
4. Osteitis pubis
5. Pelvic Floor dysfunction
6. Pubic rami stress fracture

**Tests and Results:**
MRI pelvis:
- rectus abdominis insertion and right adductor tendon origin is normal in signal intensity and morphology.
- No evidence of osteitis pubis.

Ultrasound:
- thickening of right adductor tendon with evidence of enthesopathy and calcifications worse on the right.
- No evidence of osteitis pubis.

**Final Working Diagnosis:**
Right adductor tendinopathy

**Treatment and Outcome:**
1. Underwent PRP injection of right adductor tendon
2. Was non weight-bearing for 1 week post-injection
3. Progressed to full weight bearing and light exercise (swimming with just arms), 1-6 weeks post-injection
4. Began eccentric exercises, 7 weeks post injection
5. Ultrasound showed full tendon healing, cleared to return to full swimming and lifting, 12 weeks post injection

**Final Return to Sport Pending at the Time of Submission.**
HISTORY: A 15-year-old high school basketball player reported insidious onset of left knee pain. Knee pain was only present when running and pivoting. He denied ankle or hip dysfunction.

PHYSICAL EXAMINATION: Knee range of motion (ROM) and strength were unremarkable. Moderate weakness noted in bilateral hip extensors and abductors, as well as abdominals. Knee pain was reproduced during squating movements. Significant lumbar spine, hip, and knee movement compensations were observed while squatting due to hip mobility restrictions. Lower extremity (LE) musculature demonstrated decreased extensibility. Hip internal rotation (IR) ROM limited to 10° left and 20° right, while hip external rotation (ER) limited to 30° bilaterally. Hip flexion limited to 70° left and 100° right. He described “pinching” in left groin during hip impingement special test. All other special tests for hip and knee were negative. Manual assessment of left hip joint accessory mobility revealed hypomobility in all directions.

DIFFERENTIAL DIAGNOSIS:
1. Knee pain compensatory in nature, related to decreased hip joint ROM and LE muscle extensibility
2. Femoral acetabular impingement, due to significant hip mobility deficits
3. Patellar tendinopathy
4. Patellofemoral pain syndrome

Treatment was initiated; however, no improvements in hip ROM were documented after 4 visits of physical therapy that included aggressive joint mobilization and ROM exercises, which led to the suspicion of femoral acetabular impingement. This warranted referral to orthopedic physician for imaging studies.

TESTS AND RESULTS:
The patient showed significant weakness of the right gluteus medius and quadriceps muscles. Tests for mechanical disruption and intra-articular injury were negative. Further examination of the hip and ankle joints as well as the general systemic examination were unremarkable.

DIFFERENTIAL DIAGNOSIS:
Quadriceps tendinopathy
Patellar tendinopathy
Patello-femoral pain syndrome
Chondromalacia patellae
Patellofemoral osteoarthritis
Iliotibial band syndrome
Other sources of knee pain (such as arthritis and gout)

TEST AND RESULTS: Ultrasound: No soft tissue abnormalities. Suggestive area of a bony infarct in the distal femur. Plain radiographs (R-knee): Hypo-透cent area-distal femur (proximal to the condyles) MRI Knees: Bilateral areas of increased signal in the distal femoral shaft, suggestive of bilateral bony infarcts, were identified. Blood tests: within normal limits.

FINAL WORKING DIAGNOSIS: Spontaneous osteonecrosis of the knee (SPONK)/ Adiebck’s Disease.

TREATMENT AND OUTCOMES: 1. Initial management: Conservative - physical therapy and eccentric strengthening exercises. 2. Final outcome: Returned to physical activity, but it is still debated whether this athlete should return to full participation in ultra-marathon running.
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2685 June 1 4:15 PM - 4:35 PM
Knee Injury - Soccer
Matthew C. Hess, Garry W. K. Ho, FACSM. VCU-Fairfax Family Practice Sports Medicine Fellowship, Fairfax, VA. (Sponsor: Garry W. K. Ho, MD, FACSM, RMSK, FACSM)
(No relevant relationships reported)

History: 21-year-old male soccer player presented with a 2-day history of diffuse right knee pain which began suddenly after slipping over a soccer ball and landing awkwardly on his leg. Patient reportedly heard a ‘loud pop,’ was unable to ambulate off the soccer pitch, and has had difficulty walking since. He noticed immediate swelling, and complained of decreased range of motion. He denied numbness, tingling, weakness or prior injury to the knee.

Physical Examination: Examination in the clinic was notable for antalgic gait, and a large right knee effusion. The patient’s active and passive range of motion was restricted from 0 to 100 degrees on the right secondary to pain with normal tracking of the patella. He had tenderness over the medial joint line. The patient had 5/5 strength with flexion and extension. There was normal patellar glide without apprehension. He had a negative Lachman and anterior drawer, but this examination was limited by guarding, making accurate assessment difficult. Valgus stress testing revealed mild laxity. End point was firm with varus stress. Posterior drawer was negative, and he had no appreciable sag sign. The patient was unable to tolerate a McMurray test secondary to pain. He had a normal distal neurovascular exam.

Differential Diagnosis:
1. Tear of the anterior cruciate ligament
2. Medial meniscus tear
3. Strain of the medial collateral ligament
4. Osteochondral defect
5. Tibial plateau fracture

Tests and Results:
Plain film radiography not immediately available due to technical difficulties. Targeted point-of-care musculoskeletal ultrasound of the knee:
--Large joint effusion with moderate sized hemotoma posteriorly along lateral wall of intercondylar notch suspicious for anterior cruciate ligament injury

Final Working Diagnosis:
Acute Anterior Cruciate Ligament Tear

Treatment and Outcomes:
1. Rest, ice, compression, elevation
2. Ibuprofen 600-800mg by mouth every 8 hours as needed for pain and inflammation
3. Right knee anterior-posterior, lateral and sunrise radiographs (once completed, showed soft tissue swelling and avulsion (Segond) fracture of the lateral tibial plateau
4. Weight bearing as tolerated
5. Referral to Orthopedic Sports Medicine for consideration of ACL reconstruction

2686 June 1 4:35 PM - 4:55 PM
Knee Snapping After Arthroscopy Diagnosed With Ultrasound In A Runner And Weightlifter: A Case Report
(No relevant relationships reported)

History: A 38-year old male presented for a diagnostic ultrasound to evaluate right knee snapping and pain with squats. He had a right knee arthroscopy 11 months prior for an osteochondral lesion of the patellofemoral joint with removal of loose bodies and chondroplasty of the defect. Post-operatively, he complained of 3/10 pain in the knee that became sharp with deep squats and a popping sensation within the terminal 10 degrees of extension.

Physical Examination:
Gait: Gait was non-algatic. Heel and toe walking were normal. Squatting reproduced lateral right knee pain.
Knee Exam: Active terminal knee extension reproduced supralateral knee snapping. Patellofemoral crepitus was noted. Ligamentous testing and meniscal provocation maneuvers were negative with no joint line tenderness.

Differential Diagnosis:
Intraarticular loose bodies
Lateral meniscus tear
Osgood-Schlatter disease

Extra-articular snapping (biceps femoris, IT band, popliteus)

Tests and Results:
Right knee plain radiographs demonstrated mild tricompartmental degenerative arthritis.
Diagnostic ultrasound of the superolateral right knee revealed hypertrophic synovial tissue snapping over a lateral femoral condyle osteophyte. There was no associated synovial hyperemia or joint effusion. 

**FINAL WORKING DIAGNOSIS:**
Right superolateral knee snapping secondary to hypertrophic synovial tissue snapping over a lateral femoral condyle osteophyte.

**TREATMENT AND OUTCOME:**
An ultrasound-guided diagnostic injection of lidocaine was performed around the osteophyte which provided immediate relief. He was able to squat 135 lbs during the anesthetic phase, and had been unable to body weight squat without significant pain pre-injection. Given the positive response to the diagnostic injection, a repeat injection was performed with Depo-Medrol. At the two month follow-up, patient reported 60-80% symptom reduction during problematic activity (lunging and squatting) and improvement in function.

Snapping in the knee can be a difficult diagnosis to obtain in an individual who has a known history of loose bodies in the knee. While several case reports exist describing snapping biceps femoris and popliteus tendons in the lateral knee, this is the first to our knowledge to describe a lateral femoral condyle osteophyte as the culprit of snapping.

**HISTORY:** A 63 year-old recreational athlete presented with right knee snapping 3 months after medial unicompartmental knee arthroplasty. Snapping sensation localized to posterior medial knee and aggravated with active knee flexion and extension. She experienced associated pain in the same area, and occasionally at rest. No instability.

Surgical incision of anterior knee healing well without pain.

**PHYSICAL EXAMINATION:** Examination revealed knee extension to 10°, knee flexion to 120°, focal tenderness of distal semimembranosus tendon. Palpable snapping over medial hamstrings with knee extension and flexion between 20° to 90°. No varus or valgus instability. Mild knee effusion. Surgical scar to anterior knee healing well.

**DIFFERENTIAL DIAGNOSIS:**
1. Snapping Popliteal Recess
2. Hardware Loosening
3. Snapping Hamstring Tendon over Hardware
4. Snapping Pes Anserinus Syndrome
5. Snapping Fabella

**TEST AND RESULTS:**
- Right Knee AP and lateral radiographs showed slight posterior positioning of hardware, no peri-prosthetic lucency to suggest loosening or fracture.
- Right Knee MRI Maverick protocol without contrast showed the imaged portions of the biceps, semimembranosus, and semitendinosus are unremarkable. The distal aspect of the semimembranosus and semitendinosus is obscured by susceptibility artifact as it passes posterior to the unicompartmental arthroplasty.
- Right Knee Dynamic Ultrasound Evaluation showed dynamic snapping of the semimembranosus tendon over the gastrocnemius tendon while patient actively flexed and extended her knee.

**FINAL WORKING DIAGNOSIS:** Snapping semimembranosus and gastrocnemius tendons due to medial unicompartmental arthroplasty hardware impingement in the right knee

**TREATMENT AND OUTCOMES:**
1. Completion of post-surgical rehabilitative physical therapy, including achieving full knee extension, for a total of 6 weeks.
2. Trial of ultrasound guided steroid injection to tendon site for persistent symptoms.
3. Consideration for semimembranosus tenotomy if symptoms persist despite steroid injection.
4. Consideration of unicompartmental knee revision vs total knee replacement as a last resort only.
5. Snapping and pain improved though not resolved with rehabilitative exercises 6 months post-op, pending steroid injection to semimembranosus and gastroc tendon.

**F-40 Clinical Case Slide - Medical Issues IV**

**Chair:** Shawn F. Kane, FACSM. US Army, Carthage, NC.
(No relevant relationships reported)

**Discussant:** Poonam P. Thaker, FACSM. Presence Resurrection Sports Medicine Fellowship, Chicago, IL.
(No relevant relationships reported)

**Discussant:** George Guntur Pujalte, FACSM. Mayo Clinic, Jacksonville, FL.
(No relevant relationships reported)

**HISTORY:** An 18 year old male athlete detailed a recent hospitalization for viral perimyocarditis during his pre-participation examination (PPE). His medical and surgical histories were otherwise not significant. He took no medications and had no known allergies. He denied alcohol use, smoking, or illicit drug use. His family history was non contributory. During his PPE he was symptom free and was cleared for all activity. Over the next weeks he reported multiple, brief, self-resolved episodes of substernal chest pain and shortness of breath. He denied syncope or palpitations. His symptoms did not worsen with exercise. One episode of chest pain prompted evaluation in a local ER, where he had a normal chest x ray, negative troponins, and normal vital signs. Following this episode, the patient was withheld from activity and referred to cardiology.

**PHYSICAL EXAMINATION:**
General: Well appearing male.
HEENT: No jugular venous distention.
Cardiovascular: Regular rate and rhythm, normal S1 and S2, no murmurs, rubs, or gallops. Brisk capillary refill. No tenderness to chest wall palpation. No paresthesias.

**DIFFERENTIAL DIAGNOSIS:**
1. Coronary artery disease
2. Arrhythmia
3. Pericardial effusion
4. Recurrent perimyocarditis
5. Pulmonary embolism

**TEST AND RESULTS:**
Initial Hospitalization:
- EKG: Sinus rhythm with anterolateral ST elevation.
- Troponin 11.48.
- CRP 2.28.
- Transthoracic echocardiogram: LVEF 56%.
- Cardiac Catheterization: No coronary artery disease.
- CT chest: No pulmonary emboli. No aortic dissection.

**DIFFERENTIAL DIAGNOSIS:**
- Coronary artery disease
- Arrhythmia
- Pericardial effusion
- Recurrent perimyocarditis
- Pulmonary embolism

**TEST AND RESULTS:**
- Holter Monitor: Normal sinus rhythm, no arrhythmias.
- Exercise stress test: No ischemia.

**FINAL WORKING DIAGNOSIS:**
Viral Perimyocarditis (Resolved).

**TREATMENT AND OUTCOMES:**
1. Withheld from activity following ER visit
2. Referred to Cardiology
3. Exercise Stress Test
4. Holter Monitor
5. Lab work-up
6. Repeat Cardiac MRI to be performed 3 months after initial study to re-assess inflammation.
7. Return to play decision to be made following results of repeat cardiac MRI
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2692 June 1 3:35 PM - 3:55 PM
Abdominal Trauma - Football
Jonathan Goike, Michael Baria. Ohio State University, Columbus, OH.
(No relevant relationships reported)

HISTORY: A 15 year old male football player was tackled during practice and sustained blunt force trauma to his abdomen from his opponent’s helmet. He felt immediate right sided abdomen and shoulder pain. He was promptly assessed by the athletic trainer and removed from practice. The athletic trainer examined him and found both right upper quadrant tenderness and pain with rib cage / thorax compression. Though the athlete reportedly felt improved, the athletic trainer recommended further evaluation by a sports medicine physician.

PHYSICAL EXAM: Orthostatic vitals revealed a heart rate increase from 66 to 114 on sit to stand. He was alert, oriented and in no distress. He had significant right upper quadrant tenderness with rebound and positive Murphy’s sign with moderate generalized abdominal tenderness. He had minimal right sided tenderness to palpation over the ribs without flat chest. No respiratory distress. Lung fields were clear to auscultation. Heart rate and rhythm were regular.

TESTS AND RESULTS: Abdominal Radiograph – Non-obstructive bowel gas pattern, no pneumatoperitoneum
Ultrasound FAST exam – Free peritoneal and retro-vesicular fluid
CT Abdominal/Pelvis – Grade 3 Liver laceration (7.9 cm) and Grade 1 Splenic laceration


FINAL/WORKING DIAGNOSIS: Grade III Liver and grade 1 splenic laceration

TREATMENT AND OUTCOMES: 1. Immediate transfer to emergency department for trauma evaluation followed by observation in the ICU and surgical floors for 3 days. 2. Limited to walking for exercise and 10 pound lifting restriction for 6 weeks. 3. Returned to low impact, non-contact exercise and machine based strength training after 6 weeks. 4. Anticipate gradual return to sport following 6 months no contact and after repeat testing including CT, LFTs.

2693 June 1 3:55 PM - 4:15 PM
Improved Pulmonary Function in a Patient with Lymphangioleiomyomatosis Following Exercise Training
Thomas W. Lowder. University of Central Arkansas, Conway, AR.
(No relevant relationships reported)

HISTORY: Lymphangioleiomyomatosis (LAM) is an interstitial lung disease the results in cystic destruction of the lung parenchyma, resulting in a decline (often rapid) in pulmonary function. There is no cure for this disease and lung transplantation is often required. Even with transplantation, the disease will still present, as the cells originate in the body (origin is at present unknown) and migrate to the lungs. This disease affects women almost exclusively.

PHYSICAL EXAMINATION: A 29 year-old female, diagnosed with Tuberculous Sclerosis Complex (TSC) at age 5 and LAM at age 21, underwent 12mo of high-intensity exercise 2d/wk. Prior to training and every 3mo pulmonary function, oxygen uptake (\(\text{VO}_2\)) and bone mineral density were assessed.

DIFFERENTIAL DIAGNOSIS: LAM is similar to TSC in that TSC is a predisposing condition for LAM and several shared clinical features exist in both diseases (angiomylipomas, TSC2 gene mutations). LAM shares similarities with both Birt-Hogg-Dube syndrome and Sjogren syndrome.

TEST AND RESULTS: After one year of training the patient improved forced expiratory volume in one second (FEV\(_1\)) by 9%, FEV\(_1\)/FVC (forced vital capacity) by 10%, peak flow by 47%, and a 20% increase in oxygen consumption.

FINAL WORKING DIAGNOSIS: Exercise can be used to improve pulmonary function and work capacity in a patient with TSC/LAM.

TREATMENT AND OUTCOMES: Treating LAM with high-intensity exercise resulted in marked improvement in this patient. Improvements were not seen until after 6mo, indicating that short-duration interventions may be insufficient in improving lung function.

2694 June 1 4:15 PM - 4:35 PM
Amanda J. Cunningham, Grand Valley State University / Central Michigan University, Allendale, MI.
(No relevant relationships reported)

The aim of this study was to evaluate the effectiveness of the Girls on the Run program. Twenty seven girls who participated in the Girls on the Run for eleven weeks were evaluated pre and post the program on self-esteem, self-perception of body image and aerobic capacity. The girls were evaluated by a written survey and the PACER test. There was a significant positive increase in self-esteem (p=.014) and body age (p=.705), following the program the girls learned to be more accepting of themselves ad their body image. There was a non-significant increase in mean aerobic capacity starting at 39.8 ml/kg/min and ending at 41.87 ml/kg/min. This could be due to part to low intensity training versus highly structured high intensity training. The Girls on the Run program was shown in this study to have a positive outcome on girls’ mental, emotional, and physical health through varying activities and positive leadership in the role models who coach. Future studies should evaluate the effects of high intensity training over a long period of times. As well as showing the effects of self esteem and positive body image in the young girls as they age.

2695 June 1 4:35 PM - 4:55 PM
Hematoma - Cross Country
Peter Obourn. University of Connecticut Health Center, Hartford, CT.
(No relevant relationships reported)

HISTORY: 21 year-old female cross country runner with 1 week of gross hematuria. History of microscopic hematuria on several occasions since age 3 with no history of gross hematuria. She was having hematuria on and off for a week. She had one painful void with 3 out of 10 burning pain at the urethra during hematuric void. Her urine color is consistent with fruit punch. Just prior to the episode of gross hematuria she had completed a 4 mile run consistent with her normal daily activity, not significantly more vigorous than her normal training routine. This had occurred about 3 days prior. She denied any increased urinary frequency or feelings of urinary retention. She denied fevers, chills, nausea, vomiting, muscle cramps, or flank pain. She denied unprotected sexual intercourse or vaginal discharge. She denied any recent illnesses, specifically sore throat.

PHYSICAL EXAMINATION: Vital signs were normal. Healthy, well appearing, in no apparent distress. Head normocephalic, and atraumatic. Sclera and conjunctivae unremarkable with EOM intact. All gross deformities of the ears bilaterally and no obvious hearing deficits. Oropharynx clear without erythema or exudates. No cervical lymphadenopathy. Normal respiratory effort. Bowel sounds were normoactive with no bowel sounds. No organomegaly. There was no costovertebral angle tenderness and no pelvic tenderness. Normal mood and affect. No visible skin lesions.


FINAL WORKING DIAGNOSIS: Thin basement membrane disease

TREATMENT AND OUTCOMES: -Patient is believed to have thin basement membrane disease at this time. Her hematuria workup has been negative to this point. It was determined that she has a brother with thin basement membrane disease. -Referral to nephrology for further recommendations -Cleared to continue normal activities for cross country -Though likely benign, we may need to obtain further testing including possible biopsy to prove benign diagnosis
Wheelchair racing has been one of the official events in Paralympic Games since 1964. Understanding the energetic profiles in wheelchair racing may provide information in developing training strategies. However, there is lack of concrete quantitative research on energetic profile of Wheelchair Racing 1500m.

**PURPOSE:** To quantify the energy contribution of wheelchair racing 1500 m in high level athletes.

**METHODS:** Eight males (24±5 years, 174.4±5.9 cm, 67.3±9.1 kg, training experience of 15±10 years) from the Chinese national team participated in the research for a graded exercise test and a 1500 m all-out test. A portable gas analyzer (K4b², Cosmed, Italy) was used to measure VO₂ at every breath. A GPSports (GPSports HPU, Canberra, Australia) and heart rate belt (Polar Accurex Plus,Polar Electro Oy,Finland) were used to monitor speed and HR changes. Capillary blood was taken from the earlobe before and after the warm-up, immediately before the time trials and the during the 1st, 3rd, 5th, and 7th minute of the recovery. Then it was assessed with a lactate analyzer (Biosen C-Line, EKF, Germany). The energetic contribution was measured with the maximal accumulated oxygen deficit (MAOD).

**RESULTS:** Results showed that the accumulated oxygen deficit, the maximal heart rate and the peak blood lactate values were 2667.3±894.5 ml, 188.9±9.0 bpm, and 11.1±2.3 mmHg, respectively. The total energy contribution of the 1500 m test was 205.5±29.2 kJ. The aerobic and anaerobic energy contributions were 146.6±21.6 kJ (71.7%) and 58.9±18.9 kJ (28.3%), respectively. Significant (P<0.05) negative correlations were noted between race performance, the peak blood lactate and accumulated blood lactate for the 1500 m test (r=-0.635 and -0.735, respectively).

**CONCLUSION:** Wheelchair racing 1500 m is an aerobic-dominated event. The knowledge of energy supply in this event underestimates the importance of aerobic contribution. Anaerobic glycolysis exerts a significant influence on the performance of this event.

Supported by Shanghai Key Lab of Human Performance(Shanghai University of sport).

(NO. 11DZZ261100)

**FRIDAY, JUNE 1, 2018**
 ENERGY expenditure from resistance exercise (RE) is an important consideration for exercise prescription, yet prediction models are lacking. PURPOSE: To develop regression equations to predict energy expenditure (kcal) for RE involving each major muscle group using commonly measured demographic & exercise variables. With regards to fitness, performance, and weight management, these equations will aid practitioners and exercising adults in documenting kcal expenditure from RE.

CONCLUSIONS: Energy expenditure for a total RE bout and for specific RE exercises can be reasonably estimated in adult men and women using commonly measured demographic and RE variables. With regards to fitness, performance, and weight management, these equations will aid practitioners and exercising adults in documenting kcal expenditure from RE.

Weearable fitness trackers are relatively cheap and convenient tools that track an individual’s physical activity. Such qualities have led to an emergence of various fitness trackers available on the market for consumers, but does convenience and relatively low cost compromise accuracy? For this study, we compared Garmin Vivosmart HR (G) and the Cosmed KBox-2 metabolic backpack (C) to determine if the cheaper and more user friendly, G is as accurate as the laboratory “gold standard” C.

PURPOSE: The purpose of this study is to compare G and C’s accuracy in determining energy expenditure via kcals (EE).

METHODS: 19 recreationally active students and professors volunteered to participate. Prior to the start of the study, participants had their height, weight, BP and resting HR recorded. The participants were asked to wear both G and C while walking at a low to moderate intensity on a treadmill for 10 minutes.

RESULTS: The mean EE for C was 49.91 ± 8.2 kcal and G was 47.42 ± 19.7 kcal. CONCLUSIONS: Our data indicate that there was no correlation between G and C with an r-value = -0.273; p = 0.273. Further research is warranted with a more extensive population to determine the accuracy of the Garmin Vivosmart HR, and by how many more calories.

INTRODUCTION: The Polar M430 (M430) uses optical technology to measure heart rate (HR) from a sensor that is built into the back of the watch. The Polar V800 (V800) uses a wireless chest transmitter that is held in place by a chest strap. Both of these watches estimate exercise energy expenditure (ExEE) for numerous types of exercise. Although there is evidence that suggests that the wireless transmitters provide accurate estimates of ExEE, there is little information that shows that watches equipped with optical sensors provide accurate measurements of ExEE. PURPOSE: The purpose of this study was to compare the ExEE values obtained from the M430 and the V800 to ExEE values measured using indirect calorimetry during different bouts of exercise.

METHODS: Two females (age = 20 ± 1 y, BMI = 24.2 ± 2.8 kg/m²) and ten males (age = 22.8 ± 1.0 y, BMI = 26.1 ± 1.3 kg/m²) were strength tested to determine their 3-5 repetition max (RM) on commercial pneumatic RE equipment 1 week prior to their experimental RE bout. Body composition was assessed using DEXA. For the experimental RE, a warm-up set followed by 2-3 sets of 8-12 reps at 60-70% predicted 1RM were performed for each exercise. Each set started every two minutes. Exercises progressed order: leg press, chest press, leg curl, lat pull, leg extension, triceps extension, and biceps curl. VO₂ was measured continuously throughout the RE bout via automated metabolic cart. Total exercise volume (TV) was calculated as sets*reps*weight lifted. Multiple Linear Regression (Stepwise Removal) was used to determine the best model to predict kcal consumption based on the highest adjusted R² and least amount of variance inflation.

CONCLUSIONS: The V800 provided accurate estimates of ExEE during each bout of exercise. The M430 provided accurate estimates of ExEE only when walking. When running, the M430 consistently underestimated ExEE and the underestimation increased with exercise intensity. At the highest exercise intensity, the M430 underestimated ExEE when compared to both the V800 and indirect calorimetry. Caution should be taken when using the ExEE values obtained from the M430 when running.
In the field of exercise science, the Actigraph GT3X (A) accelerometer is regarded as one of the most accurate field measurement devices for physical activity (PA). Many PA devices have recently been added to the market to measure PA for individuals. The Garmin Vivosmart HR (G) watch is currently among the top devices on the market to measure PA. The underlying question that needs to be answered is; how accurate is the G watch? In this study, we compared the accuracy of the G to A in regards to measuring energy expenditure in kcals (EE). Purpose: To compare the accuracy of G to A in measuring EE. Methods: Individuals were recruited via word of mouth to participate in this study. The study required individuals to attach the G to the left wrist and A placed around the waist with the measuring device on the left side of the subject. The duration of the study consisted of a ten minute low-moderate intensity walk on a treadmill. Prior to exercise, weight, height, and RHR and RHP were obtained. We recruited 19 subjects, 18 years and older, of varying activity levels. The data showed no correlation between the two devices in regards to EE (r-value = -0.194; p-value = 0.456). Our data suggests further research is needed in order to determine which device is more accurate when measuring energy expenditure.

Injections of recombinant human erythropoietin (rHuEpo) have been shown to increase endurance performance and has been banned by the World Anti-Doping Agency (WADA). Recently a study has identified several gene transcripts differentially expressed after rHuEpo administration (Wang et al, 2017). There is a lack of knowledge on the effect altitude has on these genes and if they can identify differentially expressed after rHuEpo administration from baseline. Purpose: The primary aim of this study is to investigate the haematological and transcriptomic changes induced by altitude exposure. The secondary aim of this study is to compare these alterations with those caused by rHuEpo (analysis ongoing). Methods: Fourteen endurance trained athletes were recruited, blood samples were taken at sea level, during altitude exposure, and provided blood for 27 days after return to sea level. Samples were analysed for haemoglobin concentration (HGB), haematocrit (HCT) and reticulocyte percentage (RET%). Results: Compared with baseline, HGB significantly increased 9 days after arrival at altitude (14.1±0.7 vs 15.4±0.7 g dL-1, P<0.01) and remained significantly elevated 27 days after return to sea level (14.7±0.7 g dL-1, P<0.01). HCT significantly increased upon arrival compared with baseline (41.3±2 vs 43.8±2%, P<0.01) and remained significantly elevated 27 days after return (44.6±2%, P<0.01). There were no significant differences in RET%. These results show HGB and HCT increased by elevated 27 days after return to sea level (14.1±0.7 vs 15.4±0.7 g dL-1), while G was 47.42 ± 19.72.

In the study by Wang et al (2017), the subjects traveled to Suluta, Ethiopia (~2800 m) for 27 days and returned to sea level. Subjects were recruited, blood samples were taken at sea level, during altitude exposure and provided blood for 27 days after return to sea level. Subjects traveled to Suluta, Ethiopia (~2800 m) for 27 days and provided blood for 27 days on return to sea level. Samples were analysed for haemoglobin concentration (HGB), haematocrit (HCT) and reticulocyte percentage (RET%). These results show HGB and HCT increased by elevated 27 days after return to sea level (14.1±0.7 vs 15.4±0.7 g dL-1), while G was 47.42 ± 19.72. Conclusion: The data showed no correlation between the two devices in regards to EE (r-value = -0.194; p-value = 0.456). Our data suggests further research is needed in order to determine which device is more accurate when measuring energy expenditure.

Selection of prospective law enforcement officers can be facilitated with the use of simple, field-expedient fitness tests. Identification of qualified candidates has been demonstrated to significantly reduce costs for work-related injuries. Purpose: To develop a simple, field expedient, pre-hire muscular fitness tool to predict success in effecting an arrest and other essential job functions in the form of a Criterion Task Test (CTT). Methods: A Job Task Analysis (ITA) was conducted via survey, on-site observations, and interviews of incumbent federal officers (n=1025) with the objective of creating a surrogate (CTT) for the essential function of foot pursuit and effecting an arrest. Respondents were asked to provide best estimates of distances, heights, and weights associated with critical and arduous tasks. Subjects: Applicants (N=641, including 55 females (9%)) who presented for employment served as subjects for this study. Because they had received no prior physical screening these subjects represent a sample of applicants that was not range restricted on physical ability. A test for maximum pushups in 2-minutes was administered twice, separated by one day to determine test-retest reliability (intraclass coefficient= 0.95, p<0.001, n=444). Results: Incumbent and supervisory personnel, (n = 77) acting as Subject Matter Experts (SMEs) independently reviewed and rated (acceptable or unacceptable) five representative paces of an actor performing the CTT. The cutpoint for graduation success was established through a consensus model (2/3rd agreement). A two-way contingency table for sensitivity and specificity was developed to demonstrate the predictive power of the 2-minute push-up test. There was no evidence of sex bias for any of the fitness predictors. The ability to perform pushups was highly correlated with success on the CTT (pushups predict 42% of the variance in CTT, p<0.001).

Conclusions: The ability to perform a minimum of 10 push-ups correctly predicted a pass rate of 89% (sensitivity); conversely, failure identified 100% (specificity) of those who failed the CTT.

Supported by the Department of Homeland Security

PURPOSE: To explore the diagnostic value of an impedance-technology based health risk assessment system (ITHRAS) for hypertension, hyperglycemia and hyperlipidemia, which is an important part of pre-exercise evaluation and assessment.

Methods: 200 retirees (93 males, 117 females, age = 66.1±5.4 yr.) from Tsinghua University in China were tested using ITHRAS; subjects removed metal articles, took off their shoes and stockings, laying hands and feet on the electrode plate and two electrodes are attached to the head. During the test, the subjects kept quiet and relaxed, which uses the electrical impedance tomography technology to obtain biomedical information related to human physiological and pathological conditions according to the electrical characteristics of human tissues and organs, their hypertension, hyperglycemia and hyperlipidemia were also tested by sphygmomanometer and blood biochemistry analyzer on the same day. Predictive validity of ITHRAS on hypertension, hyperglycemia and hyperlipidemia was evaluated by chi-square test and ROC curve.

Results: There was no significant difference (p > 0.05) between the true health status and classified by ITHRAS, according to the chi-square tests (see Table 1 for details). The area under ROC curve (AUC) of the system for hypertension, hyperglycemia and hyperlipidemia were 0.947, 0.933, 0.808 (AUC=0.7), respectively. The results indicate that ITHRAS has high predictive validity in terms of the hypertension and hyperglycemia.

Table 1. Statistical Summary of Predictions by ITHRAS

<table>
<thead>
<tr>
<th></th>
<th>Hypertension</th>
<th>Hyperglycemia</th>
<th>Hyperlipidemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>True Health Status (%)</td>
<td>38.272</td>
<td>32.099</td>
<td>49.383</td>
</tr>
<tr>
<td>Prediction by ITHRAS (%)</td>
<td>40.741</td>
<td>35.802</td>
<td>45.679</td>
</tr>
<tr>
<td>Chi-square test (p-value)</td>
<td>0.774</td>
<td>0.629</td>
<td>0.581</td>
</tr>
<tr>
<td>ROC (AUC)</td>
<td>0.947</td>
<td>0.933</td>
<td>0.808</td>
</tr>
</tbody>
</table>

Conclusion: The predictive validity of ITHRAS in preliminary screening of hypertension and hyperglycemia was confirmed. But the accuracy of hyperlipidemia
Some authors have suggested concussion symptoms may be due to subtle visual problems because they are similar to those that occur with difficulty focusing the eyes. Although binocular vision tests (BVTs) are frequently used to evaluate visual symptoms, their reliability has not been evaluated. The 10 BVTs under investigation measure: 3D vision (gross stereoscopic acuity (GSA)), saddaces, anatomic deviation (AD) at 30 cm and 3 m, and the eye’s ability to move/fix follow/sync (convergence motor function, punctum proximum (CMPF), binocular fusion with convergence (BFC) and divergence (BFD) at 30 cm and 3 m, convergence fusional proximal (CFP)).

**PURPOSE**: To determine the one-week test-retest reliability of 10 BVTs in healthy participants.

**METHODS**: One clinician examined each participant at their earliest convenience (T1), and one week after their first visit (T2). We assessed test-retest reliability using intraclass correlation coefficient (ICC) and limits of agreement (LoA). We judged an ICC of ≥0.5 as poor, 0.51-0.74 as moderate, 0.75-0.89 as good, and ≥0.90 as excellent reliability. We present 95% LoA for the % difference i.e. the difference in scores (T1-T2)/2 divided by the average of the scores (T1+T2)/2 times 100.

**RESULTS**: We tested 20 participants (1 lost at T2, excluded from analysis). There were 10 males and 10 females with a mean age of 25.5 (SD = 4.0) years. Our ICC results suggest good reliability for AD 3m (0.88), and moderate reliability for GSA (0.62), AD 30cm (0.69), CMPF (0.54), BFC (0.54) and BFD (0.66) at 30 cm, and CFP (0.64). There was poor reliability for saccade (0.34), and BFC (0.49) and BFD (0.43) at 3 m. LoA was best for saccade (±34%) and worst for AD 30 cm (±121%), and ranged from ±55% to ±70% for 7 other tests. For AD 3m, LoA (<±200%) did not provide an accurate summary as it assumes a Normal distribution of values. In fact, 18/20 pairs of measurements were identical, one paired scored 0 and 1, and the other scored 0 and 2.

**CONCLUSIONS**: Our results demonstrate good to moderate test-retest reliability for 7 out of 10 BVTs, and poor reliability for saccades, and BFC and BFD at 3 m. LoA results suggest the effect of concussion must have a moderate to large effect on the scores of most of the tests if they are to be clinically helpful.

**Board 13**

**Determined Consistency And Agreement Of Scores Across Two Measurements Of The Visual System: Test-retest Reliability**

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(No relevant relationships reported)

**Board 14**

**Hit Or Miss: Kinematic Predictors Of In-game Performance In Collegiate Pitching**


(No relevant relationships reported)

Baseball coaches, scouts, and statisticians argue over the variables that lead to a successful season. Among pitchers, earned run average (ERA), strikeouts per inning (SIP), and fielding-independent pitching (FIP) are useful metrics to evaluate the quality of a pitcher. Kinematic predictors of these measurements can provide strength coaches and athletic trainers with valuable information for exercise prescription.

**PURPOSE**: To assess kinematic predictors of success in collegiate pitchers via SpartaTrac measurements.

**METHODS**: We collected data on 30 Division 1 baseball pitchers. Independent variables were height, weight, year in school, Sparta force plate data (Load, Explode, and Drive), vertical jump, and pitch speed. SpartaTrac data were recorded as the best of six trials and were collected at multiple times throughout a season. Dependent variables were winning percentage, ERA, SIP, and FIP; each of these was calculated as a season statistic. Multiple linear regressions were done on larger pools of pitchers.
PURPOSE: Lowering intramuscular temperature is thought to enhance recovery from strenuous exercise. Cold water immersion (CWI) is a popular form of cryotherapy but is limited by a short treatment duration due to safety considerations and the impracticality of repeated treatments. Phase change material (PCM) cooling packs fitted in wearable garments can provide prolonged post-exercise cooling that facilitates recovery without safety concerns; however, the efficacy of PCM cooling on body temperature is not clear. To compare intramuscular and core temperature changes with CWI versus PCM cooling treatments.

METHODS: In a randomized crossover design, 11 male subjects (276±6 y, 184±9 cm, 81±12 kg) wore compression shorts fitted with either 15°C PCM cooling packs, covering the quadriceps for 3 h (PCM treatment) or were immersed to the iliac crest in a temperature regulated water bath maintained at 15±1°C for 15 min (CWI treatment). Vastus lateralis intramuscular temperature (at 1 and 3 cm) and core temperature were recorded during, and for 2 h after CWI, and for 3 h during, and 1 h after PCM cooling. Treatment effects were assessed using time by treatment repeated measures ANOVA.

RESULTS: Intramuscular temperature was decreased (p<0.001) with both CWI and PCM, with initially greater effects with CWI, and ultimately greater effects with PCM (Treatment by Time P<0.0001; Fig. 1). Core temperature was reduced with PCM and CWI treatments (p<0.001; -0.23°C 1 h post CWI, -0.16°C at 2 h post PCM application, -0.24°C 1 h post PCM removal) with no difference between treatments. CONCLUSIONS: The PCM cooling provided substantial, prolonged, muscle cooling (<30°C for 2.5 h at 3 cm and for 3.5 h at 1 cm) that was well tolerated, and compared very favorably to CWI (<30°C for 0.75 h at 3 cm and 1.25 h at 1 cm). PCM cooling garments provide a practical means of delivering prolonged cooling to the musculature.

2736 Board #19  June 1 2:00 PM - 3:30 PM

Validity of Heart Rate Measurements for the Apple Watch and Fitbit Charge HR 2

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(NO relevant relationships reported)

Abstract:

Only a few studies have examined the validity of heart rate (HR) measurements for the Apple Watch and Fitbit Charge HR devices. PURPOSE: This study examined the validity of heart rate measurements for the Fitbit Charge HR 2 (Fitbit) and the Apple Watch devices. METHODS: Thirty young adults (15 females, 15 males, age 23.5±3.0) completed the Bruce Protocol while HR measurements were recorded from the electrocardiogram (ECG) and each device every minute. Average HR for each participant was calculated for very light, light, moderate, vigorous and very vigorous intensities based on ECG-measured HR. A concordance correlation coefficient (CCC, r) was conducted to examine the strength of the relationship between the ECG measured HR and the device measured HR. Relative error rates (RER) were calculated to indicate the difference in HR measurement between each device and ECG. RESULTS: The HR from the Apple Watch was significantly lower compared to the ECG HR (122.78±13.40 vs 128.81±9.46 BPM, P<.01) for moderate intensity. For very vigorous intensity, the Apple Watch HR was significantly lower compared to the ECG HR for females (174.47±8.79 vs. 180.39±13 BPM, P<.05). The HR measured by the Fitbit Charge HR 2 was significantly lower compared to the ECG measured HR for light intensity (100.25±5.93 vs 104.24±9.09 BPM, P<.01), for moderate intensity (106.66±23.74 vs 117.79±10.27 BPM, P<.01), for vigorous intensity for males (143.00±11.63 vs 145.39±15.99 BPM, P<.001) and for females (137.24±18.86 vs 155±11.9±14 BPM, P<.05) and for very vigorous intensity (157.47±13.15 vs. 181.35±14.36 BPM, P<.001). The Apple Watch also showed lower RER (2.4%-5.1%) compared with the Fitbit (3.9%-13.5%) for all exercise intensities. For both devices, the strongest relationship between the device measured HR and the ECG measured HR was found for very light intensity with a very high CCC (r>.90). The strength of the relationship declined as exercise intensity increased for both the Apple Watch and the Fitbit. CONCLUSION: Our study indicated an inverse association between exercise intensity and HR measurement accuracy for the Apple Watch and the Fitbit Charge HR 2. The Apple Watch revealed lower error rates for all exercise intensities compared to the Fitbit Charge HR 2.

Keywords: heart rate measurement; wearable devices; validity

2737 Board #20  June 1 2:00 PM - 3:30 PM

Wingate Test Retest Reliability in Healthy Subjects


(NO relevant relationships reported)

Learning effects, biological changes, and motivation contribute to variability in performance on standardized exercise tests. Performance improvement on short-duration, high-intensity tests, such as a 30-second Wingate test of anaerobic power, may be more sensitive to motivational and learning changes in novice, healthy subjects. PURPOSE: To examine performance changes during serial Wingate tests in healthy college aged students. METHODS: Twenty college students were recruited to do three 30-second Wingate tests over three days. They were given identical instructions before each test. Sleep and nutrition were controlled. Standard Wingate parameters were collected. Multivariate analysis was used to examine changes in performance parameters; data are highlighted for the singular variable: peak power. RESULTS: Eighteen subjects completed all three tests. The overall multivariate analysis for test number was not significant, and there were no significant differences across test days for peak power, power decline, average power, minimum power, power at max speed, or total energy expended. For peak power; averages for test 1 (1.72 ± 0.31 W/kg), test 2 (1.74 ± 0.28 W/kg), and test 3 (1.79 ± 0.32 W/kg) were similar, but examination of percent changes in performances illustrate why results appear homogeneous. Thirteen of 18 subjects improved their performance with repeated trials. The average improvement in peak power for those subjects was 9.8 ± 5.2%. Five subjects had performance declines from the first trial of 4.9 ± 3.9%. One subject had no change in performance. CONCLUSION: The fluctuation from zero to as high as 22% illustrates high variability of these power measurements (power decline ranged as much as 97% within one subject). This degree of variability is well outside.

Abstracts were prepared by the authors and printed as submitted.
what would normally be expected for biological variation and could be construed as problems with equipment calibration. Without application of criteria for subject effort, such as applied to cardiopulmonary exercise testing, it is difficult to make objective intra-group or intra-subject comparisons for Wingate testing.

**2738 Board #21 June 1 2:00 PM - 3:30 PM Bilateral Deficit: A Comparison Of Maximal Strength Between The Bilateral And Unilateral Leg Press Exercise**

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(No relevant relationships reported)

The bilateral deficit (BLD) is a phenomenon in which the maximal strength of both limbs contracting simultaneously is less than the sum of the weight lifted by each limb contracting in isolation. The connection between the BLD and how it influences performance is unknown.

**Purpose:** To determine if the BLD is present during a dynamic leg press in trained participants. **Methods:** Thirty volunteers (19 male, 11 female; 19-37 years old) reported to the EMU Running Science Laboratory on three separate occasions 72 hours apart. On day 1, participants performed a movement screening consisting of 8-10 repetitions at 30% of one repetition maximum (1RM) for both the bilateral and unilateral dynamic leg press training conditions to ensure that all exercises were safely performed. Two of the participants were randomly assigned to either the maximal bilateral or maximal unilateral condition. For both conditions, participants performed 6-8 repetitions at 50%1RM, followed by a single repetition at 70% of 1RM. Afterwards, the amount of weight lifted was increased by 10% between each successful lift to ensure standardization. This process continued until participants could no longer increase weight for either testing condition. On day 3, participants completed whichever condition, maximal bilateral or maximal unilateral, that was not completed on day 2 following the same procedures. A paired samples t-test was conducted to determine if there was a significant difference between the maximal bilateral condition and the sum of the left and right maximal unilateral conditions (p<0.05).

**Results:** The 30 participants had a mean ± SD age of 22 (3.97) years old, a height of 170 ± 9.3 cm, and weighed 73 ± 11.5 kg. A significant difference was observed and the maximal strength was greater for the bilateral condition (495 ± 209 lbs) compared to the unilateral condition (387 ± 208 lbs). **Conclusion:** A BLD was not observed in this study. Researchers suggest that the BLD is associated with unilateral training while bilateral training reduces the phenomenon. The participants in this study reported the consistent use of bilateral training, which may explain the lack of BLD. Future investigations are necessary to determine how various resistance training protocols influence the BLD.

**2739 Board #22 June 1 2:00 PM - 3:30 PM Inter-individual Variability in Metabolic and Neuromuscular Responses During Continuous Exercise Above and Below Critical Power**

Haley C. Bergstrom,1 Terry J. Housh, FACSM2, Kristen C. Crachon-Snyman,3 Nathaniel D. Jenkins,3 Travis Byrd,3 Taylor K. Dinyer,4 Richard J. Schmidt,5 Glen O. Johnson, FACSM2, 1University of Kentucky, Lexington, KY. 2University of Nebraska, Lincoln, NE. 3California State University-Fresno, Fresno, CA. 4Oklahoma State University, Stillwater, OK.

Reported Relationships: H.C. Bergstrom: Honoraria; GNC talk at the NSCA national conference.

Theoretically, critical power (CP) reflects the demarcation of the heavy and severe exercise intensity domains, which are defined by distinct metabolic responses and motor control strategies. **PURPOSE:** This study examined the metabolic (oxygen consumption rate [VO2]) and neuromuscular (electromyographic amplitude [EMG AMP]) responses during exercise above and below CP. **METHODS:** Six women and six men (mean ± SD age: 21 ± 2 year) performed a graded exercise test to exhaustion (GXT) to determine VO2peak and peak power output (Wpeak). During separate visits, CP was determined from the 3-min all-out test followed by two, randomly ordered, rides to exhaustion at CP minus 10% (CPm10) and CP plus 10% (CPp10). The VO2 and EMG AMP (measured from the vastus lateralis) as well as times to exhaustion (Tfatigue) were recorded during the GXT and continuous exercise above and below the CP. VO2 at exhaustion from the CPm10 and CPp10 rides were compared with VO2peak using a one-way repeated measures ANOVA and follow-up pairwise comparisons (p < 0.05). Linear regression was used to examine the individual VO2 and EMG AMP amplitude responses after the first 3 min to Tfatigue. **RESULTS:** **CPm10** (74%Wpeak) and **CPp10** (90%Wpeak) rides resulted in Tfatigue of 24.61 ± 9.29 min (range = 15.02 - 38.87 min) and 6.76 ± 4.08 min (range = 3.65 - 15.57 min), respectively. The mean VO2 at exhaustion for CPm10 (3.086 ± 0.995 L min-1), but not CPp10 (3.511 ± 1.170 L min-1), was significantly lower than VO2peak (3.488 ± 1.060 L min-1). Two of the 12 subjects at CPm10 and 9 of the 12 subjects at CPp10 reached VO2peak at exhaustion. The VO2 increased for all 12 of the subjects from 3 min to Tfatigue at CPp10 and for 9 of the 12 subjects at CPp10. At CPm10, there was no change in VO2 for the time of the 12 subjects at the VO2 maintenance within 3% of VO2peak. The EMG AMP increased for 6, decreased for 4, and did not change for 2 of the 12 subjects at CPm10. At CPp10, the EMG AMP increased for 6 and did not change for 6 of the 12 subjects. **CONCLUSION:** These findings suggested CP does not demarcate the heavy from severe exercise intensity domains for all subjects as ~17% of subjects reached VO2peak. In addition, the EMG AMP suggested there was individual variability in motor control strategies (i.e., muscle activation) above and below CP and EMG AMP was dissociated from VO2 for 50% of the subjects at both intensities.

**2740 Board #23 June 1 2:00 PM - 3:30 PM Relationship Of %HRmax And %VO2max For Running And Cycling In Trained Triathletes**

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(No relevant relationships reported)

Since relative maximum heart rate (%HRmax) correlates highly (r>0.98) with relative maximum oxygen uptake (%VO2max) for all modes of exercise (cycling, running, swimming, kayaking, rowing) it can be used by athletes and coaches to accurately determine the usage of certain %VO2max for training purposes by knowing only the value of HRmax. The effect of equal cycle and running training (Triathlon) on the relationships of %HRmax with %VO2max for cycle and running exercise is not clear. **PURPOSE:** The purpose of this study was to examine the relationships among %HRmax and %VO2max in trained triathletes during running and cycling exercise. **METHODS:** Sixteen male trained triathletes (33.2 ± 4.3 yr; 78.61 ± 4.32 kg, 126.6 ± 18.5% body fat) performed an incremental maximal effort test to exhaustion on cycle ergometer (30-watt increment 3min stages) and on a treadmill (1km.h-1 increment 3min stages) with 3-4 days apart. Individual linear regressions based on HR and VO2 values measured of each stage and maximum, were used to calculate slopes and intercepts, to predict %VO2max from %HRmax, for given exercise intensities (50, 60, 70, 80, 90 and 100%HRmax). **RESULTS:** Mean prediction ± of the %VO2max from %HRmax was significantly higher (p<0.01) during running compared to cycling exercise from 50-80%HRmax (50%: 32.03 ± 7.46 v 19.77 ± 6.75; 60%: 45.18 ± 5.85 v 35.80 ± 5.65; 70%: 58.53 ± 4.57 v 51.65 ± 4.54; 80%: 71.59 ± 3.03 v 67.45 ± 4.07). The prediction of the running %VO2max was significantly (p<0.01) overestimated at 50, 60, 70 and 80% HRmax by 62.0, 26.2, 13.3 and 6.1% respectively compared to cycling. The regression equations are: Run%VO2max = 0.738*%HRmax + 26.67 and Cycle%VO2max = 0.620*%HRmax + 37.85 (R=0.99). Mean %VO2max corresponding with 90 and 100%HRmax was not different (p<0.05) between exercise modes. **CONCLUSIONS:** For submaximal (%<90%HRmax) exercise intensities during running and cycling the use of the above regression equations may produce reasonably accurate exercise intensity for training and racing purposes and help athletes better quantify training stimuli, stress and adaptations.

**2741 Board #24 June 1 2:00 PM - 3:30 PM The Creation of Effective Standardized Instructions for a Novel Flexibility Test**

Mark G. Cullum, Justin R. Bland, Kenneth T. Turley, FACSM. Harding University, Searcy, AR. (Sponsor: Kenneth T. Turley, FACSM)

(No relevant relationships reported)

Previous research has demonstrated the validity and reliability of a new test of hip and lower back flexiblity that can be performed with minimal equipment.

**PURPOSE:** This study’s purpose was to determine if an individual could perform the test correctly only using standardized instructions. **METHODS:** 44 college age subjects attempted to perform the test procedures correctly, followed by a measurement by a trained technician. Based on the results, changes were made to the instructions to account for the most common errors. 45 new subjects then completed the revised procedures to the best of their ability, followed again by a measurement by a technician. The results of the individuals were compared to those of the technician by Pearson correlation and a Paired T-test.

**RESULTS:** For both groups and the means of the individual’s scores who performed the test correctly were compared to the technician’s values, a very high correlation was found (r=0.969 for group 1, r=0.868 for group 2). The technician’s scores tended to indicate greater flexibility, with a significant difference found for the first group (p<0.01 for group 1, p=0.095 for group 2). This was expected, as the technician’s measurements were always made after the individual’s effort, and with repeated stretches flexibility tended to improve. A noticeable number of subjects in the first group made an error (21 of 44 subjects), primarily mathematically in nature. When the instructions were revised, the mathematical error did occur less frequently, though overall more errors occurred (28 of 45), primarily not performing the procedure three
times. In some cases a mistake led to minimal error (e.g. performing the procedure only once), while in other cases the error completely invalidated the results (e.g. bending the knees). As expected, when all subjects were analyzed, significant differences (p<0.01 for groups 1 and 2) and poor correlations (r=0.265 and r=0.288 for groups 1 and 2, respectively) were found.

CONCLUSION: When performed correctly, individuals can obtain a score on the new test comparable to that of a trained technician. The study also demonstrates, however, that great care was needed by both the test developer in the creation of instructions for a protocol, and by the test administrator in reading and adhering to the standardized instructions for a protocol.

The maximum rate of oxygen consumption (VO2max) is the gold-standard index for assessing cardiorespiratory fitness. The presence of a VO2/work-rate plateau at the highest work rates during incremental testing represents the primary way to confirm that a “true VO2max” was attained; however, such a plateau is often lacking. Instead, VO2max is often confirmed using “secondary criteria” based on arbitrarily-determined values for heart rate, RPE, and/or blood-lactate concentration. A constant-work rate “verification bout” can also confirm VO2max; however, support for this practice comes predominantly from studies performed on recreationally-active/athletic populations.

PURPOSE: To compare the peak VO2 responses from an incremental and verification bout in sedentary normal and overweight/obese adults.

METHODS: Twenty-eight sedentary, but otherwise healthy-normal weight (n=15; BMI: 22.6±1.4 kg/m2) or overweight/obese (n=13; BMI: 31.3±2.9 kg/m2) subjects (male/female, n=15/13; age, 28.1±4.9 years) performed a “ramp” incremental cycling test (15-20 W/min) to limit of tolerance on a lower-body ergometer followed (10 minutes) by a constant-work-rate cycling to limit of tolerance at the highest work rate attained.

RESULTS: Intraclass correlation coefficient (.980) and coefficient of variation (4.6±3.69%) indicate good reliability for peak VO2 measurement across protocols; however, the value was significantly higher during the verification bout (2.19±0.57 vs. 2.10±0.56; L/min; p=0.001) with 18 of 28 subjects demonstrating a value ≥ 2% above that derived from incremental testing. This implies that incremental testing does not reveal a true VO2max for a substantial proportion of these subjects. However, the peak incremental response would have been accepted as VO2max in all but eight subjects if the method often used (i.e., attainment of two of three criteria based on heart rate, RPE and RER) was employed. Instead, despite the lower peak VO2 response, peak heart rate and RPE were not lower for the incremental bout while peak RER was higher (1.23±0.09 vs. 1.18±0.09; p=0.003). CONCLUSION: The ramp incremental protocol revealed an underprediction of VO2max in normal and overweight/obese sedentary adults. Use of secondary criteria resulted in false VO2max acceptance in 32% of subjects.

Step tests are a simple and cost-effective method for determining cardiorespiratory performance. To estimate the maximum oxygen uptake in multi-stage step tests, the linear relationship between workload, submaximal exercise heart rate (HR) and oxygen uptake (VO2) based on the ACSM’s stair-stepping equation is used. Increasing the workload in multi-stage step tests is usually carried out by increasing the stepping frequency. Due to impairments, changing the stepping frequency can be a problem for elderly people.

PURPOSE: To examine whether an increase by the step height, representing the same physical performance like an increasing stepping frequency, lead to similar physiological responses in elderly people.

METHODS: 33 elderly volunteers without cardiovascular diseases (± 5 years, 170 ± 10 cm; 76 ± 15 kg) underwent two different step test protocols with five stages, in a randomized order. In protocol 1 (P1), the step height was constant at 25 cm. The load was increased by the climbing frequency (5 steps per minute, rpm), every two minutes, from 10 to 30 rpm. In protocol 2 (P2), the load was increased by the step height (5 cm, every two minutes, from 10 to 30 cm) at a constant stepping frequency of 25 rpm. HR, VO2, blood lactate (Lac) and evaluation of perceived exertion (RPE) were recorded before (T0), at the end of each stage (T1 - T5) and three minutes afterwards (T6). Comparison of the differences, the root mean square error (RMSE) was calculated.

RESULTS: All five stages were achieved by 27 probands, five probands aborted at stage four and one at stage three. Between the protocols, the RMSE of the HR differed from 5.7 to 7.8 bpm independently of measuring time point. The lowest deviations of LA were found in P2 (Wilcoxon p<0.05).

CONCLUSION: The measured differences are close to the expected day by day variations in step test protocol. The measured modest differences in the protocols, both are suitable for practical application in elderly people. Considering the differences in HR between the protocols, an adaptation of the maximum oxygen uptake estimation could be necessary.

PURPOSE: Vertical jump can be assessed using a number of different methods including the Sargent jump, a force platform and methods based on the time-of-flight. The Sargent jump has the advantage of being simple and inexpensive, but is known to lack precision. The force platform is the most accurate method but is very costly. The time-of-flight system is an excellent alternative to evaluate vertical muscular power. In addition to being low cost, the proposed device does not suffer from the drawbacks associated with time-of-flight methods.

The ramp incremental protocol is often confirmed using “secondary criteria” based on arbitrarily-determined values for heart rate, RPE and/or blood-lactate concentration. A constant-work rate “verification bout” can also confirm VO2max; however, support for this practice comes predominantly from studies performed on recreationally-active/athletic populations. The purpose of this study was to examine the reliability of a novel field test known as the Lopez Dummy Throw Test (LDDT) for the assessment of AP. METHODS: The participants were male high school wrestlers (n=10: age: 17.0±0.8 yrs, mass: 70.9±10.2 kgs). The participants met on one occasion in order to complete the testing protocol. The protocol initiated with the participants completing a 10-15 minute dynamic warm-up. Following the dynamic warm-up (<5 minutes), the participants performed two trials of the LDDT. In order to perform the LDDT, wrestlers stood behind the wrestling dummy in a low squat position with legs bent at 90 degrees. Next the wrestlers wrapped their arms around the dummy, and in a smooth and steady motion, pulled the dummy against their body. The height of the dummy was recorded with the use of a measuring tape. RESULTS: The correlation coefficient was excellent between the two types of measurement systems (r=0.97).

CONCLUSION: The proposed device is not sensitive to the landing position (biggest drawback of the time-of-flight system). The main difficulty of the proposed device is to ensure that the participant remains in the area covered by the ultrasonic beam. Indeed, if the participant has a large horizontal displacement during the jump, it may provide incorrect measurements. A possible solution could be to perform a 2nd order performance curve-fitting in order to remove erroneous data. The proposed device is an excellent alternative to evaluate vertical muscular power. In addition to being low cost, the proposed device does not suffer from the drawbacks associated with time-of-flight methods.
published equations were also cross-validated for comparison. Paired *t*-tests, effect size estimates, and regression were used to quantify the relationships between measured and estimated PP. RESULTS: The validation sample indicated that estimates of PP from VJ and body mass were accurate (*R* = .95, *SEE* = 405 W). Age and sex did not add substantially to the model. Upon cross-validation, accuracy was maintained (*R* = .96, *SEE* = 429 W) and similar to previously published equations from Sayers et al. (*R* = .95, *SEE* = 490 W) and Duncan et al. (*R* = .95, *SEE* = 458 W). Small mean bias was observed (men: *ES* = .01, *p* < .05), and women: *ES* = .04, *p* = .01) for both models. CONCLUSIONS: The findings from this study found stronger correlation and **lower** heteroscedasticity. The inclusion of additional dummy throw trials to the assessment protocol may enhance the degree of reliability of the dummy throw test as a measure of AP.

The countermovement jump (CMJ) is routinely used to quantify adaptions to training, as well as monitor neuromuscular readiness and fatigue in athletes. However, controversy remains in whether to incorporate an arm swing during the CMJ or keep the hands placed on the hips. Some suggest incorporating the arms yields a higher degree of sport-specificity that may produce improved reliability, especially in skilled jumpers. Conversely, others suggest the hands-on-hips approach isolates lower extremity force production and eliminates potential arm-swing variation. PURPOSE: To establish the reliability of CMJ performance metrics obtained during a single CMJ performed with and without the arm swing. METHODS: Twenty-two (men=14, women=8) NCAA Division I collegiate basketball players performed 3 CMJs with an arm swing and 3 CMJs without an arm swing, in a randomized order. To assess the test-retest reliability, participants returned one week later to perform 3 more CMJs with an arm swing and 3 without. Intraclass correlation coefficients (ICC) and coefficients of variation (CV) were utilized to assess intraday and interday reliability for the various CMJ metrics. RESULTS: A variety of CMJ metrics for both CMJ with an arm swing and without an arm swing demonstrated high levels of intraday and interday reliability. Flight time displayed the highest levels of reliability for both arm swing (men: ICC=0.808, CV=5.9%): women: ICC=0.728, CV=5.3%) and without an arm swing (men: ICC=0.906, CV=5.4%; women: ICC=0.736, CV=5.8%), while eccentric mean power demonstrated the lowest reliability for both the arm swing (men: ICC=0.316, CV=41.0%; women: ICC=0.442, CV=25.9%) and without the arm swing (men: ICC=0.527, CV=25.8%; women: ICC=0.793, CV=30.0%). CONCLUSIONS: The present study supports the reliability of select variables of CMJ when performed with either an arm swing or without an arm swing. Neither CMJ protocols emerged as clearly superior in displaying a higher degree of reliability in the various CMJ measurements observed.

Muscular power is the rate at which work can be performed and is evaluated by obtaining velocity measurements. Currently, there are several devices available to measure muscular power through velocity measurements, including the Tendo FitoDynamic Sports Power Analyzer (Tendo Sports Machines, Slovakia). However, the ability for such devices to produce consistent results is still questioned. Additionally, the reproducibility of measurement between free weight and machine exercises has yet to be examined. PURPOSE: To determine the test-retest reliability of peak velocity during barbell bench press and leg press exercises at 20-80% of one repetition maximum (1RM). METHODS: Fifteen men (height 183 ± 10.0 cm, weight 85.3 ± 12.4 kg) and fifteen women (height 169.6 ± 7.0 cm and weight 68.9 ± 7.7 kg) performed 1RM testing for the bench press and leg press (total n = 30, x̄ leg press = 189.5 ± 49 kg and bench press 66.8 ± 32.4 kg; females n = 15, x̄ leg press = 206.3 ± 53.6 kg and bench press = 90.2 ± 30.5 kg). Following at least 48 hours, each subject returned to perform one repetition at 20, 30, 40, 50, 60, 70, and 80% of their 1RM for each exercise, in randomized order with the Tendo Unit attached to each device. To determine test-retest reliability, the subjects returned to the lab one week later to perform the velocity assessment again at each intensity, in randomized order. RESULTS: The test-retest intraclass correlation coefficients (ICC) at each percentage of 1RM, averaged across all subjects were 0.982, 0.951, 0.892, 0.884, 0.722, 0.638 and 0.777 for leg press and 0.935, 0.945, 0.981, 0.981, 0.970, 0.952 and 0.816 for the bench press. When reliability was assessed based on gender, the average ICC for leg press and bench press was 0.816 and 0.689 for females and 0.832 and 0.745 for males, respectively. CONCLUSION: The findings from this study found stronger correlation coefficients for lower percentages of 1RM (20-60%) compared to higher loads (70-100%) especially for the leg press compared to the bench press. Additionally, males had slightly stronger test-retest correlations compared to the females.

Critical power (CP) is considered a distinct exercise threshold, where at workloads above CP a metabolic steady state is not achieved causing task-failure to occur in a predictable manner. During exercise at intensities below CP, a steady state of whole-body and intra-muscular metabolic parameters is thought to be achieved, allowing exercise to be maintained for a long duration (>30 min). The ventilatory responses to constant load exercise below and above CP are yet to be determined. PURPOSE: To characterize ventilatory responses during cycling exercise performed at 80% and 100% of CP. METHODS: Ten highly trained subjects (6M/4W; age: 24 ± 4 yrs; height: 1.76 ± 0.10 m; weight: 66.3 ± 9.1 kg; VO2max: 59.1 ± 7.3 ml/kg/min) performed a ramp incremental test, a 3MT (+10 -10 W), and two constant load cycling trials to exhaustion at 10% below (CP-) and 10% above (CP+) CP. CP was determined as the mean power output over the last 30 s of the 3MT. Ventilatory (e.g. minute ventilation (VE), breathing frequency (fB), tidal volume (TV), end-tidal partial pressure of CO2 (PetCO2), ventilatory equivalents for O2 (VE/VO2) and CO (VE/VO2)) and metabolic

**CONCLUSIONS:** The equation developed on the entire sample (N = 217) can be used to estimate PP: Watts = -1613.26 + (59.54 * VJ [cm]) + (34.89 * body mass [kg]), *R* = .95, *SEE* = 414 W. This equation was developed on youth participants and can be considered for use by teachers and practitioners in field-based settings where measurement of PP from a force platform is not available.
parameters, dyspnea and arterial oxygen saturation (SpO₂) were compared at 25, 50, 75 and 100% of time to exhaustion (TTE) within each trial. The same variables were compared between CP₀ and CP₂ at exhaustion.

**Results:** TTE was 1215 ± 396 and 288 ± 95 s for CP₀ and CP₂, respectively. Within each constant load trial heart rate, fb, VE/VO₂ and VE/VO₂ were significantly (p < 0.05) higher at post-CP₂ compared to 25% to TTE. During CP₂, VE, TV, VO₂ were also different (p < 0.05) between 75 and/or 100% compared to 25% TTE. However, heart rate values were different at 75 and 100% of TTE within each trial indicating a delayed steady state was achieved at both CP₀ and CP₂. VE, TV, PetCO₂, VE/VO₂, SpO₂, VO₂ were different (p < 0.05) at exhaustion between CP₀ and CP₂.

**Conclusion:** Despite reaching different values at exhaustion, ventilatory parameters stabilized during exercise at 10% below and above CP₀. Furthermore, subjects reached exhaustion, on average 25–50 s at CP₀ which may be overestimated in highly trained subjects when CP₀ is defined using the 3MT.

**Evaluation of the Accuracy Of The ACSM Walking Metabolic Equations During the Bruce Protocol**

Kayla E. Brennan, Kristofer S. Wisniewski, Patricia Fitzgerald, Saint Francis University, Loretto, PA.

The metabolic equations from the American College of Sports Medicine (ACSM) are used to determine energy expenditure during exercise. However, the equations have been shown to overestimate the measured value of oxygen uptake (VO₂). To determine the validity of the ACSM walking metabolic equations in predicting the VO₂ during stages 1-3 of the Bruce Protocol Treadmill Test. METHODS: 50 subjects (25 males, 25 females) aged 31.6 ± 13.1 years and BMI of 25.0 ± 3.4 kg/m² completed a maximal treadmill test using the Bruce Protocol. A Parvo Medics TruOne 2400 system was calibrated before each test and used to collect and measure VO₂. Steady state, defined as a heart rate ± 5 bpm for the last 2 minutes of each stage, was attained in all subjects. The measured VO₂ values during the last minute of each stage were compared to predicted values calculated using the ACSM walking metabolic equation. RESULTS: Dependent t-tests were used to compare predicted against measured VO₂ values for each stage. Predicted and measured values ± SD of stages 1-3 were 16.3 ± 1.8 ml/kg/min and 15.5 ± 1.8 ml/kg/min (p = 0.05), 24.7 ± 2.8 ml/kg/min and 23.2 ± 2.3 ml/kg/min (p = 0.0001), and 35.6 ± 4.2 ml/kg/min and 32.0 ± 4.2 ml/kg/min (p = 0.0001), respectively. The equation overestimated VO₂ during stages 1-3 in 38 (76%), 47 (94%) and 46 (91.7%) subjects, respectively. CONCLUSION: The ACSM walking metabolic equation consistently overestimated the measured VO₂ for all three stages. The ACSM states the metabolic equations can have up to 7% error. However, the predicted VO₂ for stages 2 and 3 were both 11% greater than the measured. Due to the variability between the predicted and measured VO₂ values, caution should be taken when using the ACSM walking metabolic equation to estimate VO₂ during stages 1-3 of the Bruce protocol.

**Introduction:** Assessing maximal oxygen consumption (VO₂max) is not always feasible, so alternative testing methods to predict VO₂max have been established. The purpose of this study was to assess and validate a field test to predict VO₂max using measures obtained during a 9-minute walk test. METHODS: A subsample of 147 adults, age 18-79 years, completed this test. Demographic variables included resting heart rate (RHR), age, gender, and body mass. Participants completed three 3-min walking stages at a less than, normal and greater than normal walking pace. Heart rate (HR), distance covered, and gait speed was calculated for each stage. Recovery HR was collected every 30-seconds for 2-minutes after the end of the 9-min test. Hierarchical multiple regression analysis was used to predict VO₂max utilizing variables of age, gender, and mass, and variations of heart rate, distance, speed, and recovery data. The validity of the final prediction equation to estimate VO₂max was assessed using jackknife cross-validation. Root mean square error (RMSE) and percent bias was calculated. Results: 57.7% of the sample was female, with an average age of 46.4 ± 17.2 years, BMI 25.8 ± 4.6 kg/m², VO₂max 44.7 ± 9.2 ml/kg/min, and RHR 60.5 ± 9.2 bpm. Model 1 included age, gender, and body mass (R²=0.717). Model 2 included variables from model 1 entered in step 1, with the addition of gait speed for each 3-min stage (R²=0.740). The final model included all steps from model 2, and recovery HR after 30-seconds. This model accounted for 80.4% of the variance in VO₂max (R²=0.804, RMSE=4.651 ml/kg/min). Bias between the original model and the jackknife sample (R²=0.804, RMSE=4.651 ml/kg/min, Bias Adjusted RMSE=4.6220 ml/kg/min) was <0.1% for each variable entered into the model. Discussion: The final model accounts for ~80% of the variance in VO₂max, which is in line with previously published field tests.

**Purpose:** The current study was aimed to examine the reproducibility of estimated peak power (PP) and estimated pedaling velocity (PV) in a multi-trial 10-s all-out cycling test among adult athletes of different sports. METHODS: The sample comprised 22 adult male athletes (23.5±4.73 years). Stature, sitting height and body mass were measured. Leg length was estimated as stature minus sitting height. Thigh volume was estimated from anthropometry. Body volume was obtained from air displacement plethysmography and was subsequently converted to fat mass. Fat-free mass was estimated from anthropometry. Body volume was obtained from air displacement plethysmography and was subsequently converted to fat mass. Fat-free mass was estimated from anthropometry. Energy expenditure was determined using the Wingate Anaerobic Test protocol using the optimal load from the FVT.

Supported by FCT Grants SFRH/BD/100183/2014 and SFRH/BD/121441/2016.

**Conclusions:** Estimated PP derived from the optimal load and correspondent PV outputs seemed to be reproducible in adult athletes. Future research may examine the agreement between the estimated outputs from the Force-Velocity Test. However, reproducible VO2max measured outputs were used in the Wingate Anaerobic Test protocol using the optimal load from the FVT.

**Discussion:** Under ideal circumstances, clinicians and educators seek to detect risk for injury prospectively, often through screening efforts. It is known that screening has been very useful for rapport building, improving health literacy and facilitating entryways to local healthcare systems. However screening, as we have been conducting it, has still not proven to be predictive of injury despite implementation of preventative interventions such as pre-season conditioning programs. This may be due, at least in part, to the fact that most screenings are annual in their periodicity whereas athlete schedule loads and health status changes are very dynamic. PURPOSE: To describe a daily monitoring approach to assess patient self-rated outcome (PRO) using a personal device, image-based reported survey functional measure (YADL_Ballet) that possesses concurrent validity with the SF-12 Physical Component Summary, which when measured by factor analysis, explains 61.2% of percent return to activity following injury (p=0.0000). METHODS: 241 elite classical dancers (21.5±5.0 years; 69 men, 172 women) who received regular onsite care consented to participate in prescreen monitoring and injury monitoring. Data was analyzed with a multivariate logistic regression model for the outcome variables “injured in subsequent season” and “visits in subsequent season”. RESULTS: PRO variables were associated with the primary outcome variables (p=0.003, R²=0.492, R²=0.424, adjusted R²=0.205). CONCLUSION: Compliance with personal device image-based survey, excellent, further strengthening injury prevention screening tactics for dancers should include serial PRO score assessments to predict those at greatest risk for time loss injury. <!--EndFragment-->
PURPOSE: The purpose of this study was to determine the test-retest reliability of the modified Clinical Test of Sensory Integration and Balance (CTSIB) test on a clinical balance system. A secondary purpose was to study if short term balance training could improve proprioceptive integration that could be used for studying populations that are prone to balance difficulties. METHODS: Twenty individuals who were free of concussion, lower leg injury or balance conditions volunteered to participate in the study. The participants were randomly separated, and counterbalanced for gender, into an experimental group (n=10) and a control group (n=10). All testing was conducted on the Biodex Balance System SD to determine center of pressure sway using the modified CTSIB protocol which consisted of four 30-second trials under different conditions; eyes-open firm surface (EO-S), eyes-closed firm surface (EC-S), eyes-open soft surface (EO-U) and eyes-closed soft surface (EC-U). Both groups were tested on days one, two and seven; however, the experimental group received two ten-minute balance training sessions on hard and soft surfaces between days two and six. A (3 x 4) condition (x 2 group) ANOVA with repeated measures was conducted to determine significance (p < 0.05). RESULTS: The main effect of day was not significant (p = 0.43). The main effect of group was significant (p < 0.001). The training group had less sway than the control group (1.04 ± 0.3 vs (1.18 ± 0.03). The main effect of condition was significant (p < 0.001). A Fisher LSD was used to follow up this effect. As balance conditions became more difficult sway increased. EO-F (0.54 ± 0.04) had less sway than EC-F and EO-S (0.85 ± 0.04 and 0.87 ± 0.04 respectively) which were lower than EC-S (2.81 ± 0.04). There were no interaction effects. CONCLUSION: The modified CTSIB demonstrated strong reliability for multiple day comparisons suggesting no learning effect between trials. In addition, the results suggest that a short term (1 week) training program could result in reduced sway. Finally, the CTSIB uses multiple conditions across the testing protocol which stresses the sensory feedback system needed to maintain balance. The results indicate that sway increases as sensory input is challenged this could have application translate to balance training or rehabilitation.

PURPOSE: To examine energy expenditure and enjoyment in persons with mobility impairments during A VG represented light intensity exercise, several participants achieved moderate intensity (3-6 METs) on at least one game set. Factors not accounted for that may have influenced exercise intensity include: 1) game selection, 2) limited familiarity, and 3) discomfort wearing COSMED system. Next step includes further development of adapted gaming controller and assessment of associated health and fitness outcomes. Supported by NIDLRR grant 90RE5009-01-00.

Skin temperature (Tskin) is the predominant input for the heat balance maintenance and temperature regulation during rest and exercise, providing negative and positive auxiliary feedback to the thermoregulation system. During exercising exercise it depends on the individual’s metabolic rate and capacity for heat exchange with the environment. Depending on the type of exercise, the effectiveness of the thermoregulatory response is influenced by the individual’s acclimatization state and aerobic fitness. Purpose: To evaluate the thermoregulatory response through the Tskin, and the aerobic capacity in high (HT) and moderately fit (MT) male triathletes. Further, we aimed to determine the relationship between Tskin peak and cardiorespiratory fitness data for these groups. Methods. Ninety-two trained male triathletes were classified into HT (n=37; age 33±9 yrs.; VO₂peak 57.1±3.4 ml/kg/min) and MT (n=55; age 39±7yrs; VO₂peak 47.1±4.4 ml/kg/min). HT and MT levels were defined by their cardiorespiratory fitness classification (VO₂peak) based on ACSM. Tskin (left upper chest) and cardiovascular data were continually monitored during a progressive treadmill running, followed by a recovery period of five minutes. All the tests were performed in a controlled environment (humidity~ 40-60% and temperature~23-24 °C). Results. MT exhibited lower VO₂peak (p<0.001), Tskin peak (p<0.026), peak run speed (p<0.001), HR (p<0.001); VE (p<0.001), Tskin baseline (p<0.003) and were older (p<0.004) with higher BMI (p<0.000) compared with HT. Tskin peak correlated with VO₂peak, age and RER (p<0.05). Conclusion. Our data show that higher levels of VO₂peak are positively associated with a better thermoregulatory response, while age has a negative association with temperature control in male triathletes. These data may have implications for exercise safety in hot environments in male triathletes.

**Table 1. Cardiorespiratory Fitness and Skin Temperature data for HT and MT groups**

<table>
<thead>
<tr>
<th>Variables</th>
<th>HT (n=37)</th>
<th>MT (n=55)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>31.49</td>
<td>39.7 ± 7</td>
<td>.004*</td>
</tr>
<tr>
<td>BMI (kg-m-2)</td>
<td>22.9 ± 1.6</td>
<td>24.8 ± 2.1</td>
<td>.000*</td>
</tr>
<tr>
<td>Peak run speed (km/h)</td>
<td>7.3 ± 1.4</td>
<td>14.8 ± 1.3</td>
<td>.000*</td>
</tr>
<tr>
<td>VO₂ peak (ml/kg/min)</td>
<td>57.1 ± 3.4</td>
<td>47.1 ± 4.4</td>
<td>.000*</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>185 ± 9.7</td>
<td>178 ± 8.9</td>
<td>.011*</td>
</tr>
<tr>
<td>RER</td>
<td>1.05 ± 0.53</td>
<td>1.04 ± 0.51</td>
<td>.327</td>
</tr>
<tr>
<td>VE (l/min)</td>
<td>146.5 ± 19.9</td>
<td>121.9 ± 15.6</td>
<td>.000*</td>
</tr>
<tr>
<td>Tskin baseline (ºC)</td>
<td>34.55 ± 0.73</td>
<td>34.06 ± 0.77</td>
<td>.003*</td>
</tr>
<tr>
<td>Tskin peak (ºC)</td>
<td>35.70 ± 0.94</td>
<td>35.45 ± 1.4</td>
<td>.026*</td>
</tr>
<tr>
<td>Tskin end (ºC)</td>
<td>35.28 ± 1.4</td>
<td>35.03 ± 1.46</td>
<td>.859</td>
</tr>
<tr>
<td>Tskin recovery (ºC)</td>
<td>35.97 ± 1.25</td>
<td>35.55 ± 2.0</td>
<td>.111</td>
</tr>
</tbody>
</table>

Note: values are mean (Standard Deviation). Abbreviations: BMI (body mass index); VO₂ peak (peak oxygen uptake); HR (heart rate); RER (respiratory exchange rate); VE (ventilation); Tskin (skin temperature). * Between-groups differences (p < .05). † Significant correlation with Tskin peak in HT (p < .05). ‡ Significant correlation with Tskin peak in HT (p < .05).

**Table 2. Overall correlation between skin temperature and cardiorespiratory fitness data**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>BMI</th>
<th>Peak Run</th>
<th>VO₂ peak</th>
<th>HR</th>
<th>RER</th>
<th>Tskin Bas</th>
<th>Tskin End</th>
<th>Tskin Rec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tskin peak [ºC]</td>
<td>r</td>
<td>-0.43</td>
<td>-0.12</td>
<td>-0.269</td>
<td>0.279</td>
<td>0.08</td>
<td>-0.227</td>
<td>0.62</td>
<td>0.94</td>
</tr>
<tr>
<td>p</td>
<td>.004*</td>
<td>.256</td>
<td>.009*</td>
<td>.007*</td>
<td>.430</td>
<td>.030*</td>
<td>.000*</td>
<td>.000*</td>
<td>.000*</td>
</tr>
</tbody>
</table>

**Significant correlation (p < .05)**
Purpose: To monitor national team development camp ice hockey players with player worn sensors (PWS) to identify fatigue by reduced on-ice accelerations and changes in heart rate. Methods: 46 (15 yr; 174.83 ± 7.53 cm; 72.17 ± 11.80 kg) USA Hockey 15 national development camp participants consented to procedures approved by the EMU-HSRC. PWS measured tri-axial accelerations (ACC) and heart rate (HR) (Zephyr, MD) for each on-ice session (n=7) during the 5-day camp. Exponentially weighted Dynamic Accelerations (DYNA) were calculated from raw ACC. Three traditional games (G1, G2 and G3) were played on days 2, 4 and 5 and a 3:3 small-sided game on day 3. Peak ACC (g’s) were divided into neuromuscular (NM) (10 sec), anaerobic (AN) (20, 30, 40, 60 sec) and aerobic (AE) (90, 120, 180, 300, 600, 1200, 1800, 2700 s) time domains to determine relevant physiological fatigue factors. DYNAs (g’s) were determined for time frames longer than the AN domain. Peak HR (bmp) were divided into AN and AE domains at same time frames as ACC. MANOVAs for G only, P only and G vs P were performed (α = .05), in the case of significance a Tukey’s post hoc was performed using SPSS 24.0 (IBM, NY). Results: ACC were greater for G vs P in the NM (10 s), AN (20-60 s) and AE (90 - 180 s) whilst P were greater than G for ACC from 300 - 3600 s, respectively: p<.05). DYNAs were greater than G for AN (60 s) and AE (90 - 180; 1200 - 1800; 1800 - 2700 s) or p<.05) respectively. HR was greater at AE (300 - 1200 s; p<.05) domain for P vs G. Non-significant, small effects (η2 = .01 - .042) were seen for reduced accelerations in the NM (10 s), AN (20-60 s) and AE (90 - 2700 s) from G1 to G3. Significant decreases in ACC were observed in NM (10 s) AN (20-60 s), AE (90 - 2400 s) and DYNAs in the AN (60 s), AE (90 and 2400 s) domains from P1 to P3 (p<.05). HR also declined in the AE domain (60 - 1200 s; p<.05) from P1 to P3. Conclusion: Games elicited increased ACCs and DYNAs for majority of the time points observed between 10 and 180 s, while practices elicited greater ACC and HR for durations longer than 300 s. Along with the fact that DYNArs were higher for games vs practices, these data indicate that games exhibit a more intense exertion profile with greater emphasis on anaerobic energy systems than practices. Although not as profound as expected, effects for declining ACC and DYNA from G1 to G3 indicate fatigue was evident.

Supported by USA Hockey Foundation
There are a number of fitness watches currently on the market that can predict VO_{\text{2max}} based upon resting heart (HR) values. Traditionally these watches have measured HR using a wireless chest transmitter but the Polar M430 uses optical technology which is built into the watch to measure HR. There is evidence that suggests this optical technology will accurately measure resting HR but there is limited information that suggests this. Therefore, we will attempt to validate the VO_{\text{2max}} estimates from the Polar M430 using the M430 watch which utilizes optical sensors (O_{\text{2max}}). The purpose of this study was to compare predicted VO_{\text{2max}} values obtained from the Polar M430 watch (M_{\text{2max}}) and actual VO_{\text{2max}} values (A_{\text{2max}}) obtained from indirect calorimetry. METHODS: Seven females (age = 24.0 ± 4.4 years, BMI = 26.3 ± 5.9 kg/m²) and fourteen males (age = 24.9 ± 4.7 years, BMI = 28.1 ± 5.2 kg/m²) reported to the lab, provided their informed consent, and then were instructed to lie in a supine position to rest for 10 minutes. During this time, their information (age, height, weight, gender, self-reported training hours) was entered into the watch. RESULTS: The samples sizes from individual studies were varied, ranging from 19 to 99. A wide range of confidence intervals (CI) in several products was found. Using the criteria of convergent validity coefficient of >0.8, three products demonstrated good validity and had both the mean validity coefficient and CIs above the criteria. The mean validity coefficients of four products were the above 0.8, but lower limits of CIs were below the criteria. Interestingly, the cost of these trackers was not related to the strength of validity evidence. CONCLUSION: Since the accuracy of physical activity trackers is a contributing factor to continue engaging in physical activity (Kaewkannate & Kim, 2016), it is important to carefully examine validity evidence.

Physical and physiological profiles are biomarkers of athlete’s performance level. The fitness profile of positional differences has been described in collegiate football, basketball, and soccer, but not in Acrobatics and Tumbling (A & T). A & T is a new and emerging collegiate sport for competitive female athletes, thus there is not enough physical and performance data. PURPOSE: The purpose of this study was to compare the anthropometric characteristics and fitness levels of A & T athletes based on the two positions which include tops (T) and bottoms (B). METHODS: Subjects were 21 Fairmont State University female athletes who participated in the sport Acrobatics and Tumbling (20±0.9 years of age). A test of the five-fitness component’s, which included body composition, flexibility, muscular strength and endurance, cardiovascular endurance, and vertical jump height, was given to each participant. RESULTS: The mean value of flexibility (cm ± SD) was significantly higher in tops (T) vs bottoms (B), p < .05. Body Composition (% ± SD) showed a difference between the groups Body composition showed a significant difference (p<.05) within the tops and bottoms (T vs B), p < .05. Muscular strength and endurance, cardiovascular endurance and vertical jump height do not show significant differences. CONCLUSION: The current study describes the important positional differences in body composition and flexibility in collegiate A & T athletes. Coaches can use these physical and physiological profiles to determine which positions that the athletes are suited for.
Commercially available GPS sports watches are now able to estimate VO\textsubscript{2max}. **Purpose:** To examine predicted VO\textsubscript{2max} from a GPS watch compared to measured VO\textsubscript{2max}. A secondary purpose was to determine if fitness level affects the ability of the watch to predict VO\textsubscript{2max}. **Methods:** Twenty-eight participants, (14 M, 14 F; age 18-55 yr) came to the laboratory. On day one, participants completed a treadmill graded exercise test to determine measured VO\textsubscript{2max}. Participants completed the test using a self-selected pace while grade increased 2% every two minutes until exhaustion. On day two, participants were fitted with a GPS watch and completed a 15-minute submaximal outdoor run to determine predicted VO\textsubscript{2max} (PVO\textsubscript{2max}). Participants were separated into two groups determined by MVO\textsubscript{2max} (high (n=17, MVO\textsubscript{2max} > 50 ml/kg/min) or low (n=11, MVO\textsubscript{2max} < 50 ml/kg/min)). A two-way repeated measures ANOVA was conducted to determine if there was a significant difference among MVO\textsubscript{2max}, PVO\textsubscript{2max}, and ModVO\textsubscript{2max}. A one-way repeated measures ANOVA was conducted to determine if a significant difference in recorded VO\textsubscript{2max} values was observed within groups (P < 0.05). **Results:** The 28 participants were 24.7 ± 5.7 yr, 169 ± 7 cm tall, and weighed 67 ± 15 kg. Overall, there were significant differences between all VO\textsubscript{2max} variables (MVO\textsubscript{2max}: 55 ± 10 ml/kg/min, PVO\textsubscript{2max}: 52 ± 5 ml/kg/min, and ModVO\textsubscript{2max}: 51 ± 6 ml/kg/min, P < 0.05 for all). After participants had been separated by fitness, a significant difference remained between MVO\textsubscript{2max} and PVO\textsubscript{2max} (mean difference = 6.9 ml/kg/min, P < 0.05) and MVO\textsubscript{2max} and ModVO\textsubscript{2max} (mean difference = 7.6 ml/kg/min, P < 0.05) in only the high fitness group. No significant difference was observed between any values in the low fitness group (P > 0.05). **Conclusion:** In healthy adults, the GPS watch was unable to accurately predict VO\textsubscript{2max}. After subjects had been stratified into groups based on measured VO\textsubscript{2max}, the GPS watch was able to accurately predict VO\textsubscript{2max} in the low fitness group but was unable to accurately predict VO\textsubscript{2max} in the high fitness group.

Wearable fitness tracking devices have become common tools for runners of all levels. Using accelerometers, GPS, and heart rate, these devices are able to estimate running variables such as maximum oxygen capacity, step frequency, stride length, and ground contact time which can be used to evaluate technique and performance. **Purpose:** The purpose of this study was to validate the step frequency estimation on a Garmin Forerunner 630 for both treadmill and indoor track running. **Methods:** Six male and 5 female voluteers (23 ± 4.1 years, 171.8 ± 9.0 cm, 73.9 ± 12.5 kg) performed five total running trials in random order, two on a 200 m indoor track (jogging pace and sprint pace) and three on a treadmill (6 mph, 7 mph, and 8 mph). Each trial was video recorded to count strides for 15 s which were converted to steps per minute and then compared to the estimated step frequency by the Garmin wearable device. Paired t-tests were used to compare the actual measurements to the estimated data for each of the running trials. **RESULTS:** There was no significant difference between any of the running trials actual step frequency count and the Garmin wearable device’s estimated step frequency (Table 1). **CONCLUSION:** The Garmin Forerunner 630 is an accurate estimate of running step frequency when using it in an indoor setting, both on the treadmill and an indoor track.

<table>
<thead>
<tr>
<th>Step Frequency (steps/min)</th>
<th>Treadmill 6 mph</th>
<th>Treadmill 7 mph</th>
<th>Treadmill 8 mph</th>
<th>Indoor Track Jog</th>
<th>Indoor Track Sprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>160 ± 9.8</td>
<td>165.8 ± 11.4</td>
<td>172.7 ± 12.4</td>
<td>168.7 ± 10.6</td>
<td>213.5 ± 18.0</td>
</tr>
<tr>
<td>Garmin</td>
<td>161.6 ± 9.3</td>
<td>166.5 ± 10.8</td>
<td>171.7 ± 12.1</td>
<td>169.1 ± 10.1</td>
<td>206.7 ± 24.5</td>
</tr>
<tr>
<td>Significance</td>
<td>.08</td>
<td>.21</td>
<td>.31</td>
<td>.45</td>
<td>.27</td>
</tr>
</tbody>
</table>

Table 1. Mean ± SD of actual step frequency and estimated step frequency from the Garmin wearable device for each of the 5 running trials.
## MEDICINE & SCIENCE IN SPORTS & EXERCISE®

### Board #54

**June 1 3:30 PM - 5:00 PM**

**Use of Mesenchymal Stem Cells to Treat Muscle Strain Injuries**

Megan Lerner, Shama R. Iyer, Joseph P. Stains, Frank Henn, III, Craig H. Bennett, Richard M. Lovering. University of Maryland School of Medicine, Baltimore, MD. (Sponsor: E.G. McFarland, FACS)

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<table>
<thead>
<tr>
<th></th>
<th>Pre-AD (mm)</th>
<th>Post-AD (mm)</th>
<th>p-value</th>
<th>Pre-IE (degrees)</th>
<th>Post-IE (degrees)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot</td>
<td>8.97 ± 2.71</td>
<td>9.77 ± 2.92</td>
<td>0.029</td>
<td>43.75 ± 11.49</td>
<td>44.22 ± 12.67</td>
<td>0.613</td>
</tr>
<tr>
<td>Cold</td>
<td>9.28 ± 2.43</td>
<td>8.54 ± 2.65</td>
<td>0.023</td>
<td>41.67 ± 11.94</td>
<td>41.48 ± 10.73</td>
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<tr>
<td>Control</td>
<td>9.30 ± 3.34</td>
<td>9.36 ± 3.40</td>
<td>0.767</td>
<td>45.59 ± 13.14</td>
<td>46.54 ± 10.82</td>
<td>0.703</td>
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</tbody>
</table>

(No relevant relationships reported)

Muscle strains are one of the most common complaints treated by physicians. Standard therapy for acute muscle strains usually involves rest, ice, and nonsteroidal anti-inflammatory medications, but currently there is no clear consensus on how to accelerate recovery. It is now known that mesenchymal stem cells (MSCs) have myogenic potential by contributing to development of new muscle and enhancing satellite cell function. A treatment that shortens recovery time could have a large impact in athletics, but could have a tremendous impact in patients with muscular dys dystrophies. PURPOSE: To determine the effects of MSCs on injured muscle. We tested the hypothesis that MSC delivery at the site of muscle injury will shorten recovery time. METHODS: The tibialis anterior muscles (TAs) of anesthetized Sprague-Dawley rats were injured by lengthening contractions. The injured TA was injected with either MSCs (1E5, Lonza Biotechnologies), “sham” treatment (equivalent volume of sterile saline), or received no treatment (N=3 per group). Maximal torque was measured at optimal muscle length pre- and post-injury, and at days 1, 3, 5, 7 and 9 after injury until recovery was complete. RESULTS: All animals sustained almost identical loss of muscle force after injury (60 +/-2%). MSC treatment had a beneficial effect at within 3 days after injury, resulting in a faster, and overall greater, recovery of function compared to sham and no treatment groups. The sham injections had no effect compared to no treatment. CONCLUSIONS: We conclude that MSC injection may be a promising treatment option for muscle strain injuries. Our long-term goal is to inject injured muscle with MSCs containing superparamagnetic iron oxide nanoparticles (SPIONs), which can be tracked by MRI and delivered to a targeted sites in vivo for predetermined periods of time. This method could further improve muscle regeneration and subsequent functional recovery of the injured muscle.

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**Board #53**

**June 1 3:30 PM - 5:00 PM**

**The Effect of Tissue Temperature on Ligament Laxity in Healthy Individuals**

Stacey Chen, Everett Plocek, Kathy Liu. University of Evansville, Evansville, IN.

(No relevant relationships reported)

The use of heat and ice is commonly used in the clinical setting. Heating before exercise is reported to increase range of motion and tissue pliability while icing after exercise is reported to decrease the inflammatory response and pain. PURPOSE: To examine the effects of hot and cold on ligament laxity of the ankle joint. METHODS: Seventy-five subjects (39 females, 36 males, age = 20.1 ± 1.7 yrs; height =173.8 ± 9.5 cm, mass = 71.2 ± 13.8 kg) were recruited for this study. Participants were randomly divided into three groups (hot, cold, control). An ankle was randomly selected for testing. The experimental groups either received a hot pack or an ice bag wrapped around their ankle for the 20 minute intervention period. Prior to the intervention, anterior displacement (AD) and inversion-eversion (IE) strain ratios were measured. RESULTS: Twenty-four hours after the 40-yard dash trials all athletes returned and asked to rate their level of soreness on a 1-10 visual analog scale (VAS). Then each athlete participated in a plyometric workout consisting of a warm-up, workout (210 ground contacts), and cool-down. The control group (Con) sat in a chair for 10 mins after which the experimental group (CWI) sat submerged up to the waist in a cold-water tank (15.5°C or 60°F) for 10 mins. Participants returned 48 hrs after Con or CWI treatment and asked to rate their level of soreness on a 1-10 visual analog scale (VAS). The average VAS for muscle soreness was 7.2 ± 1.6 for Con and 8.1 ± 1.7 for CWI (p<0.05) from post-workout (1.2 ± 0.42) to post-workout (2.2 ± 0.43) to 48hrs post treatment (6.4 ± 1.8). The 48hrs post treatment group also reported greater pain (p<0.05) levels of soreness as compared to 48-hrs post workout CWI experimental group (8.1 ± 0.78 vs 4.67 ± 0.5). There was no significant difference in average distance (p>0.05) found between the Con or CWI group in the pre-treatment, post-treatment, and 40-yard dash (5.66 sec ± 0.47 vs 5.53 sec ± 0.53). Furthermore, there was no significant difference in average distance (p>0.05) found between the Con or CWI group in the pre-treatment, post-treatment, and 40-yard dash (5.66 sec ± 0.47 vs 5.53 sec ± 0.53).
results (p<0.05) found between the Con or CWI group in the post-treatment trials (5.52 sec ± 0.52 vs 5.57 sec ± 0.53). CONCLUSIONS: Forty-eight hours after high-intensity plyometric training (3MC) provoked muscle soreness was elevated when compared to pre-workout values. Cold-water immersion attenuated the reported increase in DOMS but did not prevent reports of elevated soreness. However, the increase in perceived DOMS had no significant effect on 40-yard dash time 48 hours after high-intensity plyometric training in either the control or cold-water immersion group.

Tseng et al. (2016) reported that changes in MaxECC-induced muscle damage (EIMD) of the preconditioning MVC training of the knee extensors (KE) for untrained men was significantly smaller than control group. No studies have recruited untrained participants, and targeted on hamstring muscle strains in which are the most frequent injuries. These results suggest that protective effect conferred by non-damaging exercise of the knee. It is also required to further understand the underlying mechanisms of the repeated bout effect in both physiological and pathological contexts.

The previous studies proposed that two maximal voluntary isometric contractions (2MVCs) at 20° elbow flexion did not change any variables for exercise-induced muscle damage (EIMD) and delayed onset muscle soreness (DOMS) (Chen et al., 2012, 2013). These results may not apply for real outcomes resulting from the lower limb [ex: knee extensors (KE)].

PURPOSE: To investigate the protective effect conferred by MVCs of the KE on changes in muscle damage markers and pulse wave velocity (PWV) by maximal eccentric contractions of the same muscle performed 1 day later. METHODS: Twenty untrained male students were randomly assigned to a control group that did not perform 2MVCs or 1d group who performed 2 MVCs at 120° knee flexion 1 day before and max isokinetic (30°/s) eccentric exercise (MaxECC). Changes in maximal isokinetic contraction torque (MVC-MVIC) and range of motion (ROM), DOMS, PWV and blood creatine kinase (CK) activity were compared between the groups by two-way repeated measures ANOVA. RESULTS: No significant changes in any variables were evident after 2MVCs (p < 0.05). The changes in all variables after MaxECC showed smaller for the 1d group compared with control group. CONCLUSION: The results of this study show that isometric contraction of KE at a longer muscle length did not induce muscle damage and produced a protective effect.

Trauma to skeletal muscle results in tissue and membrane damage and an inflammatory response. Current treatments are merely management strategies. Nitric oxide (NO)-donation has shown therapeutic promise in mouse models of muscular dystrophy, and therefore, may be beneficial for the treatment of acute muscle injuries. PURPOSE: To clarify the role of treatment-derived NO on muscle tissue response to trauma. METHODS: Using a contusion injury model (n=10 uninjured controls and n=58 injured), rats were treated with either placebo (Plac) or NO-donor administered with gelatin blocks immediately and one day after the injury. Time points for sample collection were 1, 3, 5 and 21 days post-intervention. Content of two selected proteins in the injured tissue homogenates were assessed with Western blots and band density normalised to uninjured untreated control samples. Myeloperoxidase (MPO) and fibronectin (45+50 kDa bands combined) were used to assess inflammatory and membrane damage respectively. Data presented in arbitrary densitometric units (AU) as mean ± standard deviation. Statistical analysis: Mixed Models ANOVA with post-hoc LSD test. RESULTS: MPO peaked five days after injury in placebo (D1: ±0.32 AU; D3: ±0.47 ±0.45; D5: 8.36 ±4.92; p < 0.0001) and NO-treated groups (D1: ±0.23 AU; D3: ±0.32 ±0.29; D5: 5.57 ±6.80; p < 0.01) and resolved by D21 in both groups (Plac: 0.71 ±0.70 and NO-donor: 1.21 ±0.71 AU). The modulation of MPO on D5 by NO-donor was 33% with large individual variation between animals (Pla versus NO-donor D5: not significant). Fibronectin was reduced in both groups (Plac: 1290 ±1441 and NO-donor 1024 ±549 AU), but fibronectin resolved better with NO-donor by D21 (Plac: 12.4 ±5.6 versus NO-donor: 3.75 ±0.8; p<0.005 between groups). CONCLUSION: Five days after injury, NO-donor treatment reduced evidence of inflammation and membrane damage. This may be due to the enhanced clearance of inflammatory radicals from injured muscle and less secondary damage.

TRAUMA TO SKELETAL MUSCLE RESULTS IN TISSUE AND MEMBRANE DAMAGE AND AN INFLAMMATORY RESPONSE. CURRENT TREATMENTS ARE MERELY MANAGEMENT STRATEGIES. NITRIC OXIDE (NO)-DONATION HAS SHOWN THERAPEUTIC PROMISE IN MOUSE MODELS OF MUSCULAR DYSTROPHY, AND THEREFORE, MAY BE BENEFICIAL FOR THE TREATMENT OF ACUTE MUSCLE INJURIES.

PURPOSE: To clarify the role of treatment-derived NO on muscle tissue response to trauma.

METHODS: Using a contusion injury model (n=10 uninjured controls and n=58 injured), rats were treated with either placebo (Plac) or NO-donor administered with gelatin blocks immediately and one day after the injury. Time points for sample collection were 1, 3, 5 and 21 days post-intervention. Content of two selected proteins in the injured tissue homogenates were assessed with Western blots and band density normalised to uninjured untreated control samples. Myeloperoxidase (MPO) and fibronectin (45+50 kDa bands combined) were used to assess inflammatory and membrane damage respectively. Data presented in arbitrary densitometric units (AU) as mean ± standard deviation. Statistical analysis: Mixed Models ANOVA with post-hoc LSD test. RESULTS: MPO peaked five days after injury in placebo (D1: ±0.32 AU; D3: ±0.47 ±0.45; D5: 8.36 ±4.92; p < 0.0001) and NO-treated groups (D1: ±0.23 AU; D3: ±0.32 ±0.29; D5: 5.57 ±6.80; p < 0.01) and resolved by D21 in both groups (Plac: 0.71 ±0.70 and NO-donor: 1.21 ±0.71 AU). The modulation of MPO on D5 by NO-donor was 33% with large individual variation between animals (Pla versus NO-donor D5: not significant). Fibronectin was reduced in both groups (Plac: 1290 ±1441 and NO-donor 1024 ±549 AU), but fibronectin resolved better with NO-donor by D21 (Plac: 12.4 ±5.6 versus NO-donor: 3.75 ±0.8; p<0.005 between groups). CONCLUSION: Five days after injury, NO-donor treatment reduced evidence of inflammation and membrane damage. This may be due to the enhanced clearance of inflammatory radicals from injured muscle and less secondary damage.

REFERENCE:

PURPOSE: To investigate the protective effect conferred by MVCs of the KE on changes in muscle damage markers and pulse wave velocity (PWV) by maximal eccentric contractions of the same muscle performed 1 day later.

RESULTS:

- Significant changes in any variables were evident after 2MVCs (p < 0.05).
- The changes in all variables after MaxECC showed smaller for the 1d group compared with control group.

CONCLUSION:
The results of this study show that isometric contraction of KE at a longer muscle length did not induce muscle damage and produced a protective effect.
Muscle injuries often lead to structural and functional deficits and recurrent injuries. Nitric oxide (NO) is an endogenous bioactive molecule with multiple physiological roles. Pharmacological NO inhibition negatively affects regeneration, with excessive fibrosis, suggesting that treatment with NO may prove to be beneficial. PURPOSE: To assess a) anti-fibrotic and pro-regenerative roles of NO following muscle trauma and b) muscle function recovery following injury by treating with either NO donor or inhibitor. METHODS: The gonaecotomized adult male rats were contusion injured (250g drop-mass) followed by one of four treatments (placebo, NO-donor, NO-inhibitor or combination) administered immediately and one day post-injury and in un-injured controls. Rats were sacrificed at 5 (D5) and 21 (D21) days after intervention (n=8/group, total n=72). In situ mechanics testing was done pre-injury and before sacrifice to determine plantar flexor contractility. Fibrosis staining was done using Masson’s trichrome and Sirius red. Embryonic MHC (eMHC) was used to identify new and regenerating muscle fibers, including cross-sectional area (CSA).

RESULTS: Maximal isometric force was significantly reduced D5 post-injury (19.5 ±3.1 N/kg compared to pre-injury 26.0 ±2.5 N/kg; p < 0.0001). D21 maximal force was significantly higher in the NO-donor group (27.2 ±3.3 N/kg) versus L-NAME (21.7 ±3.7 N/kg; p < 0.05) and combination (21.6 ±3.8 N/kg; p < 0.05). NO-donor significantly increased EHMBC protein expression (5.29 ±2.64 AU versus Plac: 0.65 ±0.64; L-NAME: 0.58 ±0.51; Comb: 0.45 ±0.9 AU; p < 0.0001) and new fiber CSA (501.34 ± um²) versus other treatments (Plac: 421 ±27 p< 0.01; L-NAME: 240.38 ±p<0.001; Comb: 313.16 ±um²; p<0.001). Picrosirius red staining indicated that NO-donor treatment reduced fibrosis (7.33 ±1.87 %; Plac: 18.28 ±3.94; p< 0.0001). Masson’s trichrome staining indicated a significant increase in fibrosis following NO inhibition (22.88 ±1.57 %; p<0.01). CONCLUSION: Maximal force production recovered fully 21 days after injury in placebo-treated rats. NO influenced recovery of physiological function in injured animals with an increased maximal force production at D21, compared to a reduction following L-NAME treatment. This may be due to improvement in regenerative myogenesis and reduction in fibrosis.

Purp: Knee osteoarthritis (OA) is a common condition that often results in knee arthroplasty (KA), a costly procedure with potentially adverse clinical sequelae. Viscosupplementation with hyaluronic acid (HA) derivatives such as hylan GF-20 can be used to treat knee OA pain. Data from a large medical claims database were analyzed to identify factors associated with KA risk for patients with knee OA treated with hylan GF-20.

METHODS: Health claims data from the Optum Clinformatics Data Mart database from 2006-2016 were used. Patients were aged ≥18 years, had data for 6 months before and ≥6 months after knee OA diagnosis, and had ≥1 treatment course of hylan GF-20 (hylan GF-20 or hylan G-F 20 single intraarticular injection) as the only HLA therapy. Patients were grouped by treatment with hylan GF-20, hylan G-F 20 single intraarticular injection, or both. Kaplan-Meier curves were generated for the adjusted risk of KA with propensity scores from the first treatment with hylan GF-20 to KA.

RESULTS: From 4,027,848 knee OA patients, 62,033 were treated with hylan GF-20 and/or hylan GF-20 single intraarticular injection; 76% treated avoided KA over the 10-year study period. Kaplan-Meier analysis showed that 60-64% of patients treated with hylan GF-20 and/or hylan GF-20 single intraarticular injection were able to avoid KA at 8 years following their first injection. Risk factors for KA from first hylan GF-20 treatment were increased age (hazard ratio [HR] ranging from 2.84-8.20 for ≥40 years of age vs 18-39 years; P=0.001 for all), fewer hylan GF-20 treatments (HR 0.63, 0.47, 0.38, and 0.36 for 2, 3, 4, or ≥5 treatments, respectively, vs 1 treatment; P=0.001 for all), and no use of ultrasound (HR 0.93 with ultrasound, P=0.001).

CONCLUSIONS: In this analysis of a large claims database over a 10-year period, younger patients, those who had more courses of hylan GF-20 treatment, and those who received hylan GF-20 injections with ultrasound guidance were less likely to receive KA. Funded by Sanofi

The remarkable capacity of skeletal muscle to adapt and repair following injury is attenuated with age. Studies in young organisms suggest that acute changes in both extrinsic and intrinsic factors in the muscle environment are critical in regulating reparative potential. PURPOSE: To uncover potential factors involved in the impaired regenerative response of aged human skeletal muscle, we comprehensively assessed the molecular stress response following muscle damage in young and old individuals.

Methods: 11 young (22.7 ± 2.25 yrs) and 8 physically active old (70.9 ± 7.5 yrs) subjects completed a bout of 300 lengthening contractions (LC) on a Biodyne dynamometer. Functional tests were performed as an indirect assessment of muscle damage and muscle biopsies were taken pre-exercise and at 3, 24, and 72 hours post-exercise. High throughput multiplexed bead assays were used to analyze biopsy samples for content of inflammatory cytokines and protein concentrations of the mitogen activated protein kinase (MAPK) signaling pathway. Results: After the bout of LC’s, muscle damage was evident by the loss of isometric force production in both groups (Young: 54.11 ± 22 and Old: 33.86 ± 17%). Old muscle displayed higher expression of MCP-1 (p<0.019) that appeared at the later 24 and 72 hour time points. There was also a rapid increase in NF-κB activity in the old following the bout of lengthening contractions (group x time, p=0.05). In the old, p38 protein content increased significantly at the 3 hour time point (Young: 0.8 ± 0.09 vs Old: 1.70 ± 0.47 fold) before returning to pre-exercise levels (group x time, p=0.0043). Additionally, by 3 hours post-exercise, these intracellular proteins levels increased only in the young (Young: 1.6 ± 0.26 vs Old: 5.1 ± 0.77 fold) and remained significantly elevated (Young: 0.76 ± 0.20 vs Old: 4.5 ± 0.46 fold) 24 hours post-exercise (group x time, p<0.038) before returning to pre-exercise levels. Conclusion: skeletal muscle of physically active older individuals is characterized by a dysregulated and asynchronous inflammatory and MAPK response, each of which may individually or collectively contribute to the deterioration of muscle repair mechanisms that accompanies aging.
Chronic Low back pain (CLBP) is a common clinical disease, and most individuals required long-term treatment.

**PURPOSE**: Analysis the hip joint muscle characteristics of individuals with CLBP, in order to provide reference for rehabilitation and prevention of chronic low back pain.

**METHODS**: 64 subjects with CLBP (age: 35.2±1.5 years, 34 males and 30 females, body weight: 66.5±3.7kg) were recruited as C group (experimental group), while 29 subjects (age: 39.2±2.18 years, 16 males and 13 females, body weight: 64.8±3.2kg) were recruited as Y group (control group). Recorded the degree of pain (VAS, Visual Analogue Scale/Score) questionnaire, and used the isokinetic muscle testing System (Con-troflex System) to test the hip joint muscle strength. Analysis the differences between C group and Y group, and the differences between the CLBP ones with different degree of pain (according the VAS).

**RESULTS**: 1) There were no differences of hip flexor, extensor or adductor between C group and Y group (p > 0.05); 2) Hip flexors/ extensor ratio (isokinetic strength of C group were significantly higher than Y group bilaterally, about 2.2 times higher (p < 0.01)). This interesting result indicated that although the flexor or extensor as an independent index shows no difference between CLBP individuals and healthy individuals, but when it comes to consider the flexor and extensor as a functional group of body posture and movement, the CLBP individuals show a decrease of extensor compare to the flexor, and this also indicate the coordination of these two muscle groups may increase in the CLBP ones. 3) Hip abductor isokinetic muscle strength of Y group was significantly higher than C group, about 26% higher (p > 0.05), which means muscle strength of hip abductor of the CLBP individuals decreased; 4) In C group, VAS score, the strength of flexor, extensor and abductor of mild ones (VAS 0-3) were significantly higher than moderate ones(VAS 4-7) (p > 0.05), while the differences were 37%, 38% and 31% respectively.

**CONCLUSIONS**: The significant reduce of muscle strength of hip abductor is related to CLBP; CLBP individuals show a decrease of extensor compare with the flexor, and this indicate the coordination of these two muscle groups may decrease in the CLBP ones. And the more pain of CLBP, these muscle strength decrease more.
Kinesio Tape (KT) is a popular therapeutic intervention in sports, aimed at optimizing athletic performance and preventing musculoskeletal injury. The manufacturers of KT claim it can alter characteristics of skeletal muscle recruitment, facilitating or inhibiting contraction depending on the nature of its application. Evidence of this claim is conflicted.

**PURPOSE:** To assess the effectiveness of KT in changing recruitment properties of the rectus femoris.

**METHODS:** Twenty college-aged, recreationally-active men and women with no history of injury were enrolled (11 men, 9 women). A Cybex Humac Norm dynamometer measured force output in the dominant leg in 3 taping conditions: 1) No tape applied (control), 2) KT applied to enhance muscle recruitment (facilitation), and 3) KT applied to impair muscle recruitment (inhibition). Subjects were tested on 3 separate days with 48 hours of rest between each; they performed no other exercise prior to and throughout the testing protocol. Subjects performed all 3 trials (control, facilitation, and inhibition) during each testing session, with randomization of the testing order. A certified KT practitioner applied the tape to each subject; subjects were blinded to the orientation of the tape (facilitation vs. inhibition). Mixed-design ANOVA tested differences in taping conditions (and taping conditions by gender) on force output. The between-subjects factor was gender; the within-subjects factor was taping condition. Differences in the within-subjects factor were tested with the Bonferroni post hoc correction. **RESULTS:** There were no differences between taping conditions (F(2,190) = 0.829) nor effects of treatment group by gender (F(2,190) = 0.226). Post hoc tests using the Bonferroni correction revealed no differences between any two treatment groups (p<1.000 for each comparison).

**CONCLUSIONS:** The application of KT did not elicit changes in muscle recruitment patterns. KT neither facilitates skeletal muscle contraction nor inhibits it based on its application.

**INTRODUCTION:** Ankle bracing is used ubiquitously as an injury prophylactic in both healthy and chronic ankle instability (CAI) populations. However, research shows that during walking and bracing diminishes coordination variability in the lower extremity in individuals with and without CAI, potentially limiting the adaptability of the motor system. An understanding of the systemic kinetic adaptations that drive coordination patterns is necessary to bolster aforementioned findings. Analysis of support moment (MS) variability during walking can provide information on the performance of kinetic adaptations that occur in response to constraints acting on the system. **PURPOSE:** Examine bracing effects on MS variability during walking in healthy (H), ankle sprain “coper” (LAS), and CAI groups. **METHODS:** 48 individuals (16 per group) participated in the study. Participants completed 15 trials of walking during NB and B conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinematics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moment in the sagittal plane. Variability of the MS was expressed as the percent coefficient of variation (%CV) across stance phase. A mixed ANOVA was conducted to compare the effects of condition across groups.

**RESULTS:** A significant condition by group interaction was observed (F(2, 42) = 7.51, p = .002, partial η² = .25). Pared samples t-tests revealed that for H, %CV was significantly lower during
A deficit in proprioception following lateral ankle sprains (LAS) has been observed using various methods. The majority of studies on ankle proprioception focus on joint position sense, which measures the accuracy of position replication. However, threshold to detect passive motion (TTDPM) assesses one’s ability to detect a change in positional homeostasis and tests the sensitivity of the slow-adapting mechanoreceptors required to adequately signal musculature to contract correctly during perturbation.

**METHODS:** To examine the role of ankle injury history on proprioception, 54 male soccer players (14 healthy: age = 27.57 ± 3.23 years, height = 169.61 ± 8.33 cm, weight = 76.98 ± 17.95 kg; 14 CAI: age = 24.07 ± 4.46 years, mass: 71.78 ± 12.75 kg) were randomly assigned to the KT (n= 10) or sham (a non-elastic) tape (ST) (n=10) group. Both groups had tape applied in consistent manner on the tibialis anterior, fibularis longus, and from the medial malleolus, across the plantar surface of the foot, to the lateral malleolus.

The tape was worn for 3 days. Participants performed a single limb standing balance test (SLSB) on a force plate for 20s with eyes closed and a side hop test (SHT) 10 times laterally and medially. They were tested before (T1), immediately after (T2), and 3 days after tapping (T3). Primary outcome measures included the velocity (cm/s) of the center of pressure in the mediolateral direction (VCOPx), anteroposterior direction (VCOPY), and total excursion (VCOPt) compared to ST groups on SLSB and SHT (p >.05). While VCOPx (T1: 5.02±1.46, T2: 4.53±1.71, T3: 4.13±1.91), VCOPY (T1: 6.19±2.6, T2: 5.3±2.54, T3: 4.79±2.66), and VCOPt (T1: 8.83±3.08, T2: 7.71±3.25, T3: 7.02±3.57), the total time (T1: 11.47±4.21, T2: 10.12±3.36, T3: 9.48±2.95) decreased steadily over time in KT group, this was not a significant decrease compared to ST group VCOPx (T1: 5.08±1.69, T2: 4.83±1.93, T3: 5.32±2.43), VCOPY (T1: 6.62±3.36, T2: 6.3±3.41, T3: 5.99±2.71), VCOPt (T1: 9.32±3.92, T2: 8.87±4.1, T3: 8.93±3.89), and total time (T1: 8.9±1.49, T2: 8.11±1.34, T3: 7.67±1.19) with p-values of .48, .58, .43, and .09 for each variable.

**CONCLUSION:** The prolonged use of KT on the ankle joint is not helpful to improve static balance and functional performance in people with CAI.

**REFERENCES:**


as the percent coefficient of variation (%CV) across stance phase. A mixed ANOVA was conducted to compare group effects during B and NB conditions. RESULTS: A significant interaction by group interaction was observed [F(2, 45) = 7.51, p = .002, partial n² = .25]. Post-hoc tests for NB revealed that CAI (13.04±3.46%) had significantly lower %CV compared to LAS (20.09±6.48%) (p = .011). For B, CAI (13.06±2.93%) and B (11.85±3.06%) had significantly lower %CV compared to LAS (23.66±9.84%) (p = .001). CONCLUSION: Individuals with CAI exhibit less %CV compared to LAS during stance phase of walk. This finding suggests that dysfunction leading to CAI may be associated with more rigid kinetic patterns following ankle injury. Additionally, bracing added to the disparity in %CV between CAI-LAS groups, and H-LAS groups. It is possible that LAS individuals have a greater capacity to adapt to imposed neuromusculoskeletal constraints (e.g. bracing) compared to healthy and CAI populations. More research is needed to explore how individual joint kinetic adaptations contribute to the %CV measure across groups and in response to bracing.

Individuals with chronic ankle instability (CAI) display poor static postural control due to impaired proprioception. While previous researchers have reported specific ankle tape applications enhance neuromuscular control, many clinically used applications have not been evaluated in patients with CAI. PURPOSE: To examine the effects of traditional tape (TT), fibular repositioning tape (FRT), and kinesiology tape (KT) on static balance control in individuals with CAI. METHODS: A total of 14 subjects, with CAI (age = 24.07 ± 4.46 yr; height = 175.16 ± 10.1 cm; weight = 82 ± 24.3 kg; CAIT = 17.64 ± 4.14; FAAM-ADL = 86.69 ± 6.71; FAAM-SS = 75.45 ± 6.70) participated in the study. Participants performed three trials of a single-leg balance task on a force plate with a 10 second eyes-open (EO) and 10 second eyes-closed (EC) condition. The task was performed before and after applying TT, FRT, and KT. Dependent variables were standard deviation of the mean center of pressure (COP), displacement (SD_COP), COP excursion (Range_COP), the velocity of COP (Vel_COP) in mediolateral (ML) and anteroposterior (AP) directions, and area of COP excursion (COP area). A repeated measure ANOVA was performed to examine differences across the conditions (baseline [BL], TT, FRT, KT). RESULTS: A significantly reduced Vel_COP was observed after applying FRT (BL = 2.67 ± 0.29 cm/s; FRT = 2.34 ± 0.36 cm/s; p<.05) with EO. With EC, a significant decrease in Vel_COP (BL = 5.21 ± 0.83 cm/s; FRT = 4.43 ± 0.68 cm/s; p<.05) and Vel_COP (BL = 4.47 ± 0.70 cm/s; FRT = 3.85 ± 0.61 cm/s; p<.05) was also found. The application of KT significantly reduced Vel_COP (BL = 5.21 ± 0.83 cm/s; KT = 4.60 ± 0.69 cm/s; p<.05). Significant differences between BL and tape interventions were not found for SD_COP, Range_COP, and COP area. The application of TT produced increased SD_COP (TT = 1.33 ± 0.20 cm; BL = 1.20 ± 0.16 cm; p<.05), Range_COP (TT = 5.98 ± 0.98 cm; FRT = 5.67 ± 0.68 cm; p<.05), and COP area (TT = 26.52 ± 6.33 cm²; BL = 22.83 ± 4.86 cm²; p<.05) compared to FRT application. Based on our finding, FRT is a more effective technique to enhance static postural control than TT, or no tape. Further study is needed to investigate the effect of FRT on dynamic postural control, as well as kinematics during specific movements, to guide FRT application in clinical practice.

Lateral ankle sprains are common lower extremity injury during sport activities, which often lead to chronic ankle instability (CAI). However, no one has comprehensively examined the effects of CAI on lower extremity movement neuromechanics during jump landing. PURPOSE: To investigate the effect of CAI on landing and cutting lower-extremity kinematic, electromyography (EMG), and ground reaction force (GRF). METHODS: 100 CAI patients (22/12 yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.3±2.6 ankle sprains) and 100 controls (22±13 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports) participated. Participants performed five successful trials of a jump landing and cutting task. Sagittal and frontal planes of ankle, knee and hip joint angles, EMG activation, and GRF were collected during jump landing and cutting. Functional analyses of variance (FANOVA) were used to evaluate between-group differences for these dependent variables throughout the entire ground contact phase of the task. RESULTS: Figure 1. Relative to the control group, the CAI group revealed (i) reduced dorsiflexion and hip flexion angles, (ii) increased inversion and reduced hip abduction angles, (iii) increased posterior and vertical GRF during initial landing, and reduced posterior and vertical GRF, and (iv) increased EMG activation of peroneus longus, and gluteus medius during mid-landing and cutting phase. CONCLUSION: Our data suggest that CAI patients demonstrated different movement strategies during jump landing and cutting. Compared to controls, patients with CAI utilized the proximal (knee) joint with strengthened corresponding muscle activation to compensate for a potentially unstable distal (ankle) joint (e.g., more inversion and less dorsiflexion angle) in an attempt to reduce ground impact force. This apparent compensation may be due to sensorimotor deficits in the ankle.
Numerous taping methods have been used to prevent ankle sprains in patients with chronic ankle instability (CAI). The effects of different taping methods on dynamic postural control in patients with CAI, however, are not fully understood. **PURPOSE**: To examine the effects of traditional taping (TT), fibular repositioning taping (FRT), and kinesiology taping (KT) on joint angles and modified Y-balance test (YBT) performance in participants with and without CAI. **METHODS**: A total of 28 subjects (14 CAI: age = 24.07 ± 4.46 yr, height = 175.16 ± 5.10 cm, weight = 82.24 ±10.38 kg; 14 Healthy: age = 27.57 ± 3.23 yr, height = 169.61 ± 8.33 cm, weight = 76.98 ± 17.95 kg) participated in the study. Subjects performed three trials of the modified YBT before and after receiving TT, FRT, and KT. Hip, knee, and ankle joint angles in sagittal and frontal planes at the moment of maximum reach distance in the anterior (Ant), posterolateral (PL), and posteromedial (PM) directions were collected. Each reach distance was measured and a composite score (CS) was calculated. A 2-way mixed ANOVA (groups × 4 conditions) was performed to examine differences across treatments (baseline [BL], TT, FRT, KT). **RESULTS**: Significant interactions were not found. However, a significant decrease in PM reach distance was found across all tape applications for both groups (F(1,97,51.16) = 55.58, p < .05, n2 = .68). KT and FRT resulted in significant improvement in the modified YBT CS compared with TT (Healthy: KT = 92.24 ± 5.72%, p < .05, TT = 89.76 ± 5.97%, p < .05, FRT = 91.83 ± 6.53%, p < .05; CAI: KT = 90.01 ± 6.69%, p < .05, TT = 86.63 ± 8.83%, p < .05, FRT = 87.88 ± 8.39%, p < .05). The CS was also significantly increased when comparing KT to BL (Healthy: BL = 90.1 ± 7.28%; p < .01, KT = 92.24 ± 5.72%, p < .05; CAI: BL = 87.47 ± 6.62%; p < .05, KT = 90.01 ± 6.49%). Analysis of kinematic data revealed a significant increase in dorsiflexion during the PM reach when KT was applied (F(2,26,58.66) = 3.89, p < .05, n2 = .13). **CONCLUSIONS**: Even though PM reach distance significantly decreased after applying any of the tape conditions, only KT significantly increased DF and an improved YBT CS compared to BL. The findings suggest KT might enhance dynamic postural control more than the other tape applications. Further research is necessary to explain the mechanism for these changes after KT application.
Good countermovement vertical jump (CMVJ) performers, as defined by CMVJ height, exhibit quicker countermovements than poor jumpers via quicker unloading phases. Still, it is unknown how good jumpers manipulate ground reaction force (GRF) and velocity to more quickly complete unloading. **PURPOSE:** To assess GRF and velocity profiles between good and poor jumpers. **METHODS:** 12 men (27.3 ± 3.0 y; 88.1 ± 16.4 kg; 1.8 ± 0.1 m) performed 8 CMVJ as GRF data were obtained. Velocity was computed from GRF. Data were normalized to 101 data points to define the time from unloading to takeoff. Mean and standard deviation profiles were computed per participant. Good (n = 6, 45 ± 0.5 m) and poor (n = 6, 33 ± 0.5 m) groups were determined by the median CMVJ height (r = .2g) for the sample. Groups were compared at each data point using effect sizes (large ≥ 0.8). The unloading, eccentric, and concentric phase times were compared visually from the mean GRF and velocity data. **RESULTS:** Good jumpers unloaded less bodyweight and showed shorter unloading and longer concentric phases (Fig 1). For GRF and velocity, trivial, small, moderate, and large differences were detected for 25%, 42%, 26%, and 8% and for 18%, 64%, 11%, and 8% of the CMVJ, respectively (Fig 2). **CONCLUSION:** Good jumpers perform quicker unloading phases by unloading lesser bodyweight. Thus, they achieve greater GRF and velocity prior to takeoff. Poor jumpers might benefit from feedback cues promoting quicker unloading and enhanced eccentric braking. Such cues might allow for enhanced CMVJ performance.

Partially supported by a National Strength and Conditioning Association Foundation Grant.

**Figure 1.** Ensemble Mean Vertical GRF and Velocity Profiles for Good and Poor Jumpers

**Figure 2.** Cohen’s d Effect Sizes for the Vertical GRF and Velocity Comparisons Between Good and Poor Jumpers

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**2799 Board #82 June 1 3:30 PM - 5:00 PM**

**Force- and Velocity-Profile Differences Between Good and Poor Countermovement Vertical Jumpers**

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(Med no relevant relationships reported)

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**2800 Board #83 June 1 3:30 PM - 5:00 PM**

**Medical Post Foot Orthotic Influences Knee Valgus Angle Excursions During a Vertical Jump Task**

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(No relevant relationships reported)

Medial posting is a common therapeutic middle foot orthotic that is used to control excessive pronation movement, and creating a more supinated position of the foot. Consequently, these altered biomechanics may also create more favorable movements at other joints, such as the knee. Knee valgus angle has been identified as a risk factor for lower extremity joint injury, and medial posting may reduce excessive valgus during dynamic tasks, therefore decreasing the risk of injury. **Purpose:** Investigate if medial post orthotics influence knee valgus and performance outcomes during a vertical jump. **Methods:** Thirty healthy participants volunteered (18m/12f; age 24.8 ± 3.1y; height 173.94 ± 8.72cm; mass 73.7 ± 13.2kg). Six maximal vertical jump trials were recorded using electromagnetic 3D biomechanical and force plate assessment. Three trials were performed with bilateral medial posting orthotics, and three with a control orthotic, with order randomized. Maximal vertical jump height, jump power, and total valgus range of motion (excursion) during the take-off phase were extracted for each limb and averaged across the three trials for analysis. Paired samples t-tests were performed to assess differences in outcomes between orthotic conditions. Alpha level was set a priori at P ≤ 0.05. **Results:** There were no differences in vertical jump height between the orthotic (46.9 ± 9.0cm) and no orthotic conditions (46.1 ± 8.6cm, t = -0.58, p = 0.56). Jump power also was the same between the orthotic (1219.4 ± 520.9) and no orthotic conditions (1243.5 ± 456.5W, t = -0.35, p = 0.72). Both the left (orthotic: 15.2 ± 7.4°; no orthotic: 18.3 ± 10.5°, t = -2.46, p = 0.02) and right (orthotic: 17.9 ± 8.6°; no orthotic: 19.9 ± 12.4°, t = 1.98, p = 0.05) limbs demonstrated significantly less knee valgus excursion when using the orthotic. **Conclusions:** The medial post orthotic was successful at reducing knee valgus excursion angles during a maximal vertical jump, while also maintaining vertical jump performance, measured via vertical jump height and power. Although medial posting is a common orthotic to correct excessive pronation at the foot, it may also have therapeutic efficacy at knee joint injury prevention during dynamic tasks.

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**2801 Board #84 June 1 3:30 PM - 5:00 PM**

**Influence of Holding a Lacrosse Stick on Jump Landing Mechanics**

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(No relevant relationships reported)

Female athletes are at an increased risk for anterior cruciate ligament (ACL) injuries by noncontact mechanisms. Close to 60% of all severe injuries sustained during a game are lower extremity strains and knee internal derangements, frequently involving the ACL. No research has been done to investigate the alteration of movement patterns as a result of holding a lacrosse stick. The Landing Error Scoring System (LESS) is a biomechanical movement screen able to detect and quantify these abnormal movement patterns. **Purpose:** To determine the effect of holding a lacrosse stick on jump landing mechanics in female collegiate players during a standardized biomechanical screen (LESS). **Methods:** The LESS was used on 20 collegiate women’s lacrosse players (19.7±1.4 yo, 60.8±5.6 kg, 1.66±0.06 m) to examine jump landing mechanics with a lacrosse stick (WS) versus without (WO). Participants jumped forward off a 30-cm box to a spot on the floor 50% of their body height, and performed a maximal vertical jump upon landing. Hi-speed video (240Hz) was recorded in the sagittal and frontal planes. Sixteen biomechanical criteria were measured using video analysis software, and averaged across three trials for each stick condition. The independent variable (holding a lacrosse stick) was counterbalanced, and dependent t-tests were used to compare between LESS scores. **Results:** There was a significant relationship between poor landing mechanics and holding a lacrosse stick reflected in the LESS scores (WS=4.46±0.69, WO=3.16±0.79, p=0.05). At initial contact, knee flexion (WS=27.1°±3.7°, WO=30.7°±3.3°, p<0.01), hip flexion (WS=28.8°±3.2°, WO=31.7°±3.1°, p=0.01), and trunk flexion (WS=14.1°±5.7°, WO=17.9°±5.5°, p<0.01) angles were significantly reduced when landing with a stick. Joint flexion displacement, however, was not significantly different (p>0.05). **Conclusions:** Holding a lacrosse stick significantly changed participant’s initial landing position with knees being closer together and an overall more extended posture. Sport dependent variation in arm positioning influences lower extremity movement patterns, demonstrated by the LESS scores. Coaches should consider implementing sport specific upper extremity constraint during ACL prevention programs to increase potential transfer to sport-specific movements.
Mechanical Differences Between Adolescents and Adults during Two Landing Phases of a Drop Jump Task

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No relevant relationships reported

PURPOSE: To investigate the mechanical differences between the first and second landing phases of a drop jump task performed by adolescent and adult males.

METHODS: Eleven adolescent basketball players (age: 16.5 ± 0.7 years; height: 1.78 ± 0.07 m; mass: 68.9 ± 8.8 kg) and eleven resistance-trained adults (age: 22.3 ± 1.9 years; height: 1.80 ± 0.10 m; mass: 84.3 ± 9.3 kg) performed two trials of a drop jump from a height of 0.51 m, 0.66 m, and 0.81 m above the laboratory floor. The CoR, RSI, and RSK were computed using tri-axial force platform data and two-dimensional videography. Linear moments at the hip (PM\text{\text{HIP}}), knee (PM\text{\text{KNEE}}), and ankle (PM\text{\text{ANKLE}}) during absorption.

RESULTS: Adults produced significantly greater v\text{\text{\text{KNEE}}}max, than the adolescents (mean difference [MD]: 0.21 m/s, p<0.004) and v\text{\text{\text{HIP}}}max of the second landing was significantly greater than the first (MD: 0.24 m/s, p<0.046). Adolescents produced significantly shorter AT (MD: 0.09 s, p<0.014) and significantly lower CM (MD: 0.16 m, p<0.001) compared to the adults. CM during the second landing was significantly lower than that during the first (MD: 0.08 m, p<0.002). Adolescents produced significantly greater PM\text{\text{KNEE}} during each landing compared to the adults (MD: 1.34 BW, p<0.003) and PM\text{\text{KNEE}} during the second landing was significantly greater than that during the first (MD: 1.88 BW, p<0.001). The adolescents produced significantly greater peak moments compared to the adults (MD: 1.48 Nm/kg, p<0.001) and the peak moments during the second landing for both groups were significantly greater than those during the first (MD: 0.65 Nm/kg, p<0.024). PM\text{\text{HIP}} was significantly greater than PM\text{\text{KNEE}} (MD: 1.75 - 3.48 Nm/kg, p<0.001) while PM\text{\text{ANKLE}} was significantly greater than PM\text{\text{KNEE}} (MD: 1.73 Nm/kg, p<0.001). The increase in the PM\text{\text{KNEE}} between the first and second landing was significantly greater than PM\text{\text{HIP}} (MD: 1.89 Nm/kg, p<0.003) and PM\text{\text{ANKLE}} (MD: 0.93 Nm/kg, p<0.010).

CONCLUSIONS: The neuromuscular strategy utilized by adolescent males when landing that results in greater forces exerted during shorter absorption phases may predispose them to musculoskeletal injuries.

Alternate Forms Reliability of Reactive Strength Assessments during Depth and Repetitive Countermovement Jumping

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No relevant relationships reported

Reactive strength assessments are most commonly made using either a depth or repetitive countermovement (RCM) jumping protocol. Reactive strength measures, such as the Coefficient of Reactivity (CoR), Reactive Strength Index (RSI), and Reactive Strength Kinetic (RSK) can be modified for computation using either of the two jumping protocols. Since researchers and practitioners assume comparability of reactive strength across protocols, it is important to assess the extent that reactive strength scores vary.

METHODS: Thirty-four young adults from the general community and 21 NCAA Division I basketball players performed five RCM jumps and depth jumps from 0.40 m, 0.56 m, and 0.81 m above the laboratory floor. The CoR, RSI, and RSK were computed using tri-axial force platform data and two-dimensional videography. Linear Regressions and intra-class correlation coefficients (ICC) were used to assess the alternate forms reliability of depth jump and RCM reactive strength scores.

RESULTS: Collapsed across sex and sport participation, ICC’s comparing reactive strength scores in depth jumping and RCM jumping ranged from 0.71 to 0.77 (R6), 0.84 to 0.88 (RSI), and 0.78 to 0.90 (RSK). Regressions detected significant associations between RS (R2=0.31 - 0.48, p<0.000) and RSI (R2=0.53 - 0.59, p<0.000) scores in depth jumping versus RCM jumping. Regressions failed to detect significant associations between CoR scores in depth jumping versus RCM jumping (R2=0.00). The 59% of the variance in the strength scores in RCM jumping. These results suggest that scores obtained from the RCM jumping protocols are not necessarily predictive of reactive strength scores in depth jumping. Additionally, these results suggest that the RCM jumping protocol may not be as specific of an assessment of reactive strength in young adults when compared against the depth jumping protocol.

Effect of Fatigue on Leg Muscle Activation and Tibial Acceleration during a Jumping Task

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No relevant relationships reported

Lower extremity stress fractures are a common occurrence during load bearing activities of jumping and landing. To detect biomechanical changes during jumping while injured, a fatigue model could be used. PURPOSE: To evaluate muscle activation and tibial accelerations in the triceps surae complex, anterior compartment and lateral compartment pre-to-post fatigue following a jumping task. METHODS: Thirty college-age subjects with and without a previous history of stress fractures were recruited (15 male, 15 female, 21 ± 5.04 yrs, htl=173.5 ±12.7cm, wgt=72.6 ±16.4kg) resulting in 177 leg trials for evaluation (control, stress fracture injured and stress fracture contralateral). EMG activity and acceleration of the proximal tibia were recorded pre-to-post fatigue. The EMG protocol consisted of surface electrodes placed on the medial gastrocnemius (MG), soleus (SOL), and tibialis anterior (TA) following a standardized placement protocol. A triaxial accelerometer was attached to the proximal anterior surface of the tibia. Subjects performed a maximal vertical jump on one leg 3 times with arms folded across the chest pre-to-post fatigue. Standing heel rises were used to ensure a consistent foot placement at a pace controlled by a metronome until task failure was reached for the fatigue testing protocol. Legs were tested using a randomized testing order. Pre-to-post fatigue measurements included the linear envelopes of the MG, SOL and TA and peak accelerations (resultant acceleration in take-off and landing). RESULTS: There was an interaction for leg and test for TA (P<0.050) with a difference between stress fracture and control posttest (P<0.05). Decreases in EMG linear envelope following fatigue (P<0.01) were evident for the MG (P<0.01) and TA (P<0.12), but not for the soleus (P>0.11). There was a significant difference for tibial acceleration for leg (P<0.029) in the stress fracture contralateral leg in comparison to the control leg at takeoff (P<0.042). At landing, there was a significant difference for test (P<0.01) as tibial acceleration increased post-test (P<0.01), leg (P<0.01) where there was a difference between stress fracture injured with stress fracture contralateral (P<0.01). CONCLUSIONS: Attention should be directed to the MG and TA muscles and in providing landing and take-off guidance upon return to activity.
Drop landing tasks are used to screen for anterior cruciate ligament (ACL) injury risk. Soft landing with greater knee and hip flexion is considered ACL protective. Greater vertical excursion of the center of mass is thought to improve shock attenuation by reducing ground reaction forces and increasing the contribution of hip extensors. It is not known if vertical excursion of the L5S1 accurately reflects sagittal plane flexion at the knee and/or hip. **Purposes:** To examine the relationship between L5S1 displacement with peak knee and hip flexion during the deceleration phase of a drop landing task. **Methods:** Female soccer players (n = 93; 14 ± 2.49 years; 52.9 ± 12.4 kg) performed a drop landing (36 cm box). Kinematic data was collected (250 Hz) with 8 camera motion system. Peak knee (pkkn) and hip (pkhp) flexion angles were identified during deceleration (contact to minimum L5S1). Total flexion (totflex) was calculated as the sum of pkkn and pkhp. Data were averaged between limbs. Vertical L5S1 excursion (L5S1ex) was calculated as the difference between minimum L5S1 and L5S1 in standing and normalized by standing L5S1. A stepwise linear regression was used to determine which variables best explain L5S1 excursion during a drop landing task. **Results:** L5S1ex was positively correlated with pkkn (r = 0.95; p < 0.00), pkhp (r = 0.74; p < 0.00) and totflex (r = 0.892; p < 0.00). Of these variables, pkkn was the only predictor of L5S1ex (r² = 0.91; p < 0.00; prediction equation: L5S1ex = 0.27 + 0.005 × pkkn). **Conclusion:** Vertical L5S1 excursion during a drop landing is reflective of knee flexion angle explaining 91% of the variance. When considering the difference between actual pkkn and pkkn calculated with the prediction equation the differences ranged from 0.03 - 11.7 degrees (average: 3.03 ± 2.37 degrees). L5S1ex may be used as a surrogate for knee flexion angle during ACL risk factor screening with a drop landing. Further research is needed to investigate the relationship between L5S1ex and shock attenuation.

**RESULTS:** Valgus angle at initial contact displayed no difference (males: -4.8 ± 1.7°; females: -3.0 ± 1.8°; p = 0.40). It was found that knee flexion at initial contact was different (males: 16.1 ± 10.5°; females: 20.7 ± 8.10°; p = 0.05). No differences were observed in valgus ROM (males: 2.75 ± 13.7°; females: 6.6 ± 14.2°; p = 0.32) nor knee flexion ROM (males: 37.1 ± 19.0°; females: 40.2 ± 10.7°; p = 0.42). **Conclusions:** These results suggest that the knee kinematic profiles for non-contact ACL injury are not present in pre-adolescent subjects and may develop during maturation.

Adolescent and post-adolescent females experience injury to the anterior cruciate ligament (ACL) more frequently than do their male counterparts in similar sports. It has been observed that females tend to land with less knee flexion and greater knee valgus angles than their male peers. These landing patterns are associated to the non-contact ACL injury mechanism.

**Purposes:** To examine the relationship between knee kinematic landing patterns in youth in the frontal and sagittal planes to determine whether these same kinematic differences exist between pre-adolescent males and females.

**Methods:** Thirty-two subjects (16 females and 16 males; aged 6 to 10 years) volunteered for participation in the study. They were asked to perform maximal jump and landing motions while being recorded for biomechanical analysis utilizing a 10-camera infrared system (200 Hz; all XYZ coordinates filtered at 20 Hz) and an imbedded force plate (1,000 Hz; filtered at 20 Hz). Values for knee flexion and valgus angles at touchdown and at maximal flexion were extracted from the data and compared between genders with an unpaired t-test: alpha ≤ 0.05.
External load may increase the demand on the neuromuscular system to safely control knee motion above its capacity, resulting in knee injury. PURPOSE: To assess the influence of external load on knee motion during a backwards single-leg jump-landing. It was hypothesized that external load would increase motion in the frontal plane, but not in the sagittal plane. METHODS: Eleven recreationally active participants (23.1 ± 3.1 y, 1.78 ± 0.08 m, 78.2 ± 11.6 kg) performed backwards single-leg jump-landings without (BW) and with (BW10%) external load applied via a weight vest worn around the torso. Participants jumped backwards over a 15 cm hurdle on the dominant leg, landed on the same foot on the force plate, and stabilized. Three trials were completed per condition and averaged for analysis. Frontal and sagittal plane knee angles were identified at initial contact (IC) and peak vertical ground reaction force (vGRF). Effect size (d) was used to evaluate differences in the means between conditions. RESULTS: Participants were in greater knee flexion at IC with external load compared to without (d = 0.40; BW: 94.1 ± 2.4°; BW10%: 92.0 ± 2.6°; p < 0.05). During the weight acceptance phase participants extended at the knee in both conditions, but extension was greater with external load than without (d = 0.53; BW: 10° ± 7.9°; BW10%: 5.7 ± 15.2°; p < 0.05). Participants were in a comparable valgus position at IC (d = 0.00; BW10%: 2.2° [-1.1 - 5.4]; BW = 2.1° [-1.5 - 5.5]) and moved similarly towards a varus position during the weight acceptance phase (d = 0.08; BW10%: 1.7° [-3.9 - 0.4]; BW = 1.5° [2.4 - 0.7]), ultimately resulting in comparable valgus positions at peak vGRF (d = 0.02; BW10% = 0.5 [-2.1 - 3.0]; BW = 0.6 [-2.4 - 3.6]). CONCLUSIONS: Frontal plane knee kinematics were similar between conditions, possibly because the external load was not great enough to exceed the ability to safely control knee motion. Participants landed in greater knee flexion with external load but extended the knee during the weight acceptance phase, possibly due to the unique movement challenges of a backwards jump. This may heighten vertical stiffness, challenge the lower extremity's passive stability, and increase the risk for knee injury.

Although the importance of core muscles on human motions has been recognized, little is known about the effect of trunk muscle fatigue and activation on drop jump (DJ) performance. PURPOSE: To examine how trunk muscle fatigue and activation relate to DJ performance. METHODS: The study included 7 healthy, well-trained males (age 20.8 ± 1.4 years, height 186.4 ± 5.7 cm, weight 67.1 ± 8.0 kg). Subjects held vertical trunk position against a wire with one end attached to the posterior thorax, pulling the trunk posteriorly, with the other end attached to a weight corresponding to 25% of maximal voluntary isometric trunk flexor contraction force (MVIC), and double- and single-leg DJ height (DH), contact time (CT), and DJ index (DJH; DH/CT) were measured. Surface electromyography was recorded from the dominant side of the anterior and posterior trunk musculature during DJS. Mean differences before and after the fatigue task were examined using paired-sample t-tests. Simple linear regression analyses tested the relation of relative changes before and after the fatigue task in the jump performance index and trunk muscle activation during pretreatment, braking, and push off phase of each DJ. RESULTS: After the fatigue task, MVIC was significantly decreased to 68.8 ± 11.5% (p = 0.01), DJH (Pre vs. Post fatigue for double- and single-leg DJ: 1.18 ± 0.31 vs. 0.94 ± 0.36, 0.52 ± 0.13 vs. 0.41 ± 0.15) and DJH (Pre vs. Post fatigue for double- and single-leg DJ: 22.12 ± 5.09 vs. 20.01 ± 5.24 vs. 13.21 ± 3.04 cm; IC 11.73 ± 6.4 cm) were significantly decreased (p < 0.01). CONCLUSION: Trunk muscle fatigue and decreased trunk flexor muscle activation during DJ have negative effects on both double- and single-leg DJ.
The gluteus maximus (GM) has a triplanar function at the hip joint. It was hypothesized that increased GM activation before and after foot contact (FC) on landing would affect trampoline hip and trunk kinematics and anterior cruciate ligament (ACL) injury risk.

**PURPOSE:** To examine how increased GM activation before and after FC affect hip angles and trunk inclination during single-leg landing. **METHODS:** A double-leg drop jump from a 30-cm box, followed by single-leg landing onto a force plate, was performed by 13 males and 15 females in both control (CC) and experimental conditions (EC). Kinetic and kinematic data were collected from the force plate and 3-dimensional electromagnetic motion tracking system, respectively. Hip joint angles and sacrum and thorax inclination angles in space on FC, peak ground reaction force (GRFpk), and peak knee extensor moment (KEMpk) during single-leg landing were calculated. Comparisons were performed using two-way (sex x conditions) repeated measures analysis of variance with a significance level < .05. **RESULTS:** The hip joint exhibited more abduction (EC vs. CC at FC, GRFpk, and KEMpk, respectively: -13.2 ± 7.8° vs. 9.5 ± 6.3°, -8.9 ± 7.7° vs. -4.9 ± 6.8°, -3.3 ± 8.9° vs. -2.6 ± 6.5°) and external rotation (-14.8 ± 8.5° vs. -9.8 ± 9.9°, -8.0 ± 3.6° vs. -3.6 ± 9.7°, -6.1 ± 9.7° vs. -1.1 ± 11.2°) at all time points in EC than in CC. The sacrum showed more lateral inclination toward the supporting leg at all time points (14.3 ± 6.0° vs. 11.1 ± 6.4°, 12.1 ± 8.8° vs. 9.0 ± 6.1°, 8.9 ± 7.1° vs. 6.7 ± 6.2°) and more erect position at KEMpk in EC (-1.0 ± 10.6°) than at CC (-4.6 ± 10.5°). No significant differences were observed in thoracic inclination angles. No significant interactions were observed among all variables.

**CONCLUSIONS:** Increased GM before and after FC on single-leg landing may have positive effects on frontal and transverse plane hip motion to reduce ACL injury risk. However, excessive GM activation may result in excessive trunk lean toward the supporting leg and more erect position, which increase risk for ACL loading. Thus, appropriate GM activation is necessary to protect the ACL during single-leg landing.

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**2814 Board #97**

**June 1 3:30 PM - 5:00 PM**

**Effects of Increased Gluteus Muscle Activation on Hip and Trunk Kinematics during Single-Leg Landing**


(No relevant relationships reported)

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The anterior single leg hop for distance test (SLHOP) is a common functional assessment task that is often used to assess return to play criteria following ACL reconstruction. Clinicians primarily assess SLHOP distance, but the way an individual completes the task may be important when determining return to play status. Recent research has indicated that non-uniformity in vertical ground reaction force (VGRF) profiles may be related to pathomechanics during a vertical jump, but little research has been done to explore the relationship between force profiles and SLHOP distance.

**PURPOSE:** To determine the correlation between a force profile ratio and SLHOP distance. **METHODS:** Twenty-three female collegiate soccer players (19.1±1.5 years; 166.9±7.1 cm; 62.6±8.3 kg) performed three SLHOP for maximal distance off a tri-axial force plate. The SLHOP was performed on the dominant limb. Ground reaction force (GRF) data were collected during SLHOP take-off phase to produce force-time curves that were used to calculate the ratio between the instantaneous and average force profile across three events. Force profile ratios were calculated between A) the minimum GRF after initiation of the countermovement and the peak GRF prior to takeoff, and B) the point during the countermovement when body weight is reached and peak GRF. Ratio A and B where calculated in both the vertical (z) and anterior-posterior (y) axes. All forces were normalized to body weight, and SLHOP distances were normalized to leg length (cm/cm). The strength of the association between each of the aforementioned force profile ratios and maximal SLHOP distance were calculated using Pearson correlation coefficients with an alpha level set a priori at p<0.05. **RESULTS:** There were no significant correlations between any combination of force profile ratios and SLHOP distance (p-value range: 0.19 to 0.62, r range: -0.11 to -0.26). **CONCLUSION:** Force profile ratios between straight-line and trace-line distance are not significantly related to average or maximum SLHOP distance. Further research should explore the relationship between other phases within the force-time curve, pathomechanics, and SLHOP distance.

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Many factors are associated with an athlete being able to safely return to sport (RTS). Frontal plane control and endurance in the frontal plane is recognized as an important factor in RTS. The ability to absorb energy while fatigued is critical to help dissipate forces and minimize injury risk. Current RTP guidelines do not evaluate fatigue and power absorption. A new 30-second endurance side hop test could provide a means of clinically evaluating this ability. **PURPOSE:** Compare the change in energy absorption over a 30-second side hop test in healthy subjects. **METHODS:** 17 healthy subjects (11 M, ages 22.4±3.14, BMI 22.96±3.06) with no prior lower extremity injuries performed an instrumented single limb lateral hops between two force plates 15.24 cm apart as many times as possible in 30 seconds. Errors were subtracted from total successful hops and included landing between the force plates or putting the non-stance limb down. The change in energy absorption from beginning to the end of the test was also calculated. Pearson product moment correlation was used to evaluate the relationship between the average number of hops to the change energy absorption over 30 seconds. We also assessed the difference in hops between those who maintained versus those who had a reduction in power absorption with an independent samples t test. **RESULTS:** Subjects performed an of 29.4±6.6 lateral hops over 30 seconds. There was a strong, significant correlation between the number of hops to energy absorption (r=0.68, p<0.003). There was also a significant difference (p=0.04) in the number of hops between those who maintained energy absorption (32.3±4.4 J) versus those who did not (26.1±7.3 J).

**CONCLUSIONS:** This 30-second side hop endurance test was significantly correlated to energy absorption. Those who were able to maintain energy absorption throughout the testing protocol. Potentially, the ability to maintain the ability to absorb energy while fatigued may reduce injury, as these athletes are better able to attenuate loads. Having established the relationship to energy absorption, future studies should evaluate the test’s relevance to injury prediction.
warranted to examine the relationship between force and RFD profiles and other jump tasks. Future studies should examine the effect of sex and sport on the relationship between SLHOP distance and force variables.

F-57 Free Communication/Poster - Children and Youth

Friday, June 1, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

2818 Board #101 June 1 2:00 PM - 3:30 PM
Evaluation Of The Implementation Of An Academically-integrated Intervention Targeting Obesity-related Health Behaviors In Preschooler-age Children

Christine W. St Laurent, Sarah Burkart, Sofiya Alhassan, FACSM. University of Massachusetts Amherst, Amherst, MA. (Sponsor: Sofiya Alhassan, FACSM)

No relevant relationships reported

Obesity related health behaviors [ORHBs; physical activity (PA), diet, and sleep] interventions targeting preschool-age children implemented within childcare centers have shown mixed results. The variability of these findings could be related to process evaluation measures, which are frequently not reported. PURPOSE: To describe the process evaluation (feasibility, acceptability, and fidelity) outcomes of a 12-week preschool intervention targeting ORHBs that was integrated into early education learning standards (state mandated policies) in preschools. METHODS: Two preschools (classrooms, n = 7) were randomized to either the 12-week Physical Activity, Diet and Sleep (PADS) intervention or control condition. The PADS program was led by research staff and teachers and included ORHB lessons and activities implemented on four days/week (three days of morning PA, three days of afternoon PA, one day of diet, and one day of sleep). PADS PA intervention intensity was assessed on one randomly selected weekday morning/week with accelerometers. Other process evaluation outcomes were assessed (daily, weekly, and at 12-weeks) using semi-structured questionnaires completed by research staff and teachers. RESULTS: Fifty, 33.3, 77.8, and 100.0% of observed lessons were implemented as planned for diet, sleep, morning PA, and afternoon PA, respectively. Only 44.7 ± 8.6% of the morning PA lessons were spent in moderate-to-vigorous intensity. Among all observed lessons at least 50% of the students participated and the majority of students seemed to enjoy the activities. Teacher encouragement was present in 62.5% (diet) - 72.2% (morning PA) of observed lessons. Greater than 90% of the lessons were perceived as effective and would be used in the future by teachers. CONCLUSIONS: This pilot data suggests that integrating ORHBs into education learning standards is feasible and acceptable by preschool teachers and students. PADS PA lessons had the highest levels of implementation, whereas modifications were recommended for some diet and sleep lessons. Implementation of all lessons may also improve with greater teacher encouragement.

2819 Board #102 June 1 2:00 PM - 3:30 PM
Mixed-method Analysis Of An After-school Program To Increase Physical Activity

Kelly R. Rice1, John Schuna2, Tim Behrens, FACSM.1 Eastern Oregon University, La Grande, OR. 2Oregon State University, Corvallis, OR. 3Northern Arizona University, Flagstaff, AZ. (Sponsor: Tim Behrens, FACSM)

No relevant relationships reported

Physical activity (PA) is essential for adolescent health and prevention of chronic diseases. After-school programs and time spent outdoors are important for addressing health behaviors, particularly PA. PURPOSE: The purpose of this study was to increase PA through an afterschool program that utilized outdoor resources. METHODS: Get Outside - After School Activity Program (GO-ASAP), a 20-wk (2d wk for 150-180 mins) PA program designed to increase lifestyle PA. Participants (N = 18) were recruited from a local middle school. The Physical Activity Questionnaire for Children (PAQ-C), as well as accelerometers, was used to assess PA. Assessment of social cognitive (SCT) and self-determination (SDT) constructs were measured on a 5-point Likert scale. All assessments were administered pre- and post-intervention. Focus groups were conducted post-intervention to assess self-confidence and enjoyment. RESULTS: Participants (male = 11, female = 7) were 12.9 ± 0.9 years of age. Accelerometer-derived PA indicated an increase in MVPA min hr (2.9±0.8 to 3.9±2.4) but was not significant (p = 0.28). Self-reported PA increased from baseline to post (2.06 ± 0.56 to 2.54±0.92; p < 0.042). There were no significant changes noted in SCT or SDT constructs. Five themes emerged from focus groups: (1) students liked participating in the GO-ASAP, (2) students learned new skills and activities while exercising outdoors, (3) participation in the GO-ASAP had a positive effect on confidence and self-esteem, (4) Participation in the GO-ASAP had a positive effect on life-long commitments to fitness, and (5) there is a positive interaction between students and GO-ASAP leaders. CONCLUSIONS: Results of this pilot project indicated that outdoor-based PA programs might yield small effects in PA. Additional explorations with larger sample sizes are warranted to fully investigate the efficacy of these findings. The need for after school programs involving activities promoting PA into adulthood should be explored.

2820 Board #103 June 1 2:00 PM - 3:30 PM
Changes On Neuroendocrine Parameters (cortisol, Melatonin) And Anxiety Levels After A School-based Exercising And Nutrition Counseling Intervention In School-aged Obese Adolescents From Monterrey México.

Marco A. Enriquez Martínez1, Oswaldo Ceballos Guerro1, 2, Raul Lomas Acosta1, José Alberto Valadez Lira2, Armando Cocca1, 3, Benemérita Escuela Normal Manuel Ávila Camacho, Zacatecas, México. 1Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, Mexico. 2Secretaría de Educación Coahuila, Saltillo, Coahuila, Mexico. (No relevant relationships reported)

BACKGROUND. Recent studies point to high prevalences of obesity in adolescent populations worldwide. Its implications derive in various disorders, among which are inflammatory processes, as well as disorders related to sleep-wake, both processes involved in stress situations. There are two neuroendocrine parameters (cortisol and melatonin) two hormones associated with the sleep-wake process that lead to a certain level of anxiety in obese subjects. Both cortisol and anxiety have been evidenced in various investigations as obsesogenic factors. For its part, the practice of physical exercise has been indicated as a factor associated with the increase in melatonin levels, which has anti-inflammatory and recovery functions. PURPOSE. To assess the changes in the levels of neuroendocrine parameters (cortisol, melatonin) and anxiety after an intervention of nutritional counseling and exercise in school-age obese adolescents of Monterrey Mexico

METHODS: Experimental study with a sample of 31 adolescents (13 ± 2) randomly assigned in three work groups had participation during 4 months. The control group (CG) did not receive any treatment; experimental group 1 (EG1) participated in a health program composed of 4 weekly sessions of 60 minutes of physical activity; Experimental group 2 (EG2) 4 weekly sessions of 60 minutes of physical activity sessions of nutritional guidance and 2 weekly sessions of light therapy of 45 minutes. The values of cortisol and melatonin were taken in saliva and for anxiety the questionnaire of state anxiety (STAI) was used.

RESULTS: After comparing initial and final values, the results showed significative changes into EG2 increasing melatonin (p > 0.001). Salivary cortisol showed significant decreases into EG1 (p = 0.004) and also into EG2 (p = 0.006). Anxiety state showed a significant increase into CG (p < 0.001), and significant decreases into EG1 (p = 0.003) and into EG2 (p < 0.001)

CONCLUSIONS: The School-based Exercising And Nutrition Counseling shows favorable effects in the reduction of cortisol levels and anxiety, both factors associated with inflammation. The use of light therapy seems to help into the recovery processes increasing secretion of melatonin and recovery after exercise: we suggest analyze sleep variables for further studies

2821 Board #104 June 1 2:00 PM - 3:30 PM
Impact of After-School Jump Rope Program on Psychological Outcomes

Jessica Albers. Minnesota State University Mankato, Mankato, MN. (No relevant relationships reported)

As childhood obesity increases and physical activity (PA) in youth populations decreases, it is crucial to implement programs which successfully increase PA while providing positive psychological experiences for growth. After-school program offers opportunities for youth to not only engage in PA but to experience varied types of PA and social interactions which can positively impact their perceptions on PA, exercise, and how they view themselves. PURPOSE: The purpose of this study was to explore the impact participating in an after-school jump rope program had on self-perceptions, PA enjoyment, goal orientation, and weekly PA. METHODS: Students ages 8-12 years old from two elementary schools (n=28) participated in a 12-week after-school jump rope program that met twice a week for 90 minutes each session. Participants practiced individual and group jump rope skills and learned a team routine that they performed at the end of the 12 weeks. Participants completed pre and post-test measures including Harter’s Self-Perception Profile, the PA Enjoyment Scale, a combination of the Sport and Classroom Goal Orientation Scale, and the Self-Administered PA Checklist.

RESULTS: There were no changes in self-perceptions from pre to post-tests measures.

Abstracts were prepared by the authors and printed as submitted.
Physical activity (PA) and cardiometabolic fitness (CRF) are independently associated with lower cardiometabolic risk, and may affect risk through different pathways. PA and CRF are two different constructs (behavior vs trait), and CRF has a genetic component suggesting that some may be predisposed to higher CRF in whom associations between PA and cardiometabolic health might be less pronounced than those with low CRF. Therefore, CRF might moderate the association between PA and cardiometabolic risk, however, only cross-sectional studies have examined such an influence of CRF on this relationship so far. PURPOSE: To examine if CRF moderate the prospective association between PA and cardiometabolic outcomes in 10-year-old children. METHODS: In total, 718 children (50.3% boys) had valid measures of PA measured by accelerometer (GT3X), and CRF assessed by the Andersen intermittent running test, as well as the cardiometabolic outcomes: systolic blood pressure, waist circumference (WC), total cholesterol, high-density lipoprotein, triglycerides, glucose, and insulin. Outcomes were analyzed individually, and as a clustered cardiometabolic risk score (sum of z-scores). PA and cardiometabolic risk factors were measured at baseline and follow-up seven months later. Linear mixed modelling was used to examine the prospective associations between PA exposures and cardiometabolic risk outcomes, including the interaction term (PA × CRF) in the model to assess moderation by CRF. RESULTS: CRF modified the association between baseline PA (counts per minute) and between moderate-to-vigorous PA (MVPA) (min/day) with clustered cardiometabolic risk at follow up (P<0.026). Moreover, CRF modified the association for PA and MVPA with insulin independence of WC (P<0.022). When stratified by CRF level (low-high), PA and MVPA predicted lower insulin resistance [MVPA β=0.119 (95% CI: -0.207, -0.038); P=0.008] and clustered cardiometabolic risk [MVPA β=-0.092 (95% CI: -0.166, -0.018); P=0.014] in children with low CRF, but not among their fitter peers (P>0.323). CONCLUSION: CRF moderate the prospective association between PA and clustered cardiometabolic risk; this moderation was most pronounced for insulin resistance. Our findings suggest that PA may be especially important in children with low CRF.
METHODS: Cross-sectional analyses of data from the 2016 Physical Activity and Fitness in China - the Youth Study. Participants were 90,712 primary, junior middle, and junior high school students aged 9-17 years recruited from 1204 schools across 32 administrative provinces in the Mainland of China. Participants’ moderate-to-vigorous physical activity (MVPA) levels and SES of family were collected via a questionnaire completed by the children and guardians.

RESULTS: Analysis of covariance revealed that 9-11-year-old boys from high SES families spent more minutes per day in MVPA (M=12055, SD=3247), t(17)=2.10, p=0.025. The program was designed to promote and sustain positive health behaviors, and suggests that Latina caregivers of children with DD are physically active. However, we (M=12055, SD=3247), t(17)=2.10, p=0.025.

CONCLUSIONS: Overall, the average MVPA minutes per day among Chinese school-aged children is low, and families may be considered in the development of PA interventions and policies.

Latina caregivers of children with developmental disabilities (DD) have more chronic health conditions and poorer health compared to both White and Latina caregivers of children without DD. It has been well documented that Latina women, in general, report less than recommended levels of physical activity (PA). A challenge of Latina caregivers is that they focus on caring for the family and the child with DD and take less time to care for themselves which contributes to the low levels of leisure-time PA and exacerbates already existing health disparities in this population. PURPOSE: To describe PA levels of Latina caregivers of children with DD and identify if one educational session led to changes in PA. METHODS: An 8-week caregiver intervention pilot was conducted with 24 caregivers of children with DD. Promotoras de Salud, community health worker (CHW) provided health education. Participants met with CHW in two-hour home visit sessions once a week. One entire session was dedicated to PA, which included the importance and benefits of PA, incorporating PA in everyday routines, and a stretching exercise activity. Participants had a wrist-worn ActiGraph GT3X+ accelerometer for 7 days at baseline and 8 weeks. RESULTS: This analysis included accelerometer data from baseline and post-test of 18 caregivers, M±sd=44±2, all foreign born. The majority of this sample was highly active with a range of 7132 to 19620 steps/day at baseline and 72% and 67% of the participants exceeding 10,000 steps/day at baseline and at post-test, respectively. Participant’s average step count significantly decreased at post-test (M=11092, SD=2705) from baseline (M=12055, SD=3247), t(17)=2.10, p=0.025. CONCLUSIONS: The present study suggests that Latina caregivers of children with DD are physically active. However, we were not able to identify whether this activity was from leisure-time, occupational or caregiving as we were only able to report on step count from wrist-worn accelerometer data. The program was designed to promote and sustain positive health behaviors, and one 2-hour educational session was not enough to promote PA. PA Interventions for Latina caregivers of children with DD should promote leisure-time PA to address the health disparities in this population.

Supported by Midwest Roybal Center P30 AG028849

Purpose: Evaluate Bright I Bodies (BiB) intervention for sedentary adolescents with type 1 diabetes (T1D) for safety and health outcomes. Methods: Eighteen sedentary adolescents with T1D (age 13.7±2.3y, female 67%, Black/Latino 67%, BMI 88±12%'ile, annual income 33% <$20k, 55% <$40k, A1c 9.5±2.3%, 79.9±25.1 mmol·mol−1) participated in group exercise classes (35min @ 60-80%HRmax) for 12wk. Anthropometrics, glycemic control, brachial blood pressure, fasting lipids, and cardiopulmonary fitness (15 Progressive Aerobic Cardiovascular Endurance Run modified to slower starting speed, MPACER) were compared at baseline and 12wk using repeated measures ANCOVA for intent-to-treat (n=18) and per protocol completers (attended ≥8 sessions, n=10). Results: Blood glucose (BG) dropped from 12.16±4.35 mmol·L−1 at start of exercise to 9.16±2.94 mmol·L−1 at completion (p<0.01). Hypoglycemia (BG<3.89 mmol·L−1) with signs and/or symptoms occurred once (0.6%). Average of 8.61±1.26 carbohydrates were required before, during, and/or after exercise. In the total sample (n=18) there were no changes in cardiopulmonary fitness, body fat, waist circumference, mean arterial pressure, or lipid profile (p>0.05). In the 10 completers, cardiopulmonary fitness improved (30.1±17.3s×37.1±20.8 MPACER shuttles, p<0.04), LDI increased but within normal ranges (2.23±0.54s vs 2.52±0.59 mmol·L−1, p<0.02), and all other variables were unchanged (p>0.05). Conclusion: BiB was safe for sedentary adolescents with T1D and improved cardiopulmonary fitness among competent exercisers. Exercise sessions decreased BG into A1D target range (3.9-10.0 mmol·L−1) with low risk of hypoglycemia and minimal need for supplemental carbohydrates (~35 kcas per 35min exercise session). However, overall glycemic control remained poor and BMI overweight, suggesting this at-risk population needs more intensive interventions. Support: NIH-T32DK097718, Friends of Yale New Haven Children’s Hospital, Yale School of Nursing Biomedical Research Lab, NEACSM Young Investigator Award, NIH-UL1TR000142

Purpose: Disparities in physical activity (PA) participation remain a public health concern with higher rates of inactivity reported in ethnic minority and low-income populations. METHODS: Adolescent girls (N=42; 18 overweight or obese girls (OW/OB; >85th percentile); M±sd=11.7±1.1) attended one (weeks 5) camp intentional in need-supportiveness and completed follow-up 12 weeks post-camp. Objective PA was measured via accelerometer. Self-determined PA motivation was assessed using Behavioral Regulations in Exercise Questionnaire-3. RESULTS: At baseline, compared to OW/OB, healthy weight girls (HW): a) were similar in PA motivation (18.66±5.32, 19.88±3.59; p>0.05), b) took more steps/day (12,172±2,103 vs. 7,442±3,737; p<0.05), and c) engaged in greater moderate-to-vigorous intensity PA (MVPA) (291.7±46.4 vs. 185.4±90.8, p<0.05). In PA motivation, the repeated measures analysis of variance results showed a significant within-subjects effect (F[1,38]=6.83, p<0.01, η2=0.29). The within-subjects contrast analyses indicated a linear and a positive growth pattern for OW/OB but a quadratic inverted U-shape for HW. Similarly, the analysis of covariance determined that the camp had a significant between-group effect on PA (steps: F[1,19]=15.85, p<0.01; η2=0.46; MVPA: F[1,19]=21.63, p<0.01; η2=0.52) compared to OW/OB increasing their PA whereas HW PA remained stable. CONCLUSIONS: These findings suggest that the psychological need-supportive summer camp may be more effective in improving and sustaining PA motivation and behavior in OW/OB compared to their healthy weight counterparts.
youth. When implemented effectively, classroom-based PA interventions may help to reduce these disparities by providing structured PA at school. The purpose of this study was to evaluate the variability in implementation of interventions. "Height-Enhanced Sitting with Activity (HiPACT), a classroom-based PA intervention, in three economically and racially diverse schools in Southeast Michigan. METHODS: Three elementary schools in Michigan, one suburban (school 1: 90% white; 25% on free/reduced lunch), one rural (school 2: 90% white; 50% on free/reduced lunch) and one urban (school 3: 59% black; 74% on free/reduced lunch) participated. Prior to the start of the intervention, teachers were trained to incorporate 10, 3-minute moderate-to vigorous physical activity (MVPA) breaks in their classrooms each day. Throughout the intervention, teachers completed surveys to document the number of MVPA breaks completed per day. Direct observation was also used to assess intervention fidelity. RESULTS: There was a significant difference in the number of MVPA breaks completed in the classroom per week by school (school 1: 82±11 min; school 2: 98±11 min; school 3: 50±13 min, p<0.04). There was also a significant difference in the percent of students who engaged in MVPA by school (school 1, 92±0.03%; school 2, 84±0.03%; school 3, 77±0.05%, p=0.02). There was a trend towards a significant difference in the number of activity breaks implemented per day (school 1: 5 breaks; school 2: 6 breaks; school 3: 3 activity breaks; p=0.06). CONCLUSIONS: Implementation of the HiPACT intervention varied based on school with school 1, the low-income, ethnically diverse school accumulating significantly fewer minutes of MVPA in the classroom compared to the higher-income, predominantly white schools. Although this intervention was successful in two of our three target schools, tailored intervention strategies are needed to improve implementation in low-income schools to better address disparities in physical activity participation.

### Board #113

**June 1 2:00 PM - 3:30 PM**

**Effect Of School-based Physical Activity Programs On Hamstring Flexibility: A Meta-analysis**

Sonia Montero-Bricheco, Isaura M. Castillo-Hernández. 
University of Costa Rica, San José, Costa Rica. (Sponsor: Ellen M. Evans, FACSM)

**PURPOSE:** Flexibility is an often neglected but very important physical fitness component that is gaining attention regarding its role in correct posture and the incidence of chronic injuries, especially among children and adolescents. The aim of the study was to examine the chronic effect of school-based physical activity (PA) programs on hamstring flexibility (HFlex) and to evaluate potential moderators of this effect using a meta-analysis approach.

**METHODS:** A computerized literature search was conducted based on five databases: SPORTDiscus, Google Scholar, PubMed, DIALnet Plus, and MEDLINE. Studies needed to meet the following inclusion criteria to be included in the meta-analysis: 1) a randomized controlled trial design, 2) PA program took place in a school setting 3) published in English or Spanish, and 4) reported descriptive statistics that permitted effect size (ES) calculation. We identified random-effects models with a within-group design used to calculate the ES. The moderator effects were analyzed either by one-way analysis of variance of independent groups or by Pearson product-moment correlation coefficients, depending on the variable considered.

**RESULTS:** From 2006 articles, 13 studies representing 18 ES’s and totaling 792 participants (males and females, 10.3 ± 0.5 y) were included in the analysis. The mean quality score for the studies was 3.4 ± 0.7 (on a scale from 1 to 5). A moderate overall ES of 0.38 (p ≤ 0.001; CI = 0.22 to 0.87; z=4.58; Q=13.38; I²=92.48%) was found suggesting a low-moderate effect of the school-based PA programs on enhancement HFlex. Neither a quality of the studies (r = -0.16, p = 0.52), nor c) minutes per session (r = -0.03, p = 0.93) were significant moderators. Sex could not be included as a moderator because 78% of the studies did not report the effect on HFlex separately by sex. No bias was found according to Egger’s regression analysis (p=0.80).

**CONCLUSION:** School-based PA programs have a significant positive overall effect on children and adolescents’ HFlex compared with their control peers. Reporting the effect differentiated by gender and including detailed group demographic data (i.e., experimental and control) is recommended for individual studies.

**KEYWORDS:** hamstring flexibility, school-based physical activity

### Board #115

**June 1 2:00 PM - 3:30 PM**

**Standing Desk Intervention In Elementary School Children: Effects On Physical Activity And Sedentary Behavior**


**PURPOSE:** To provide a better understanding of and examine the effectiveness of interventions to increase physical activity (PA) in children and youths from low-income families and ethnic minorities (LIEM) through a meta-analysis. **METHODS:** We identified relevant studies through August 2017 from PubMed, Medline, CINAHL Plus, SPORTDiscuss, ERIC, PsychINFO, Scopus, ProQuest, and The Physical Activity Index. The main outcomes were the general PA levels and moderate-to-vigorous-intensity of PA. Inclusion criteria applied were: (a) necessary statistics to compute effect sizes (ES); (b) PA intervention studies; (c) LIEM participants aged 3-12 years; and (d) full-text articles written in English and published in peer-reviewed journals. A random-effects model was used to estimate the ES. Furthermore, moderator analysis was conducted using five moderators: (1) intervention duration <13, 13-47, or >47 weeks; (2) participant age (<10, 10-12, or >12 years); (3) intervention delivery (teacher, parents, teacher and parents, or specialists), (4) technology (used or not used); and (5) behavioral modifications (not used or used). The ES were calculated using the Comprehensive Meta-Analysis 3.0. The ES were computed using Hedges g with 95% CI, and the group difference was examined using the Q-statistic. **RESULTS:** The results indicate that there were small to medium effects of PA interventions on PA (Overall ES = .325, 95% CI = .088, .561). Moderator analysis did not identify any significant differences across groups. However, ES for groups with less than 13 weeks (ES = .527, 95% CI = .163, .891, p = .005), participants aged 10-12 (ES = .540, 95% CI = .185, .895, p = .003), interventions delivered by specialist (ES = .535, 95% CI = .104, .966, p = .015), interventions without technology (ES = .367, 95% CI = -.099, .504, 95% CI = .007), and interventions with behavioral modification (ES = .304, 95% CI = -.046, .592, p = .022) were significantly different from zero. **CONCLUSION:** The results from this study indicate that interventions targeting increase in PA in LIEM children and youths were somewhat successful with small to medium effects.

### Board #116

**June 1 2:00 PM - 3:30 PM**

**Impact Of Coordinated-bilateral Physical Activity Activities On Attention And Concentration In School-aged Children**

Weiyun Chen, Heidi Harris. University of Michigan, Ann Arbor, MI.

**PURPOSE:** This study examined the effects of a 4-week, daily 6-minute coordinated-bilateral physical activity (CBPA) breaks in classroom attention and concentration in school-aged children. **METHODS:** 116 fifth graders from two elementary schools were assigned to three groups: two intervention groups (n = 60) and one control group (n = 56). Three groups were pre- and post-tested with the d2 Test of Attention, a cancellation test that measures students’ performance in attention and concentration.
One intervention group (n = 31) participated in six minutes of daily coordinated-bilateral physical activity (CBPA) classroom break for four weeks. Another intervention group (n = 29), the Fithit Only (Fithit-O), wore Fithit per day. Five school days per week for four weeks without CBPA breaks. Processing Speed, Focused Attention, Concentration Performance, Attention Span, and Accuracy were used as parameters of attention performance for data analysis. The d2 Test had high test-retest reliability coefficients for all parameters, ranging from 0.95 to 0.98. A 2 x 3 ANOVA repeated measures analysis were conducted, followed by the post hoc comparisons. RESULTS: The repeated measure ANOVA revealed a significant interaction between time x treatment in processing speed (F1,23 = 3.37, p = 0.038, 0.058), focused attention (F2,23 = 4.37, p = 0.015, 0.074), concentration performance (F1,23 = 13.53, p = 0.001, 0.197), and attention span (F1,23 = 8.04, p = 0.011, 0.128) but not in accuracy. Subsequently, the post hoc comparisons indicated that the CBPA group showed significant increases in processing speed (p = 0.001), focused attention (p = 0.018), and concentration performance (p = 0.002), and attention span (p = 0.149, p = 0.000) over the control, but not in accuracy. The CBPA group also showed significant improvement in concentration performance (F1,23 = 24.162, p = 0.000) and attention span (F1,23 = 8.931, p = 0.011), compared to the Fithit-O. No significant changes in all five attention parameters were found between the Fithit-O and the control.

CONCLUSIONS: Engaging students in daily, highly-focused, coordinated-bilateral activities is an effective strategy to improve attention and concentration in school-aged children.

2835 Board #118 June 1 2:00 PM - 3:30 PM Evaluation of Physical Activity and Flexibility Metrics in Children with Congenital Heart Diseases or Obesity Attending a Golf Camp

Christopher Kist, Amanda Gier, Nicole Weisner, Seth Gray, Bob Siegel, Clifford Chin. Cincinnati Children’s Hospital, Cincinnati, OH.

(No relevant relationships reported)

PURPOSE: The purpose of this study is to evaluate the effects of a 5-week summer golf camp on cardiovascular fitness and flexibility in youth with obesity or congenital heart disease.

METHODS: Twenty-six youth, ages 8 to 13, were recruited for the First Tee golf camp sponsored by the Children’s Heart Association. Twelve patients had congenital heart disease and 14 patients were obese. The camp consisted of a 3-day SCRATCH golf training program followed by 5 weeks of golf sessions. Golf sessions were 90 minutes long, offered twice weekly, for a total of 13 sessions. Informed consent/assent was obtained for all participants. Pre and post-camp flexibility measurements were assessed via the back saver sit-and-reach test. Subjects completed the PACER test to assess aerobic capacity before and after the completion of camp.

RESULTS: Mean age of participants was 11 years old. Pre and post-test data from the PACER test was obtained from 22 (85%) participants (14 boys, 8 girls). There were significant improvements in PACER scores from baseline (p < 0.0001). 21 (95%) participants improved PACER scores by the conclusion of camp. PRE PACER lap score was (10.0 ± 5.6). POST PACER lap score was (13.3 ± 7.0). Pre and post-test sit and reach data was obtained from 25 of the 26 (96%) camp participants (17 boys, 8 girls). There were significant improvements in right and left leg sit and reach scores for both girls and boys (right side, p < 0.0001; left side, p < 0.0001). Right side PRE sit and reach was (9.7 ± 2.3) compared to POST (11.3 ± 2.1). Left side PRE sit and reach was (9.5 ± 2.9) compared to POST (11.4 ± 2.4).

CONCLUSIONS: Youth with congenital heart disease and/or obesity show significant improvements in flexibility and cardiorespiratory fitness after attending golf camp. Camp appears to offer health benefits in addition to learning about golf and may promote children to be outside and active. There is limited research on the effects of participating in a golf camp in pediatric congenital heart disease and obese populations; further studies may identify additional health benefits.

2836 Board #119 June 1 2:00 PM - 3:30 PM The Association Of Blood Lipids With Selected Other CVD Risk Factors In Michigan Adolescents

Ashlyn Jendro1, Breanne R. Carlson2, Erich J. Petushek1, Karin A. Piffer1, FACSM1, Joseph J. Carlson2,3. 1Northern Michigan University, Marquette, MI. 2Michigan State University Extension, East Lansing, MI. 3Michigan State University, East Lansing, MI. (Sponsor: Karin Piffer, FACSM)

(No relevant relationships reported)

Cardiovascular disease (CVD) is the leading cause of death in adults in the United States. A concern in U.S. children is the increasing rates of CVD risk factors (obesity, dyslipidemia and low cardiorespiratory fitness) which tend to track into adulthood and are related to premature morbidity and mortality. Specifically, high levels of low-density lipoprotein (LDL), total cholesterol and blood pressure, alongside low levels of high-density lipoprotein (HDL) and cardiorespiratory fitness, have been identified as risk factors for CVD. PURPOSE: To identify the association of several CVD risk factors from a pediatric population participating in (S)Partners for Health. METHODS: This cross-sectional study included 248 (151 female, 97 male), 9-13 year old students in 2008-2013, from Michigan, who participated in baseline measures for the (S)Partners for Health. Pearson correlations were used to evaluate if LDL, HDL or total cholesterol were directly associated with body weight, percent body fat, waist circumference, body mass index (BMI), mean arterial pressure (MAP) and aerobic performance (20-meter PACER scores). RESULTS: There were significant, but weak, correlations among HDL, LDL, total cholesterol and body weight, body fat, waist circumference and BMI (Table 1). CONCLUSION: The weak associations between lipid indicators and CVD risk factors measured in (S)Partners for Health align with previous research. Future studies should investigate the modifiability of these variables and use factor analytic or profiling methods to address the various measurement properties for this extensive CVD risk assessment battery to improve efficiency.

| Table 1: Correlation of lipid indicators and other CVD risk factors |
|----------------------|----------------------|----------------------|----------------------|
| LDL                 | HDL                 | Chol.               |
| Body Weight         | -0.268**            | 0.265**             | 0.019**             |
| Body Fat            | -0.292**            | 0.241**             | -0.096**            |
| Waist Circumference | -0.264**            | 0.286**             | -0.132*             |
| BMI                 | -0.239**            | 0.334**             | 0.219**             |
| 20-meter Pacer Score| 0.107               | -0.151*             | 0.232**             |
| MAP                 | -0.032              | 0.232**             | 0.232**             |

**p < 0.01; * p < 0.05

2837 Board #120 June 1 2:00 PM - 3:30 PM Changes in Physical Activity Enjoyment following HIIT Training in Adolescents

Elizabeth K. Bailey, Christine Tassitino, Lexi Byrd, Brianna Marino, Taylor McMaster, Bre’anna Warren, Megan Farrell, Stephen P. Bailey, FACSM. Elon University, Elon, NC. (Sponsor: Stephen P. Bailey, FACSM)

(No relevant relationships reported)

Pleasurable experiences with exercise appear to be important in the development of positive lifelong physical activity habits in adolescents. High-intensity interval training (HIIT) has been described as being a more pleasurable experience than traditional exercise training. PURPOSE: The purpose of this investigation was to describe the impact of HIIT training on enjoyment of physical activity, cardiovascular fitness,
and body composition in male and female adolescents. METHODS: Thirty-six (6
male, 7 female, Age=12.8±0.7 years) adolescents completed an 8 week HIIT training
program. HIIT training consisted of two 30 minute sessions a week (5 min warm up,
20 minute stimulus, 5 min cool down). During the stimulus period, subjects completed
twenty 30 sec “on”, 30 sec “off” intervals. The initial “on” workload was set to be
equivalent to 90% of maximal workload recorded during the VO2 max test, while the “off”
workload was set to be equivalent to 50% of maximal workload. Intensities were
adjusted during each session so that during the last 5 intervals was equivalent to
at least 9 out of 10 on the Borg RPE scale. Enjoyment of physical activity (Physical
Activity Enjoyment Scale, PACES), VO2 max and body composition were assessed before
and after the training program. RESULTS: Response to the PACES improved
23% following HIIT training (Pre=52.2±3.4, Post=64.3±3.0; p=0.01). Similarly, VO2 max
(18%) (Pre=26.7±2.0 ml kg-1 min-1, Post=31.6±2.7 ml kg-1 min-1; p=0.002) and maximal
workload (56%) (Pre=153.6±4.6, Post=228.1±14.4; p=0.001) increased as a result of HIIT.
CONCLUSION: The results of this investigation indicate that HIIT training elicits a more positive perception of exercise and beneficial adaptations in cardiovascular fitness and body composition. HIIT training appears to be a good option to develop positive lifelong physical activity habits in adolescents.

**2838 Board #121 June 1 2:00 PM - 3:30 PM**

**Effects Of A Weight Bearing Exercise Program On Bone Mineral Density Of Adolescent Female Athletes**

Kayla Daniel1, Kelsey Conrad1, Jaqueline Buell1, Julie Young1, Lihong Huang1, Anastasia Fischer, FACSM2. 1 Nationwide Children’s Hospital, Columbus, OH. 2 Ohio State University, Columbus, OH. (Sponsor: Anastasia Fischer, FACSM) (No relevant relationships reported)

**PURPOSE:** Bone Mineral Density (BMD) is a modifiable target of the Female Athlete Triad for intervention. Low BMD can be screened, prevented, and treated. In female adolescents, low BMD is associated with increased risk of fracture and development of osteoporosis. Weight bearing exercise interventions are known to provide health-related benefits in children. The purpose of this study was to evaluate for a change in BMD in female adolescent athletes after a weight bearing exercise program designed to optimize BMD and bone architecture.

**METHODS:** A convenience sample of 19 female high school athletes completed a Dual Energy X-Ray Absorptiometry (DEXA) scan and resting metabolic rate (RMR) as well as eating and activity questionnaires. Girls participated in a one hour program designed to improve BMD twice per week completing 16 sessions in 8-12 weeks. Following the program, girls completed a second DEXA scan. 12 months after the program, girls completed a third DEXA scan. Total Body Less Head (TBLH), lumbar spine, and Total Fat Free Mass (TFFM) were recorded. Energy availability (EA) was calculated using estimated energy intake from eating questionnaire and energy needs were estimated using the activity questionnaire added to their RMR. Girls were diagnosed with decreased EA if they consumed <396 kcal/FFM per day. Repeated measures ANOVAs were run to examine differences between BMD between three time points.

**RESULTS:** Average age at the beginning of the study was 16.3±1.19. Fourteen girls were tested immediately after the exercise program and 8 one year after the program. There were differences in RPE during both spine or TFFM (p=0.22, p=0.23, p=0.29 respectively) over the program. Girls with decreased EA did not accrue BMD significantly differently than those with adequate EA.

**CONCLUSIONS:** BMD did not increase following a weight bearing exercise program in adolescent female athletes. EA did not affect accrual of BMD during this short time period in this research cohort.

**2839 Board #122 June 1 2:00 PM - 3:30 PM**

**Physical Activity Enjoyment in Different Physical Activities in Parent-Child Dyads When They Exercise Together**

Noelle Merchant1, Patrick Filanowski1, Ronald J. Iannotti2, Sarah M. Camhi1, Jessica A. Whiteley1, Laurie Milliken, FACSM1, 1 University of Massachusetts Boston, Boston, MA. 2 CDM Group, Inc., Bethesda, MD. (Sponsor: Laurie Milliken, FACSM) (No relevant relationships reported)

**PURPOSE:** To objectively measure and compare the intensity of 5 physical activities completed by parent-child dyads.

**METHODS:** Thirteen parent-child dyads (parents mean age = 37.1 ± 7.5 yrs, children mean age = 6.6 ± 1.8 yrs) participated in physical activity (PA) sessions. Each parent-child dyad completed 5 different PAs in random order [brisk walking (BRISK), jumping games (JG), dancing (D), body-weight exercises (BWE), and tag games (TG)] together for 8 minutes each. Minutes of PA for each participant was measured using Actigraph GTX4 accelerometers worn at right hip. Time spent in moderate (%MPA) and vigorous (%VPA) PA were estimated using validated cut points for appropriate age ranges.

Independent t-tests were used to compare PA between P and C. A repeated measures ANOVA was used to compare PA across 5 different PAs, separately for P and C. Alpha was set at p = 0.05.

**RESULTS:** [P versus C]: C had more %VPA than P during BRISK (mean difference: 15.8 ± 23.1, JG (21.2 ± 0.1), D (16.2 ± 12.0), and TG (24.7 ± 7.6). P had more %MPA than C during BRISK (mean difference: 22.2 ± 4.9), JG (10.8 ± 3.1), and TG (12.3 ± 0.5). [Brisk walking]: BRISK (68.1 ± 18.8) resulted in more time spent in %MPA for P when compared to C (28.2 ± 5.6), BWE (31.0 ± 1.8), D (39.7 ± 19.3), and TG (41.7 ± 10.3). C had more %MPA during BRISK (45.9 ± 23.7) than JG (17.4 ± 6.5). [Jumping games]: P had more %VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 0.0), BWE (13.3 ± 6.3), and TG (4.5 ± 5.3). C had more %VPA during JG (50.6 ± 9.5) than BRISK (15.8 ± 23.1), BWE (30.9 ± 12.6), D (21.5 ± 16.6), and TG (29.2 ± 12.9). [Body-weight exercises]: P had more %VPA during BWE (13.3 ± 6.3) when compared to BRISK (00.0 ± 0.0), BWE (31.0 ± 12.6), D (21.5 ± 16.6), and TG (29.2 ± 12.9). [Tag games]: P had more %MPA during TG (41.7 ± 10.3) when compared to JG (28.2 ± 9.6) and BWE (31.0 ± 8.8). C had more %MPA during TG (29.4 ± 9.8) than JG (17.4 ± 6.5). p<0.05 for all comparisons mentioned.

**CONCLUSIONS:** C spent significantly more time in VPA during all 5 PAs when compared to P. However, P spent significantly more time in MPA during BRISK, JG, and TG than C. For both P and C, JG had the most VPA when compared to the other PAs. These findings can be used to plan future PA interventions for P and C exercising together.

**2840 Board #123 June 1 2:00 PM - 3:30 PM**

**The Contribution Of A Community-Based Gym And Aquatics Program To Physical Activity In Children**

Mark R. Scudder, Neel P. Sharma, Sharon E. Ta文ero Ross, John M. Jakicic, FACSM. University of Pittsburgh, Pittsburgh, PA. (No relevant relationships reported)

**PURPOSE:** To compare physical activity in children accumulated from gym and aquatic instruction during a 2-hour community-based physical activity program. METHODS: The community-based program consisted of a summer weekday program and a fall Saturday program, with each program including both a gym and aquatics component. Each program served approximately 60-85 boys and girls 3-13 years of age. Observations were conducted over 10-12 sessions for each program to quantify the amount of physical activity engagement. Observations included use of the System for Observing Fitness Instruction Time (SOFIT) to quantify children’s physical activity (e.g., sedentary vs. ‘very active’) and the context of the program (e.g., skill practice vs. free play). SOFIT observations were made by two trained observers, and the inter-rater reliability was greater than 90%. Physical activity and context variables were subjected to linear mixed model analyses, with type of instruction entered as a fixed factor, and multiple observations of the same age or skill group entered as a repeated factor.

**RESULTS:** Gym and aquatic instruction each contributed approximately 25 min of moderate-to-vigorous physical activity, with the proportion of time spent in moderate- to-vigorous physical activity not statistically different during aquatic vs. gym sessions (53.4% vs. 49.0%, p = 0.09). Compared to the gym session, however, the aquatic session resulted in less time sitting (4.8% vs. 17.2%) and more time ‘very active’ (25.1% vs. 13.9%, p<0.001), as well as higher estimated energy expenditure (0.087 vs. 0.079 kcal/kg/min, p<0.001). Compared with the gym, children spent less time in management contexts (i.e., breaks and transitions; 15.9% vs. 30.2%, p<0.001) and more time in free play (10.7% vs. 0.7%, p<0.001) during the aquatic sessions. CONCLUSIONS: The results suggest that these types of programs can be effective at engaging children in physical activity during out-of-school time, with the data from the aquatic sessions of particular interest. Additional research is needed to examine whether these results are consistent across different community-based programs and with varying skill level of program instructors, and whether the physical activity achieved with these programs provides health-related benefits in children.”
participants’ enjoyment of each PA during the PA sessions. Each parent child dyad completed 5 different PA’s together (brisk walking, jumping games, dancing, body-weight exercises, and tag games) in random order for 8 minutes each. Immediately after completion of each of the 5 PA’s, research assistants provided the VAS to the parent and child, independently, and asked them to indicate their enjoyment rating of the preceding PA. A Mann-Whitney U test was used to compare enjoyment of the 5 different PA’s between parents and children, with a significance level set at p < 0.05. Friedman tests were used to compare the differences in enjoyment of the activities separately for parents and children. Post hoc analyses with Wilcoxon signed-rank tests were conducted with Bonferroni corrections applied, resulting in a significance level set at p < 0.0125 to compensate for multiple comparisons.

RESULTS: Parent’s enjoyment was significantly higher for dancing compared to children’s (parents mean = 3.22 ± 0.78, children’s mean = 3.01 ± 0.82, U = 34, 5, p = 0.007). When comparing PA’s performed by parents, parents enjoyed tag games (mean = 3.13 ± 0.48) significantly more than brisk walking (mean = 2.38 ± 1.21, Z = -2.547, p = 0.011) and body-weight exercises (mean = 2.77 ± 1.36, Z = -2.859, p = 0.004). When comparing activities performed by children, children enjoyed tag games (mean = 1.23 ± 0.59) significantly more than dancing (mean = 3.00 ± 0.58, Z = -2.825, p = 0.005).

CONCLUSION: Both parents and children enjoyed tag games the most, when compared to the other 5 PA’s. These results could aid future PA programming and interventions when recommending activities for families to complete together. Future studies should investigate if varying enjoyment levels of parent-child dyads could impact the likelihood that they would exercise together where enjoyment levels are not matched.

2842 Board #125 June 1 2:00 PM - 3:30 PM Effects Of An Educational, Nutritional And Recreational Camp Intervention On Health Parameters In Overweight Children Carmen Silvia Grubert Campbell1, Suliane Beatriz Rauber2, Henrique Lima Ribeiro1, Isabella Reis Praça1, Joyce Bonfim Vicente1, Geiziane Melo1, Zelia Vargas dos Reis1, Valeria Pedrosa1, Pablo Cidelino1, Daniel Fernandes Barbosa1, Eric Vale1, Alison Luiz Aquino da Silva1, Herbert Gustavo Simões2, 1Catholic University of Brasilia, Taguatinga, Brazil. 2Catholic University of Brasilia, Asugas Claras, Brazil.

PURPOSE: To investigate the impact of a Health Educational Program for Children (HEP)child composed by 5 days of Camp Kids (KIDS) and 12-weeks of follow-up (FOU) on the Physical Activity Level (PAL), Sedentary Behavior (SB), Anthropometric data and Food Intake (FI) in overweight children. METHODS: Twelve children attended the HEPchild program which consisted of pre assessments, KIDS and 12 weeks of FOU. The PAL, SB and FI were assessed throughout questionnaires. RESULTS: The anthropometric were reduced (p<0.05) after KIDS which was maintained after 12 weeks of FOU. After the FOU, children increased (p<0.05) their mean level of physical activity by 344 METs/week. In addition 25% of the children became more active (>1500 and <3000METs/week) after FOU in comparison to pre KIDS. The SB showed a significant reduction in 17.14 and 41.43 minutes along the weekdays and the weekends respectively. Before KIDS, the consumption of sugars and candies were out of control (100% inadequate), and, after the intervention, 58.4% started to consume these foods in a balanced way. In addition, the body fat, triceptal and subcapular skinfolds, waist circumference and waist-to-height ratio decreased significantly after KIDS and the results maintained after FOU in comparison to pre KIDS. In addition, it was observed a significant reduction in body fat, tripeps and subcapular skinfolds, waist circumference and waist-to-height ratio after KIDS which was maintained after FOU in comparison to pre KIDS. CONCLUSION: The HEPchild (5-days KIDS camp + 12 weeks of FOU) contributed to increase the PAL and to reduce the SB and anthropometric data in overweight children. Financial Support: CNpq, CAPES and FAP-DF.

2844 Board #127 June 1 2:00 PM - 3:30 PM Are Graded Task-based Interventions The New Remedy For Unfit Overweight And Obese Female Adolescents? Emmanuel Bonney, Gillian Ferguson, Bouwien Smits-Engelsman. University of Cape Town, Cape Town, South Africa. (No relevant relationships reported)

PURPOSE: To determine the efficacy of two graded task-based interventions in improving neuromotor fitness among adolescent girls.

METHODS: Fifty-six female adolescents (14.4±0.9years) classified as overweight or obesity participated in the study. Participants were randomly allocated to receive either the graded Wii exercises or task-based functional exercise and attended weekly 45min exercise sessions for 14 weeks. During the training period, the participants received supervised exercise training that was systematically graded with simple objects such as sandbags and plastic bottles over 14 sessions. Outcome measures included motor competence, lower extremity muscular strength (both isometric and functional strength), aerobic and anaerobic fitness. Data on enjoyment and ratings of perceived exertion were collected for each session. A repeated measure ANOVA was used to analyse the data with significance level set apriori at p<0.05.

RESULTS: At the end of the intervention, it was observed that both groups had significant improvement in motor competence [F(1.54)=4.045, p=0.037], lower extremity muscular strength (isometric strength) [F(1,54)=592.470, p=0.001], lower extremity muscular strength (functional strength) [F(1,54)=15.993, p=0.001, aerobic [F(1,54)=2.568, p=0.022] and anaerobic fitness [F(1,54)=45.792, p=0.001]. Though the two interventions were equally considered to be enjoyable by the participants, there was no difference in outcomes for the two groups.

CONCLUSIONS: The two graded task-based interventions may be useful for increasing neuromotor fitness in this population. People working with girls in this age group could implement either of the two depending available resources. We recommend the adoption of these interventions for physical education and/or fitness promotion programmes among girls in low income settings.

Promotion of physical activity and fitness in adolescent girls who are physically unfit and have less opportunity to practice remains a challenge, particularly in low income communities. It is therefore critical to identify new methods for increasing fitness in this population.

CONCLUSION: The two graded task-based interventions may be useful for increasing neuromotor fitness among adolescent girls.

METHODS: Fifty-six female adolescents (14.4±0.9years) classified as overweight or obesity participated in the study. Participants were randomly allocated to receive either the graded Wii exercises or task-based functional exercise and attended weekly 45min exercise sessions for 14 weeks. During the training period, the participants received supervised exercise training that was systematically graded with simple objects such as sandbags and plastic bottles over 14 sessions. Outcome measures included motor competence, lower extremity muscular strength (both isometric and functional strength), aerobic and anaerobic fitness. Data on enjoyment and ratings of perceived exertion were collected for each session. A repeated measure ANOVA was used to analyse the data with significance level set apriori at p<0.05.

RESULTS: At the end of the intervention, it was observed that both groups had significant improvement in motor competence [F(1.54)=4.045, p=0.037], lower extremity muscular strength (isometric strength) [F(1,54)=592.470, p=0.001], lower extremity muscular strength (functional strength) [F(1,54)=15.993, p=0.001, aerobic [F(1,54)=2.568, p=0.022] and anaerobic fitness [F(1,54)=45.792, p=0.001]. Though the two interventions were equally considered to be enjoyable by the participants, there was no difference in outcomes for the two groups.

CONCLUSIONS: The two graded task-based interventions may be useful for increasing neuromotor fitness in this population. People working with girls in this age group could implement either of the two depending available resources. We recommend the adoption of these interventions for physical education and/or fitness promotion programmes among girls in low income settings.

2843 Board #126 June 1 2:00 PM - 3:30 PM Six-month Sustained Improvement In Motor Proficiency In Youth After A 24-week Home-based Intervention Daniela A. Rubin, FACSM1, Kathleen S. Wilson1, Debra J. Rose1, Marilyn Dumont-Driscoll1, 1California State University Fullerton, Fullerton, CA. 2University of Florida Gainesville, Gainesville, FL. (No relevant relationships reported)

PURPOSE: Motor proficiency and physical activity (PA) levels are below average in youth with Prader-Willi syndrome (PWS), a rare neurodevelopmental disorder causing motor, behavioral, and medical challenges. This study aimed to determine if participation in a 24-week parent-led PA intervention led to sustained improvement in gross motor proficiency (MP) in youth with and without PWS.

METHODS: Participants included 107 age youth ages 8-16 with PWS or without PWS but categorized as obese, assigned to an intervention group or to a wait-list control group. After serving as controls, the wait-list group received the intervention. Follow-up assessments were then conducted six months post intervention. The home-based PA program included playground and interactive console games scheduled 4 days a week. Training and program materials were provided to families at baseline to guide implementation of the program. Gross MP (Bruininks-Oseretsky Test of Motor Proficiency body coordination and strength and agility subtests) was obtained at baseline (pre), after 24 weeks of participating in the intervention (post) and at 6-month FU.

RESULTS: All youth demonstrated improved upper-limb coordination, bilateral coordination, balance, running speed and agility, and muscular strength at post (p<0.04 for all). At FU all youth maintained improvements in bilateral coordination (pre=9.3±0.4, post=12.0±0.5, FU=11.6±0.5) and speed and agility (pre=9.2±0.4, post=10.8±0.5, FU=11.4±0.5), p<0.05. At FU all youth maintained improvements in upper-limb coordination (pre=10.7±0.5, post=12.2±0.6, FU=12.1±0.8) balance (pre=8.1±0.3, post=9.3±0.4, FU=9.2±0.5) and strength (pre=8.0±0.3, post=9.0±0.4, FU=9.0±0.5), but the FU scores for these tests showed a slight decrease such that they were no longer significantly different from baseline (p>0.05).

CONCLUSIONS: This parent-led game-based PA program resulted in immediate positive changes in gross MP in youth with and without PWS with improvements maintained for six months post intervention. Participation in a PA routine emphasizing motor skill development at home shows promise in leading to sustained improvements in MP in obese youth and in youth with PWS.

Funded by USAMRAA W81XWH-11-1-0765

Abstracts were prepared by the authors and printed as submitted.

FRIDAY, JUNE 1, 2018
Type II diabetes is a concern in the United States, and risk factors that contribute to this disease are largely mediated by lifestyle interventions. Identification of those at high risk for type II diabetes and implementation of risk reduction behaviors may prevent onset of the disease. PURPOSE: To investigate the effect education on the perceived risk of type II diabetes and intent to adopt healthier lifestyles in traditional-age college students. METHODS: 29 participants provided demographic information, physical activity level, anthropometric measures, and 4-day diet recalls, as well as completing the Risk Perception Survey-Developing Diabetes (RPS-DD), perceived risk of diabetes visual-analogue scale (PRD-VAS), and the diabetes risk calculator (DRC), with 17 of these participants also providing information on their intent to change fitness behaviors. RESULTS: RMANOVA assessed changes across time in the RPS-DD and PRD-VAS. Kendall’s tau-B correlations were conducted to examine relationships between the abovementioned variables. Data analysis showed six participants at high risk for prediabetes and 12 with at least one risk factor for metabolic syndrome. RPS-DD risk and PRD-DD knowledge scores did not change, but analysis of the PRD-VAS indicated a significant change across time (p < 0.01). The DRC did not correlate with prediabetes or metabolic syndrome. Significant interactions between prediabetes status and perceived risk (p = 0.04), but not between prediabetes risk and intent to adopt healthier lifestyle (p = 0.42) were shown, and between metabolic syndrome and prediabetes risk (p = 0.03), as well as criteria for both diseases, excluding Hba1c (p = 0.15). CONCLUSIONS: Students in this study possessed many risk factors for development of type II diabetes; however, those at high risk for such diseases demonstrated an understanding of their risk, but did not express an intent to modify their lifestyle behaviors. Further, the noninvasive prediabetes and diabetes risk calculator did not consistently identify these diseases in this population. Research should be dedicated to determining how to change perceived risk of developing type II diabetes, methods of promoting healthier lifestyles, and development of a validated noninvasive instrument for use among traditional-age college students.

Purpose: Sleep quality and physical activity (PA) participation are two crucial factors that help individuals maintain a healthy lifestyle. However, evidence regarding associations between sleep and PA in young adults remains unclear. The purpose of this study was to determine the relationships between Chinese college students’ objectively-measured daily PA and sleep. METHODS: A total of 220 college students (115 females; M_age = 20.29 ± 2.37) were recruited from a South Central Chinese University. Students’ PA-related Social Cognitive beliefs (i.e., self-efficacy, enjoyment, family support, friends support, and environment) were assessed using a validated questionnaire. One-week PA levels were recorded via ActiGraph Link accelerometers. Finally, body fat percentage and objective health status were evaluated using the InBody 230 Monitor whereas cardiovascular fitness was assessed via the 5-Minute Step Test. RESULTS: Correlation analyses indicated both self-efficacy and environment factors were significantly related to family friends’ support and enjoyment (r range: 0.11 - 0.48, p < 0.05), and that friends’ support were highly related to family support (p < 0.01). Interestingly, regression analyses revealed self-efficacy to negatively predict average MVPA per day (β = –0.21, p < 0.01) but, as expected, that a lower body fat percentage was predictive of improved objective health (β = 0.17, p < 0.05). Finally, significant sex differences were observed for average MVPA per day, F(1, 213) = 22.2, p < 0.01, ηp² = 0.09, PA self-efficacy (F(1, 217) = 6.5, p < 0.01, ηp² = 0.01), and PA enjoyment (F(1, 217) = 3.9, p < 0.05, ηp² = 0.02), whereas males demonstrated higher values for all three outcomes. No other sex differences were observed. CONCLUSIONS: Findings suggest that male and female Chinese college students differ with regard to MVPA per day in addition to PA-related self-efficacy and enjoyment. As self-efficacy and enjoyment are predictive of long-term PA participation, PA interventions among college students, particularly females, are needed targeting these Social Cognitive beliefs to improve various health outcomes such as body fat percentage and cardiovascular fitness.
PURPOSE: In previous studies, a variety of scales were used to evaluate physical activity intensity among children, such as the Children’s Effort Rating Table and OMNI Scale of Perceived Exertion scale. However, most of the Perceived Exertion Scales are only applicable to children over six years old. Therefore, it is necessary to design a Perceived Exertion Scale of Physical Activity Intensity for Chinese Preschool Children (PESPAI).

METHODS: The draft scale was designed according to the children’s Perceived Exertion Scales and the Observer Evaluation Scale of Physical Activity Intensity for Preschool Children of our previous research. A Zephyr monitor and an ActiGraph triaxial accelerometer were used to measure physical activity of 116 children. The children completed the PESPAI. The revision of the scale was based on the heart rate, Count value and children’s feedback. Finally, the reliability and validity of the final scale were analyzed by SPSS Statistics 13.0.

RESULTS: The PESPAI utilizes cartoon images for the items and contains 6 options. Each option includes a children’s cartoon image, a ribbon and description language. Some children questioned the image of gender and minority characteristics. Thus, the revision of the scale was based on that. There was very significant difference between each option index (P<.01). It is indicated that the PESPAI can reflect the changes of different activity intensity of preschool children. There was a strong correlation between the scale scores in the first test and second test (r=.842, P<.01), indicating that the scale has high reliability. The scale scores of preschool children had a moderate correlation with heart rate only during high intensity activity. It is indicated that the correlation between scale scores and objective indexes is related to the physical activity intensity. When all the data were analyzed, it was found that there was a strong correlation between the scale scores and heart rate (r=.604, P<.01), indicating that the scale has good validity.

CONCLUSIONS: The PESPAI utilizes cartoon images for the items and contains 6 options. The PESPAI has good reliability and validity, which indicates that the scale can be used to evaluate the preschool children’s physical activity intensity. The scale is more applicable to evaluate high intensity physical activity.

A Multi-Level Analysis of the Effects of Epoch Length on Children’s Physical Activity Pattern

Han Chen, Valdosta State University, Valdosta, GA.

PURPOSE: Most parents were Mexican (63%), stay-at-home caregivers (71%), completed high school or less (55%), and had low acculturation (86%). On average, children consumed 2.25± 1.44 servings/day of F/V, consumed 15.5± 2.6 kcal/day from sugary drinks, accumulated 12.9± 2.9 min/hr of total PA, watched 98.7± 74.2 min/day of screen time, and 46% were overweight or obese. Only 6% of children met the F/V recommendation, 54% met screen time recommendations, 27% met the IOM PA recommendations, and 58% met the sugary drinks guideline.

CONCLUSIONS: In this community sample of Latino preschool children, nearly half were overweight/obese and few were meeting recommendations from the 5-2-1-0 message; this suggests our sample is comparable or worse off than the general U.S. preschool population for these key behaviors. Efforts are needed to effectively intervene and improve 5-2-1-0 behaviors associated with excessive weight gain in Latino preschool children.
Traditional real-time direct observation (DO) systems have been used for decades to assess children’s free-living physical activity (PA). Using video-taped DO would overcome several methodological issues and allow for more precise assessments of behaviors. **PURPOSE:** To develop and test a novel video-based DO system for children’s free-play activity. **METHODS:** Following iterative DO system development (The Observer XT, Noldus), researchers coded videos for the main Whole-Body Movement and four modifiers: 1) Locomotion, 2) Limb Movement, 3) Activity Type, and 4) MO. For intra-rater reliability, percent agreement was calculated from six randomly selected videos, using duplicate entries by an expert coder one week apart. For inter-rater reliability, three videos were used to calculate percent agreement between entries from trained, novice coders (n=6) and the expert coder. To assess construct validity, time spent in activity intensity categories from expert-coded DO MET values were compared with accelerometer estimates using Wilcoxon Rank-Sum tests. **RESULTS:** Percent agreement for intra-rater reliability was above 80% except for Locomotion (47%); video 4, 26%; video 3) and Limb Movement, and MET value (19%, 78%, respectively; video 3). Across all variables, percent agreement for interrater reliability ranged widely from 12%-96%; 0-100%, and 36%-97% for videos 1, 2 and 3, respectively. Mean estimated time spent in PA intensity categories from AG-H overestimated sedentary (SED; p<.008), moderate (MPA; p<.001), and moderate-tovigorous PA (MVPA; p<.017) and underestimated light (LPA; p<.001). The AG-W underestimated SED (p<.05) and LPA (p<.001) but overestimated MPA (p<.001) and MVPA (p<.001). **CONCLUSIONS:** The current DO system is feasible for observing detailed changes in children’s free-play activity. However, refinement to the system must be made to improve reliability before it is adopted as a criterion measure for free-play activity in children. Supported by: University of Massachusetts Amherst Commonwealth Honors College.

**Associations Of Physical Activity And Screen Time With Obesity In Chinese Children And Adolescents**

Zheng Zhu1, Shengxia Ma1, Yang Bai1, Yan Tang1, Jie Zhuang1, Yang Liu1, Peijie Chen1, Zhen-Bo Cao2,3, Shanghai University of Sport, Shanghai, China. 2University of Vermont, Burlington, VT. (No relevant relationships reported)

**RESULTS**

Tenacity. Correlation and Regression models were assessed in version 20 of SPSS. Significant correlations were found between the response variable, GPA, and predictor variables of GRIT Score, students ages 17 and under, and occurrence of eating breakfast. GPA = 2.728 + (GRIT Score * .196) + (Age under 17 * .328) + (Breakfast of the time * .148) + (Breakfast most of the time * .148). No significant differences were found between physical activity and GPA. The statistical significance for GRIT score and eating breakfast all the time had a p value = 0.001, age 17 and under p-value = 0.01, and eating breakfast most of the time p-value = 0.009.

**PURPOSE:** To develop and test a novel video-based DO system for children’s free-play activity. **METHODS:** Following iterative DO system development (The Observer XT, Noldus), researchers coded videos for the main Whole-Body Movement and four modifiers: 1) Locomotion, 2) Limb Movement, 3) Activity Type, and 4) MO. For intra-rater reliability, percent agreement was calculated from six randomly selected videos, using duplicate entries by an expert coder one week apart. For inter-rater reliability, three videos were used to calculate percent agreement between entries from trained, novice coders (n=6) and the expert coder. To assess construct validity, time spent in activity intensity categories from expert-coded DO MET values were compared with accelerometer estimates using Wilcoxon Rank-Sum tests. **RESULTS:** Percent agreement for intra-rater reliability was above 80% except for Locomotion (47%); video 4, 26%; video 3) and Limb Movement, and MET value (19%, 78%, respectively; video 3). Across all variables, percent agreement for interrater reliability ranged widely from 12%-96%; 0-100%, and 36%-97% for videos 1, 2 and 3, respectively. Mean estimated time spent in PA intensity categories from AG-H overestimated sedentary (SED; p<.008), moderate (MPA; p<.001), and moderate-tovigorous PA (MVPA; p<.017) and underestimated light (LPA; p<.001). The AG-W underestimated SED (p<.05) and LPA (p<.001) but overestimated MPA (p<.001) and MVPA (p<.001). **CONCLUSIONS:** The current DO system is feasible for observing detailed changes in children’s free-play activity. However, refinement to the system must be made to improve reliability before it is adopted as a criterion measure for free-play activity in children. Supported by: University of Massachusetts Amherst Commonwealth Honors College.
CONCLUSIONS: This study found statistically significant correlations with GRIT score, age related GRIT score, and breakfast frequency. Results related to physical activity may be related to social desirability bias. Given that this study is the first description of nutrition and physical activity habits of this understudied population, it opens the door to further research in this highly-trained group of equestrian athletes.

Purpose: The purpose of this study was to identify student perceptions of interdisciplinary collaboration in healthcare professions before and after community health fair experiences. METHODS: Three community health fairs provided an intentional, foundational experience to support development as members of an interdisciplinary healthcare team. Students recognized the importance of interdisciplinary teamwork skills may need improvement.

Purpose: The efficacy of physical exercise prescription as therapy in breast cancer survivors is largely documented in literature. Unsupervised exercise produces short-term improvements in physical fitness of breast cancer survivors, but regarding the mid-term effectiveness only few studies are available. The purpose of this study was to assess the effects of an unsupervised exercise prescription program on body composition, physical fitness and Health Related Quality of Life of breast cancer survivors. Methods: Forty-two (average age 52.0±10.1 years) women were enrolled. Assessments performed at baseline and after 6 months of exercise prescription: - body composition (anthropometric parameters and bioimpedance analysis); - physical fitness: aerobic capacity by Six-Minute Walk Test (6 MWT), limbs strength by Hand Grip Test and Chair Stand Test, flexibility by Sit and Reach Test; TOGLIERE PRESSIONI - Health Related Quality of Life (SF-36). Statistical analysis was conducted by Student’s t-tests and multiple regression. Results: Body composition improvements: - BMI (T0=27.3±4.2; T5=26.1±3.9 kg/m²; p<0.001); - waist circumference (T0=90.2±10.8; T5=85.3±9.8 cm; p<0.001); - extracellular water (T0=17.5±1.9; T5=16.8±1.9 L; p<0.001); - fat mass (T0=25.0±8.1; T5=22.6±7.2 kg; p<0.001). Physical fitness improvements: - 6 MWT (T0=518.6±133.0; T5=584.8±197.2 m; p<0.001); - Hand Grip (T0=24.3±4.8; T5=26.5±4.5 kg; p<0.001); - Chair Test (T0=15.4±3.8; T5=18.3±4.3 repetitions; p<0.001); - Sit and Reach (T0=2.6±9.3; T5=8.5±7.1 cm; p<0.001). Health Related Quality of Life improvements: - Physical Functioning (T0=72.7±24.6; T5=83.7±17.1 L; p<0.001); - General Health (T0=64.7±20.4; T5=69.1±18.9%; p<0.001); - Social Functioning (T0=60.5±24.5; T5=67.6±22.9%; p<0.05); - Mental Health (T0=63.4±14.8; T5=67.3±12.5%; p<0.05). The percentage change in fat mass has been associated with adjuvant cancer therapy (intercept –0.016; b=8.629; p<0.05). Conclusions: An unsupervised exercise prescription program improves body composition, physical fitness and Health Related Quality of Life in breast cancer survivors. Longer term follow-up studies to establish the real capacity of this program to induce long-term changes in lifestyle are needed.

Purpose: Given there is little available research on equestrian athletes, and none about their interdisciplinary teamwork skills may need improvement.
 shoulder range of motion (SRM; measured by back scratch test); aerobic endurance (AE; 2-minute step test); and mobility and balance (MB; up and go test), were assessed at baseline and 12-month for cancer survival rates.

RESULTS: Dependent t-tests revealed no significant mean differences in TC, HDL, LDL, and CA from pre- to post-test (all p > 0.05). However, significantly change in BG was observed (p < 0.05, Cohen's d = 0.38) at 12-months. Moreover, functional fitness LBF (p = 0.05, Cohen's d = 0.55) and MB (p = 0.01, Cohen's d = 0.67) significantly improved after the intervention. Notably, patients' AE (M±SD = 92.26 ± 21.26) and CA (M±SD = 1.26 ± 1.26) demonstrated the greatest improvements among all outcomes.

CONCLUSIONS: A 12-month smart watch-based PA intervention may promote improved biomarkers and functional fitness among Chinese BCS. Such innovative PA intervention has important implications in promoting disease prevention and management in this population. Larger samples with randomized clinical trials are warranted.

2861 Board #144 June 1 2:00 PM - 3:30 PM
Changes in Sedentary Time and Physical Activity of Cancer Survivors Participating in an Exercise Program
Sarah Greteman. Concordia College, Moorhead, MN.

No relevant relationships reported.

Purpose: The purpose of this investigation was to examine changes in sedentary time (SED) and physical activity (PA) of cancer survivors participating in a post-treatment, 12-week, group exercise program.

Methods: Forty-seven cancer survivors volunteered to wear armband activity monitors for seven consecutive days over three different time points of the group exercise program: weeks 1, 6 (midpoint), and 12 (endpoint). A repeated measures ANOVA with mixed model framework and time varying covariate time point differences in SED, LBF, and VIG between weeks 1, 6, and 12 was used to analyze the data. Results: Of the 47 recruited, 15 participants (11/42 survivors (mean age=10.7±6.2 years) and 10/42 controls (mean age=10.6±1.1 years)) completed weeks 1 to 12. Only 11/42 survivors (mean age=10.7±6.2 years) and 10/42 controls (mean age=10.6±1.1 years) have completed comprehensive CRF assessments. Survivors appear to have similar CRF compared with controls in terms of VO2max (43.1 ± 46.3mL/kg/min; p = 0.31; 47±60 percentile; p = 0.41) and 6MWT distance (737 ± 690m; p = 0.07; 85±78 percentile; p = 0.43). Preliminary data suggest little difference in self-reported CRF (p = 0.98) and overall fitness (p = 0.07).

Conclusion: Only one-third of young survivors of childhood cancer are meeting American Cancer Society’s physical activity guidelines. Preliminary data indicate similar fitness levels between survivors and age-matched controls. However, considering the increasing risk of late-effects during aging in survivors, regularly assessing physical activity and CRF provides clinicians with vital information to monitor and encourage survivors to mitigate risks by adopting a healthy lifestyle long-term.

2862 Board #145 June 1 2:00 PM - 3:30 PM
Effect Of Self-control Exercise Practice Dose On Lymphocyte Subsets Of Lung Cancer Patients
Jibing Wang1, Weimo Zhu, FACSM1, Renwei Wang1, Jiaying Lang1, Ruirui Xing1, Shuhao Quan1, Tongji University, Shanghai, China. 2University of Illinois at Urbana-Champaign, Urbana, IL. 3Shanghai University of Sport, Shanghai, China.

No relevant relationships reported.

Purpose: Self-Control Exercise (SCE), known also as Gaolun Qigong, is a mind-body exercise being used in China for cancer survival for more than 40 years. This study was to examine the dose of SCE on lymphocyte subsets of lung cancer patients and the possible mechanisms.

Methods: 33 lung cancer patients (9 males & 24 females; M±SD: Age in yr: 60.24±16.14; Cancer survival yr: 1.67±0.69) were recruited from the Shanghai Cancer Club. All patients were diagnosed pathologically. The patients began to learn SCE for 3 weeks and then performed 24-week SCE at their will. Cancer history was surveyed, physical activity including SCE was recorded during the intervention. The lymphocyte surface antigen CD3/CD4/CD8/CD28/CD16/56/CD19/CD4/CD25 were examined by direct immunofluorescence staining and flow cytometry. Pearson correlation coefficient were computed to determine the correlations between the change of lymphocyte surface antigen and the SCE duration (minutes) per week.

Results: The mean SCE practice was 80.91±44.68 minutes per day with a range from 30 to 180minutes per day. It was found that CD4+ increased significantly (p<0.01), CD4+ CD25+ declined significantly (p<0.05) respectively after 24 weeks.

2863 Board #146 June 1 2:00 PM - 3:30 PM
An Investigation Of Physical Activity And Cardiorespiratory Fitness In Childhood Cancer Survivors
David Mizrachi1, Claire E. Wakefield1, Joanna E. Fardell1, David Simari1, Ann Maguire2, Gill Hubbard1, James McBride1, Penelope Field1, Richard J. Cohn1. 1University of New South Wales, Sydney, Australia. 2The Children’s Hospital at Westmead, Sydney, Australia. 3University of Stirling, Inverness, United Kingdom. 4Sydney Children’s Hospital, Sydney, Australia.

No relevant relationships reported.

Purpose: Survivors of childhood cancer experience an increasing incidence of late sequelae with age, with the effect on health likely compounded by limited physical activity and low cardiorespiratory fitness (CRF). This study aimed to determine survivors’ physical activity levels and to objectively measure CRF, compared with controls.

Methods: Stage 1: We collected physical activity data from parents of survivors aged 7–18 years, 25 years after diagnosis, from 11 Australian and New Zealand hospitals as well as from age-matched controls using the International Physical Activity Questionnaire-Short Form (Tudor-Locke). We compared moderate-vigorous physical activity (MVPA) levels with American Cancer Society guidelines (≥300 min/week). Stage 2: We then assessed CRF in survivors aged 8–18 years, ≥1 year after treatment completion, by cardiopulmonary exercise test using the Bruce Protocol, 6-minute walk test (6MW), and self-reported fitness (International Fitness Scale).

Results: Stage 1: 192 parents of survivors (mean age=12.9±2.3 years) and 111 parents of control children (mean age=12.3±2.7 years) participated. Parents reported child survivors to participate in more physical activity than controls (248.4±217.6 vs 184.8±213.6 min/week, p = 0.036), with 31% of child survivors meeting physical activity guidelines, compared with 22.7% of controls (p = 0.011). Stage 2: To date, 11/42 survivors (mean age=10.7±6.2 years) and 10/42 controls (mean age=10.6±1.1 years) have completed comprehensive CRF assessments. Survivors appear to have similar CRF compared with controls in terms of VO2max (43.1±46.3mL/kg/min; p = 0.31; 47±60 percentile; p = 0.41) and 6MWT distance (737±690m; p = 0.07; 85±78 percentile; p = 0.43). Preliminary data suggest little difference in self-reported CRF (p = 0.98) and overall fitness (p = 0.07).

Conclusion: Only one-third of young survivors of childhood cancer are meeting American Cancer Society’s physical activity guidelines. Preliminary data indicate similar fitness levels between survivors and age-matched controls. However, considering the increasing risk of late-effects during aging in survivors, regularly assessing physical activity and CRF provides clinics with vital information to monitor and encourage survivors to mitigate risks by adopting a healthy lifestyle long-term.

2864 Board #147 June 1 2:00 PM - 3:30 PM
Association Between Cancer Screening and Physical Activity in Cancer Survivors
Katlynn M. Mathis. Pennsylvania State University, State College, PA.

No relevant relationships reported.

Purpose: To determine if cancer survivors who adhere to cancer screening guidelines are more likely to be physically active.

Methods: A Health Risk Factor Questionnaire was mailed to cancer survivors in Central Pennsylvania who were identified by the PA Cancer Registry in 2017. The survey addressed physical activity levels and participation in regular cancer screenings for breast, cervical, and colorectal cancers. Physical activity levels were categorized as meeting ACSM guidelines for aerobic training, resistance training, or both. Adherence to cancer screening guidelines was determined for colorectal, cervical, and breast cancer as put forth by the American Cancer Society, which included a colonoscopy, PAP smear, and mammogram, respectively. Odds ratios were calculated for aerobic, resistance, and combined physical activity levels in people who adhered to cancer screening guideline or not.

Results: Among cancer survivors in Central PA, those who met colorectal cancer screening guidelines are more likely to meet aerobic training guidelines (OR=0.369; 95% CI=0.165 to 0.826) and those that met cervical cancer were more likely to meet aerobic and resistance training guidelines combined (OR=0.255; 95% CI=0.094 to 0.691). No other results were significant.

Conclusions: Cancer survivors who adhere to colorectal cancer screening guidelines are more likely to meet ACSM guidelines for aerobic exercise and those that adhere to cervical cancer screening are more likely to meet ACSM guidelines for
both aerobic and resistance exercise. Physical activity is an important part of cancer prevention and should be further addressed in a high risk population such as cancer survivors in Central PA.

2865 Board #148 June 1 2:00 PM - 3:30 PM Neurophy And Fine-motion-function In Survivors Of Childhood Acute Lymphoblastic Leukemia: A Report From St. Jude Life Robyn E. Partin, Carrie R. Howell, Ching-Hon Pui, Hiroto Inaba, Heather Chambless, FACSMS, Leslie L. Robison, Melissa M. Hudson, Kirsten K. Ness. St. Jude Children’s Research Hospital, Memphis, TN. 

(No relevant relationships reported)

Up to 40% of survivors of childhood acute lymphoblastic leukemia (ALL) have peripheral neuropathy and fine motor impairments with general mobility and walking. Neurophy may also interfere with fine motor skills, which potentially impacts activities of daily living and quality of life (QOL). These relationships have not been investigated in long-term survivors of childhood ALL. PURPOSE: To evaluate associations between peripheral neuropathy, fine motor skills, and QOL in adult survivors of childhood ALL. METHODS: Adult survivors of childhood ALL (N=365, 52% male; age 6.8±4.5 years at diagnosis and 28.6±6.5 years at evaluation) were evaluated using the modified total neuropathy score (mTNS), physical performance test (PPT), and Medical Outcomes Study Short Form Survey (SF-36). Neurophy was defined as a total score ≥4 on the mTNS. Participants were identified as having fine motor impairments according to timed writing and eating PPT tasks (≥10 seconds). Vincristine and cranial radiation doses from childhood cancer treatment, abstracted from medical records, were included as covariates in logistic regression models. RESULTS: 39.7% of ALL survivors had neuropathy (N=145) and 44.1% had fine motor impairments (N=161). Survivors with neuropathy received a mean cumulative dose of vincristine of 47.4 mg/m2; those without neuropathy had a mean cumulative dose of 31.5 mg/m2 (p=0.001). Neurophy was significantly associated with fine motor impairments (Odds ratio (OR): 1.5, 95% confidence interval (CI): 1.01-2.39), after controlling for current age, sex, and cranial radiation. Fine motor impairments were associated with a 2.20-fold (95% CI: 1.07-4.52) risk of a physical component summary T-score <40 on the SF-36. CONCLUSIONS: Adult survivors of childhood ALL with neuropathy are at higher risk for fine motor impairment. In addition, survivors with fine motor impairment are at increased risk for reporting poor physical quality of life. Interventions designed to address loss of fine motor function may improve quality of life in this vulnerable population.

2866 Board #149 June 1 2:00 PM - 3:30 PM Analysis of Cancer Survivor’s Accessibility to Exclusively Tailored Exercise Programs in Nebraska Ava T. Coughlin, Roderick T. Bartee, Kate A. Heelan, FACSMS, Paul R. Burger. University of Nebraska at Kearney, Kearney, NE. 

(No relevant relationships reported)

Exercise has been shown to be an effective way to reduce acute and latent side effects associated with cancer treatment, as well as improve cancer survivor’s quality of life. In Nebraska, more than 50% of the state’s population lives within two metropolitan areas which poses concerns of accessibility to exercise programs for rural residents. Purpose: The purpose of this investigation is to examine cancer survivor’s accessibility to exercise facilities (EF) and exercise programs designed exclusively for cancer survivors (EPCS) in Nebraska, USA. Methods: Geographic Information Science (GIScience) was utilized to construct a spatial database consisting of cancer patient survivors, EF, and identified EPCS, all geocoded from street addresses. Network analyses were performed to assess distance and travel time to both the nearest EF and EPCS. The U.S. Census Bureau’s Core Based Statistical Area (CBSA) definitions for 2013 were used to categorize counties as part of a Metropolitan Statistical Area (MSA) or Micropolitan Statistical Area (mSA) and the balance, rural. Results: Multi-level geocoding of cancer survivors achieved a 99.9% match rate with 90.6% successfully geocoded to either a point or street address. Fifty-nine percent of survivors reside in a county classified as an MSA, 19% are in an mSA, and 22% are rural. Survivors living in an MSA had a mean distance of 3.2±5.4 miles (2.0±4.1 minutes) away from the nearest EF and a mean distance of 15.9±28.8 miles (10.9±22.4 minutes) away from the nearest EPCS. Survivors living in an mSA had a mean distance of 6.5±8.6 miles (4.4±6.4 minutes) from the nearest EF and an mean distance of 157.2±122.4 miles (114.9±91.9 minutes) to the nearest EPCS. Similar to mSA, rural survivors had a mean distance of 25.8±20.1 miles (19.3±15.4 minutes) from the nearest exercise facility while having a mean distance of 168.4±124.5 miles (118.8±84.5 minutes) from an EPCS. Conclusion: Exercise facilities are accessible to cancer survivors throughout Nebraska, however, EPCS are not located within a reasonable distance to rural survivors to facilitate participation. On-line and prescript EPCS programs and trainings should be developed and shared with rural and mSA exercise facilities to increase accessibility.

2867 Board #150 June 1 2:00 PM - 3:30 PM Adherence To Lifestyle Recommendations Regarding Physical Activity, Diet, Smoking And BMI in Cancer Survivors Renate M. Winkels1, Wayne Foo1, Joachim Wiskemann1, Joel E. Segel2, Scherezade Mama2, Kathryn H. Schmitz, FACSMS. ’Penn State Cancer Institute, Hershey, PA. ’Penn State University, State College, PA. (No relevant relationships reported)

Purpose: Assess adherence to lifestyle recommendations for physical activity, diet, smoking and BMI in cancer survivors in Central Pennsylvania. Methods: A survey on health-related lifestyle factors was sent to cancer survivors in Central Pennsylvania (PA) facilitated by the PA Cancer Registry in 2017. The survey included questions on current BMI, smoking status, physical activity level, and diet. From this, we assessed adherence to the WCRF/AICR recommendations for cancer prevention, as they are also recommended for cancer survivors. Respondents were assigned 1 point for each of the following recommendation they adhered to: BMI between 20-25 kg/m², currently not smoking, consumption of 5 or more servings of fruits/vegetables per day and being physically active at least 30 minutes/day (maximum score 4 points). Results: The response rate to the survey was ~27%, and varied from 23% (fun) to 30% (breast). The average age of the respondents was 66 years. The overall score for adherence was 1.6 points which was largely driven by the high adherence to the recommendation not to smoke; adherence to the other guidelines was significantly lower. Survivors who adhered to the recommendation on physical activity had a similar score for the other lifestyle recommendations (1.1 out of 3) compared to 1.0 of 3 for survivors who did not adhere to the recommendation on physical activity.

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<td>Average score</td>
<td>1.6</td>
<td>1.7</td>
<td>1.6</td>
<td>1.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Conclusion: In this survey among cancer survivors in central PA, adherence to lifestyle recommendations was low for all types of cancer. Response rate was 27%; possibly, cancer survivors who were higher educated and more health-conscious were more likely to respond. Thus, the adherence to lifestyle recommendations among cancer survivors in central PA may even be lower than what is presented here.

2868 Board #151 June 1 2:00 PM - 3:30 PM Cardiorespiratory Fitness and Cancer In Women Baruch Vainshelbom1, Stephen M. LoRusso1, Ivan Mulligan1, Stephen Baker2, Patricia Fitzgerald3, Kristofer Wisniewski3, Jonathan Myers1, FACSMS, ’Saint Francis University, Loretto, PA. ’VA Palo Alto Health Care System/ Stanford University, Palo Alto, CA. (No relevant relationships reported)

The preventive role of cardiorespiratory fitness (CRF) in cancer is not well established among women. PURPOSE: The current study sought to evaluate the association between CRF, cancer incidence and cancer mortality in women. METHODS: Maximal exercise testing was performed in pilot cohort of 184 women (59±15.2 years) free from malignancy at baseline who were followed for a mean of 12.6±9 years. Multivox Cox hazard analyses were conducted for all-type cancer incidence and cancer mortality. Population Attributable Risks (PAR) and Number Needed to Treat (NNT) were determined for low CRF (<5 METs). RESULTS: During the follow-up, 11.4% were diagnosed with cancer and 3.2% died from cancer. CRF was inversely associated with cancer outcomes. For every 1 MET higher CRF there was a 19% reduction in cancer incidence [Hazard Ratio (HR) 0.81, 95% Confidence Intervals (CI) (0.68 to 0.96), p=0.016] and 38% reduction in cancer mortality [HR 0.62, 95%CI (0.42 to 0.92), p=0.017]. The PARs and NNT of low CRF was 12.3% and 16.6% and 38% reduction in cancer mortality [HR 0.62, 95%CI (0.42 to 0.92), p=0.017]. The PARs and NNT of low CRF was 12.3% and 16.6% and 38% reduction in cancer mortality [HR 0.62, 95%CI (0.42 to 0.92), p=0.017]. The PARs and NNT of low CRF was 12.3% and 16.6% and 38% reduction in cancer mortality [HR 0.62, 95%CI (0.42 to 0.92), p=0.017].
Effect of an Exercise Program on Fitness and Motivation Outcomes in Overweight Breast Cancer Survivors


Background/Purpose: Overweight breast cancer survivors are at high risk of recurrence and mortality. Exercise can mitigate these outcomes, but this subset of survivors dropout from exercise programs at a high rate. We tested the Breast Cancer Healthy Lifestyle Intervention Study (BCHLIS) which incorporates evidence-based components to enhance physical fitness and intrinsic motivation (IM).

Theoretical Framework: Self-determination theory (SDT) and exercise theory informed BCHLIS. We focused evidence-based components of the program on the psychological needs of autonomy (A), competence (C), and relatedness (R). Theoretically, if these are met then IM increases.

Methods: A descriptive study that used a convenience sample of 14 breast cancer survivors. BCHLIS include individualized aerobic, resistance and flexibility exercise which was delivered for 24 weeks, 12 supervised and 12 in the community. Variables measured included: VO2max, grip, balance and body composition. Psychological needs and motivation were measured with Basic Psychological Needs Scale (BPNES) and Behavioral Regulation of Exercise Questionnaire-2 (BREQ-2), at 0, 3 and 9 months. Descriptive statistics, ANOVA for repeated measures, and bivariate correlation were used to analyze the data.

Results: 14 women were enrolled, 9 women completed all survey data, 6 women completed both survey and fitness assessments, 5 women dropped out for various reasons: 1 disease related, others personal. Results included significant weight decrease (p < .023), increase in Met/hrs/week (p = .04), right hand grip strength (p = .022), balance (p = .037), and clinically relevant increase in VO2max. Psychological needs satisfaction was noted at 3 months for A, C, and R. Motivation was observed to be maintained in 7/8 survivors, but retained a greater extrinsic than intrinsic source.

Conclusions & Implications: Participation in BCHLIS resulted in increased physical activity, improved body composition and fitness profile. Motivation was maintained during the program, however a shift to more intrinsic motivation was not realized indicating that exercise programming may require external support beyond the 24 week time frame in overweight breast cancer survivors.

Advancements in treatment, such as chemotherapy, have improved survival rates among cancer patients. Today, approximately 67% of patients are at least five-year survivors; however, the combination of cancer and its care often affects the quality of those years. Patients commonly experience psychological symptoms, losses in physical function, and deterioration of cardiovascular health. Exercise ameliorates many of these consequences, but the effect of chemotherapy on exercise outcomes requires further exploration.

Purpose: To evaluate the effects of chemotherapy on exercising cancer survivors.

Methods: We enrolled cancer survivors in a comprehensive 10-week exercise program, 40 patients had never received chemotherapy (NC), 80 had a history of chemotherapy (HC), 24 were currently undergoing treatment (CC), and 13 failed to report status. During a pre-exercise evaluation, we gathered demographic, morphological, psychological, cardiovascular, and functional data. Following the intervention, we repeated all assessments. We compared baseline data and analyzed pre-to-post differences in the three exposure groups (NC, HC, and CC) using chi-square and multivariate tests; post-hoc analyses tested specific group differences.

Results: Patients in the NC group were older (p = 0.013), weighed more (p = 0.054), and had a higher body mass index (p = 0.067); obesity affected 56.7% of NC patients, 39.1% of HC patients, and 19.0% of CC patients (p = 0.026). The NC group also had a higher incidence of hyperlipidemia (p = 0.058) and worse performances in the six-minute walk (p = 0.019), timed up-and-go (p = 0.002), chair stand (p = 0.043), and epic lift (p = 0.029). There were no group differences in exercise adherence (p = 0.414). NC patients improved the least in arm curls (p = 0.022) and improved the most in VO2 max (p = 0.037) and systolic blood pressure (p = 0.064). Conclusion: Patients who used chemotherapy in the past or were currently undergoing treatment were younger than those with no history of use; age may explain the differences noted. Our results indicate chemotherapy is not a barrier for exercise participation; as long as it is tolerated, exercise should be encouraged throughout cancer survivorship. While chemotherapy did not affect attrition, our low retention rate overall limits the strength of these findings.

Purpose: Examines the associations among self-reported physical activity levels at breast cancer diagnosis to physical activity levels during chemotherapy.

Methods: Prior to beginning chemotherapy, patients were approached by research staff to participate in a walking intervention. 100 early stage (I-III) breast cancer patients participated in the intervention, and were asked to walk 150 minutes per week during chemotherapy. Patient characteristics and physical activity levels were assessed via questionnaire at baseline. Physical activity during treatment was monitored via weekly step totals obtained from a Fitbit Zip and uploaded directly into research computers. A linear regression analysis of self-reported physical activity prior to chemotherapy with mean Fitbit steps per week during chemotherapy was conducted.

Results: Breast cancer patients (age 48 ± 8 years) who reported higher self-reported walking minutes/week at baseline (79.9 ± 16.7; p < .0001) and a history of self-reported vigorous physical activity (55% vs 45%; p < .01) at baseline exhibited greater weekly Fitbit step totals during chemotherapy. Conclusion: In this sample, early stage breast cancer patients with a history of greater physical activity prior to chemotherapy are more apt to remain physically active during chemotherapy. Funding: Breast Cancer Research Foundation, New York, NY.
Cancer survivors experience several disabling long-term side effects promoted by the cancer treatment and the pathology. Although the American College of Sports Medicine recommend the practice of strength training to cancer survivors similarly to healthy subjects, these recommendations are based on a restricted literature. Cancer survivors may require a longer recovery between sessions due to physiological impairments. PURPOSE: To assess the time-course of muscle performance recovery after a resistance exercise session in Hodgkin’s Lymphoma survivors. METHODS: Four Hodgkin’s Lymphoma survivors (age: 28.00 ± 8.16; height: 1.71 ± 0.06m; weight: 68.38 ± 9.83kg) participated in this study. The volunteers attended to the laboratory in four consecutive days. On the first visit, the isokinetic knee extension produced a peak torque. The second visit assessed the knee extension exercise, using the Freedson 1998 cut-points and are presented as a percentage of wear-time spent in each intensity category. The activity data were categorized by six sets of ten repetitions at 60% and 120-sec rest interval. On the following visits, the peak torque was assessed to determine muscle recover time-course. Repeated measures one-way ANOVA was used to analyze data. RESULTS: There was no significant time effect (F = 0.036; p = 0.990) for peak torque. There was no difference between pre (178.55 ± 56.87 N.m), 24 hours (174.97 ± 58.54 N.m), 48 hours 177.90 ± 52.09 N.m) and 72 hours (179.75 ± 59.65 N.m). CONCLUSIONS: Hodgkin’s Lymphoma survivors recover muscle strength production capacity 24 hours after a resistance exercise session and do not require longer rests between training sessions.

Introduction: Physically active breast cancer (BC) survivors have higher quality of life (QOL) compared to those who are sedentary. However, exercise programs may introduce compensatory responses to total daily physical activity (PA) and sedentary time (ST) that could undermine the expected benefits of exercise training. The primary aim of this study was to evaluate changes in daily PA and ST following the implementation of an exercise training program in BC survivors. A secondary aim was to examine the relationship between PA/ST and fatigue/QOL.

Methods: 12 postmenopausal BC survivors were an ActiGraph GT3X monitor on the right hip for 7 consecutive days and the EORTC QOL questionnaire and Physic Fatigue Scale prior to and during the final week of a supervised 12-week exercise training program (45-60 min/day, 2-4 days/wk). The activity data were categorized using the Freedson 1998 cut-points and are presented as a percentage of wear-time spent in each intensity category. Results: The table presents PA, ST, perceived fatigue, and QOL scores. Note: Data are presented as mean (SD); * indicates significant change from baseline (p<0.05).

<table>
<thead>
<tr>
<th>ST (%)</th>
<th>Light (%)</th>
<th>MPVA (%)</th>
<th>Fatigue Score</th>
<th>EORTC QOL Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>77.2 (6.41)</td>
<td>17.6 (4.95)</td>
<td>5.2 (3.94)</td>
<td>80.6 (40.40)</td>
</tr>
<tr>
<td>Post-Intervention</td>
<td>71.8* (8.38)</td>
<td>22.7* (6.73)</td>
<td>5.5 (3.29)</td>
<td>66.1* (31.87)</td>
</tr>
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</table>

Conclusion: Perceived QOL plays a significant role in life satisfaction, engagement in physical activity, and physical, psychological, emotional, and social well-being. Although little significant differences were observed, the fact that PWB improved may suggest participation in the program has a positive impact on increasing energy levels, reducing pain, and improving ability to meet physical needs.
Androgen deprivation therapy (ADT) is a foundation of treatment for men with prostate cancer (PCa). However, ADT is accompanied by adverse effects that increase risk of functional decline. Although some clinical observations suggest that ADT may have a greater impact upon functional status among aged men, empirical evidence addressing age-related differences in the trajectory of adverse effects of prolonged ADT remains limited. PURPOSE: The purpose of the present pilot study was to explore differences in change in mobility performance and physical activity (PA) across 6 months among 3 different age cohorts of PCa patients undergoing ADT.

**METHODS:** A total of 44 PCa patients undergoing prolonged ADT (> 6 months of treatment) were classified into 1 of 3 age cohorts: 55-64 (n=13); 65-74 (n=19); and 75+ years of age (n=12). Measures of mobility performance (400M Walk) and objectively-determined PA were obtained from men at baseline and 6 month follow-up assessments. RESULTS: Results of 3 (Age) × 2 (Time) Repeated Measure ANOVA analysis demonstrated a significant Age main effect for mobility performance (p < .05) while the Age main effect for PA approached significance (p = .06). Post hoc analysis revealed patients in the youngest group had more favorable mobility performance relative to the middle (d = −.71) or oldest (d = −1.04) age groups and patients in the oldest group were accruing less objectively-determined PA relative to the middle (d = −.45) or younger (d = −.92) age groups. However, the Age × Time interaction was not significant for mobility performance (p = .38) or PA (p = .28) indicating no differences in the trajectory of change were observed for either outcome as a function of age across time.

**CONCLUSIONS:** This study provides some of the first preliminary evidence examining potential age-related differences in the trajectory of change in physical function and PA in PCa patients on ADT. Findings revealed that although well-established, anticipated age differences in mobility performance and PA were observed, no age-related differences in the trajectory of change in functional decline or PA emerged among PCa patients undergoing prolonged ADT.

**INTRO:** Cancer stage reflects the severity and extent of the disease, with stage IV reflecting advanced cancer and poorer prognosis. Exercise has been shown to improve a number of psychological and physiological variables in cancer survivors, such as cancer-related fatigue (CRF) and cardiovascular fitness (VO$_{2\text{peak}}$). However, the effect of stage on these improvements is unknown. PURPOSE: To examine whether diagnosed cancer stage affects or modifies improvements in CRF and VO$_{2\text{peak}}$. METHODS: A total of 384 cancer survivors (57 ± 12 years of age) completed initial assessments of CRF and VO$_{2\text{peak}}$ via the Portable Fatigue Scale and the University of Northern Colorado Cancer Rehabilitation Institute’s cancer-specific treadmill protocol, respectively. Participants were divided into four groups based on diagnosed cancer stage (I, II, III, and IV). Survivors completed supervised, one-on-one exercise sessions three days per week, 60 minutes per day for 12 weeks. The intervention consisted of individualized and progressive cardiovascular, whole-body strength, balance, and flexibility training. Participants’ CRF and VO$_{2\text{peak}}$ were reassessed following the intervention. RESULTS: Collectively, pre-to-post assessments demonstrated significant overall improvements in CRF (25% ) and VO$_{2\text{peak}}$ (11%) across all stages (p < .01). No significant differences in CRF (p = .92) or VO$_{2\text{peak}}$ (p = .44) improvements occurred between the stages. When evaluating individual cancer stage CRF (p = .01) and VO$_{2\text{peak}}$ (p = .01) were observed with each stage (I, II, III, and IV). Specifically, significant improvements in VO$_{2\text{peak}}$ (p < .01) occurred with each cancer stage. (I, 16%; II, 14%; III, 12%; IV, 11%).

**CONCLUSION:** Exercise-based cancer rehabilitation during and following cancer treatment has been shown to have positive effects on CRF and VO$_{2\text{peak}}$ but the effect of stage diagnosis on these improvements has been unclear. Findings indicate significant improvements in CRF and VO$_{2\text{peak}}$ between cancer stages, and all stages experienced significant benefits following a 12-week cancer rehabilitation program. These results suggest that reductions in CRF and improved cardiovascular function are possible in all cancer patients, regardless of cancer stage.
Increased demand for sedentary behavior reduction in workplace environments has led to the planning of large-scale interventions implemented at the group level in the form of cluster randomized controlled trials (RCTs). To date, limited evidence is available regarding cluster RCT recruitment strategies. PURPOSE: The purpose of this paper is to provide a review of recruitment strategies employed in a large cluster RCT targeting a reduction in workplace sedentary behavior. METHODS: Recruitment yields (N enrolled/N screened) x 100 were calculated. Mean (SD) and median worksite sizes were calculated at each recruitment step. The percentage of participants who progressed to each recruitment step (of the total N screened per worksite) was calculated to determine the mean percentage of a worksite successfully randomized. Recruitment barriers and modifications were recorded by the research team. A survey was completed by a subset of non-participants (N = 57) and thematic analyses conducted to examine reasons for non-participation, positive impacts and negative experiences. RESULTS: Cluster recruitment yield was 43% (24 worksites enrolled/56 screened). Individual recruitment yield was 49% (641 employees enrolled/1317 screened). On average, 52 ± 16% of the worksite was successfully randomized. Eighteen modifications were developed to overcome participant-related, context-related and research-related barriers. CONCLUSIONS: Researchers should plan to screen at least 200% of the intended number of worksites and they should target worksites that are approximately double the size of the intended cluster size to avoid loss of statistical power or timeline extensions. Acknowledging temporal fluctuations in worksite-specific workloads, providing options throughout the recruitment process, and adopting a participant-centered approach may facilitate cluster RCT success.

Orthopedic trauma can be a catalyst for substantially reduced physical activity and increased sedentary behavior that can persist post-recovery. While objective measures (e.g. accelerometry) provide rigorous approaches to assessing physical activity and sedentary behavior, they may be inappropriate for studies with some patient groups. Self-report measures provide potential alternatives, however, their validity must be established. PURPOSE: To determine, in orthopaedic trauma patients, the agreement and concordance of physical activity and sedentary behavior data from two self-report measures, the International Physical Activity Questionnaire (IPAQ) and the domain-specific sitting questions from the Australian Diabetes, Obesity and Lifestyle General Questionnaire 3 (AusDiab3), with data derived from objective measures. METHODS: 64 patients with isolated upper- or lower-limb fractures wore two activity monitors (ActiGraph, ActivPAL) for 10 days, from 2-weeks post-surgery. Participants then completed the IPAQ and AusDiab3 questionnaires relating to the previous 7 days of objective monitoring. Bland-Altman plots, Lin’s Concordance Correlation Coefficients (LCCCs) and weighted kappa statistics were used to assess agreement and concordance across several physical activity and sedentary behavior variables. RESULTS: The IPAQ overestimated objectively-assessed overall physical activity (median METmins: 550 vs.0.0) and underestimated median daily sitting time (8.00 vs. 10.59 hrs). The AusDiab3 questionnaire underestimated median daily sitting time to a lesser degree than the IPAQ (9.21 vs. 10.53/hr). There was moderate concordance between IPAQ-reported and objectively-derived overall physical activity (p=0.431, p<0.001), weak concordance between IPAQ-reported and objectively derived sitting time (p=0.384, p<0.001) and moderate concordance between AusDiab3-reported and objectively measured sitting time (p=0.51, p<0.001). CONCLUSIONS: There was disagreement and discordance between the IPAQ and AusDiab3 questionnaire and objectively derived data, suggesting that these measures cannot be used interchangeably in orthopaedic trauma patients. Modifications could be made in order to more specifically address the activity characteristics of this population.
subjective sleep quality (lower scores = better sleep quality). Mixed-effects regression models adjusted for worksite clustering and age, gender, race, job type, body mass index (BMI), and MVPA. **RESULTS:** Participants spent 333 ± 78.0 min/8hr workday and 30.7 ± 14.8 min/8hr workday in sedentary and LPA behaviors at baseline, respectively. Overall, sedentary time was reduced by 33.6 ± 13.6 min/8hr workday and LPA was increased by 0.1 ± 0.9 min/8hr workday. Increases in LPA were associated with 3-month improvements in PSQI sleep latency (β = -0.009 [20], p = 0.02). No other changes in sedentary or LPA behaviors were associated with PSQI changes. **CONCLUSION:** Workplace interventions targeting reductions in sedentary behavior may be effective for improving sleep onset, but not other aspects of sleep quality. Future interventions should examine longer term follow-up periods, assess sleep objectively, and incorporate interventions that target sedentary time and LPA behaviors during and outside of work hours.

**2885**

**Board #168**  
June 1 2:00 PM - 3:30 PM  
**Patterns of Sedentary Behavior in Pregnant Women**  
Anya Odabasic, Meghan Baruth, Rebecca A. Schlaff, Samantha J. Decere, Saginaw Valley State University, University Center, MI.  
(No relevant relationships reported)

Previous research indicates that women become more sedentary during pregnancy. However, very few studies have objectively measured sedentary behaviors in this population. **PURPOSE:** To quantify objectively measured sedentary behaviors, including patterns of sedentary behaviors, in a sample of pregnant women.  
**METHODS:** Participants included pregnant women enrolled in a behavioral nutrition and physical activity intervention. Participants wore an Actigraph accelerometer during all waking hours for seven consecutive days. The total volume of sedentary behaviors was quantified (% of day), as was the amount of time spent sedentary according to type of day (morning [6am-12pm], afternoon [12pm-6pm], evening [6pm-12am]) and type of day (weekday, weekend). Surveys were administered to assess demographic characteristics. Descriptive statistics calculated the percentage of time spent in sedentary, in addition to the percentage of time of day spent sedentary. **RESULTS:** On average, the participants (n=41) were 28.0±4.4 years of age, 17.8 ±2.3 weeks gestation, and had a pre-pregnancy body mass index (BMI) of 27.0±7.5. The majority of the sample were Caucasian (82.5%), married (68.3%), and had some college education (72.3%). Overall, participants spent 59.1% of waking hours sedentary. When looking at type of day, participants were sedentary 60.2% of the day on weekdays, and 55.6% of the day on weekend days. When looking at time of day, participants were sedentary 57.7% of time during morning hours, 58.6% during afternoon hours, and 61.3% during evening hours. **CONCLUSION:** Results indicate that pregnant women spend a majority of their day engaged in sedentary behaviors. When looking at type and time of day, the data indicate that our sample was more sedentary on weekdays and during evening hours. Given the benefits of regular physical activity during pregnancy for both the mother and baby, and the high rates of sedentary behaviors, interventions aimed at decreasing sedentary time during pregnancy are needed. Replacing sedentary behaviors with even light activity may be a first step in successfully decreasing the total volume of sedentary behavior.

The project was supported by the SVSU Allen Foundation Grant, the SVSU Ted & Ruth Braun Fellowship, and the SVSU Faculty-led Research Grant.

**2886**

**Board #169**  
June 1 2:00 PM - 3:30 PM  
**Associations Between Sedentary Behavior And Metabolic Syndrome Are Mediated By Cardiorespiratory Fitness But Not Mvpa**  
Katrina Taylor1, Megan C. Nelson2, Chantal A. Vella, FACSM2. 1Eastern Washington University, Cheney, WA. 2University of Idaho, Moscow, ID.  
(No relevant relationships reported)

Sedentary behavior is negatively associated with individual metabolic syndrome (MetS) risk factors in young adults but little research has investigated these associations using a clustered risk score. **PURPOSE:** To determine whether sedentary behavior is associated with a clustered MetS score independent of moderate-to-vigorous physical activity (MVPA) and cardiorespiratory fitness (VO2peak) in young adults. **METHODS:** 146 participants (age 22.0±3.7 years, BMI 25.0±3.9 kg/m², VO2peak 43.0±8.5 ml/min/kg). **RESULTS:** Total minutes and bouts of sedentary behavior (<150 counts/minute) and MVPA (>2,690 counts/minute) were measured by an accelerometer worn during waking hours for 7 consecutive days. MetS risk factors measured were waist circumference, blood pressure, and fasting glucose, triglycerides and high-density lipoprotein cholesterol. VO2peak was measured using an incremental treadmill cardiopulmonary exercise test. **CONCLUSIONS:** Our findings suggest sedentary behavior is associated with clustered metabolic risk in young adults, independent of MVPA, and that bouts of 20 minutes or longer may have the greatest impact on MetS risk. Additionally, fitness may play an important role in attenuating the effects of sedentary behavior on MetS in this population.

**2887**

**Board #170**  
June 1 2:00 PM - 3:30 PM  
**Adapting Sedentary Video Games to Require Physical Activity**  
Christen J. Mendonca, Jillian L. Hawkins, Sinclair A. Smith, Drexel University, Philadelphia, PA. (Sponsor: Dr. Stella Volpe, FACSM)  
(No relevant relationships reported)

Approximately $117 billion in annual healthcare costs are associated with physical inactivity. The Pew Research Center reports that about 49% of American adults play video games (VG). Adapting traditionally sedentary VG controls to require physical activity using low-cost devices may increase opportunities to adhere to physical activity guidelines. **Purpose:** To determine the effects of adapting sedentary VG to require physical activity on exercise intensity, perceived exertion, enjoyment, and VG performance. **METHODS:** Six women and nine men 19 to 52 years of age played PAC-MAN Championship Edition DX+ (NAMCO) in three conditions: sedentary play (SED), standing active play using gestures recognized by a motion sensor (AVG-G), and standing active play using buttons (AVG-B). Each participant started with SED and the two adapted conditions were counterbalanced. Exercise intensity was assessed by recording continuous heart rate using a chest strap monitor. Ratings of perceived exertion (RPE) were reported using the Borg 6 to 20 scale. Enjoyment was recorded using a abbreviated Physical Activity Enjoyment Scale. VG performance was represented by the in-game score. Repeated measures ANOVA tests were used to compare heart rate, RPE, enjoyment, and VG performance across conditions. **RESULTS:** There was a significant effect of game condition on heart rate, percent of age predicted heart rate maximum (APHRM), RPE, and VG performance (p < 0.001). Enjoyment was not significantly different across conditions (p = 0.33). Post hoc analysis indicated that AVG-G and AVG-B elicited a higher mean (±SD) heart rate (108±16 and 97±15 BPM), percent of APHRM (58±10 and 51±9%), and RPE (13±3 and 12±2) versus SED (72±13 BPM, 39±8% APHRM, 7±1 RPE). Participant VG performance was lower during AVG-G and AVG-B (57±25:07 and 68:84±35.52 arbitrary units) versus SED (201:11±91.08 arbitrary units). **CONCLUSION:** These results suggest that the majority of participants achieved and sustained moderate to vigorous physical activity during adapted sedentary VG for at least 10 minutes. Enjoyment did not suffer as a result of active play despite lower VG performance.

**2888**

**Board #171**  
June 1 2:00 PM - 3:30 PM  
**Impact of HealthSteps Lifestyle Prescription Program on Healthful Eating and Sedentary Time in At-Risk Adults**  
Dawn P. Gill1, Wendy Blunt1, Roseanne W. Pulford2, Adam Gavarkovs, Narlon C. Boa Sorte Silva1, Cassandra Bartol1, P. Karen Shimmavong3, Ashleigh De Cruz4, Guangyong Zou5, Robert J. Petrella, FACSM6. 1Western University, London, ON, Canada. 2Harvard University, Cambridge, MA.  
(No relevant relationships reported)

Chronic diseases (CDs) account for two-thirds of deaths worldwide. Physical inactivity and unhealthy eating are key risk factors contributing to the global CD burden. **PURPOSE:** 1) To determine whether a 6-month lifestyle prescription program [HealthSteps (HeS)] can improve healthy eating and decrease sedentary time in adults at-risk for CD; 2) To explore long-term maintenance of these behaviours. **METHODS:** Pragmatic randomized controlled trial of adults with ≥1 CD risk factor (metabolic syndrome or type 2 diabetes; body mass index ≥25 kg/m²; exercise <150 min/wk; sit ≥3 hr/d; eat <8 servings of fruit and vegetables/d) from 5 primary care settings in Ontario, Canada. Methods: 120 adults (N = 118; mean age 57 (SD=12 years); 76% female) were randomized to intervention (HeS) or comparator (wait-list; WL). From baseline (V0) to 6 mo. (V1), HeS included 4 bimonthly coaching sessions (lifestyle prescriptions; strategies to achieve goals and access to eHealth technologies (phone coaching; social networking; apps; website). From V1 to 12 mo. (V2), participants only had access to eHealth technologies; from V2 to 18 mo. (V3), access included on publically available technologies. We examined within and between group differences in mean healthful eating (Starting the Conversation, STC; score 0-16, lower=lower) using linear mixed models (LMM) adjusted for age, sex and site (covariates). Quanitle

**CFI=93; RMSEA=0.07.** On average, participants engaged in 503.4±87.4 minutes/week of sedentary behavior and 190.9±145.2 minutes/week of MVPA in 10-minute bouts. Total sedentary behavior was significantly and positively associated with MetS (β=−24, p<0.03). This association was independent of MVPA (β=−23, p<0.04) but mediated by relative VO2peak (β=−25, p<0.29). Similarly, sedentary behavior in bouts of 10, 20, 30, and 60-minutes or longer were all significantly and positively associated with MetS independent of MVPA (β range .23 to .29, p<0.05) but not VO2peak (β range .16 to .25, p<0.05). **CONCLUSIONS:** Our findings suggest sedentary behavior is associated with clustered metabolic risk in young adults, independent of MVPA, and that bouts of 20 minutes or longer may have the greatest impact on MetS risk. Additionally, fitness may play an important role in attenuating the effects of sedentary behavior on MetS in this population.
To examine differences in accelerometer-determined PA and sedentary behaviors assessed by activPAL are reproducible within an academic semester with the exception of moderate-to-vigorous physical activity. These results are likely explained by the physical activity requirements demanded of a full-time college undergraduate.

The Effect Of A Sit And Resistance Training Program On Sedentary Behavior

Daniele D. Wadsworth, David Pascoe, FACSM, James McDonald, Mony Rodriguez Hernandez. Auburn University; Auburn, AL.

PURPOSE: Previous research has shown that Sprint Interval Training (SIT) is effective in eliciting physiological responses comparable to continuous forms of training. Despite these physiological benefits, there is some evidence that vigorous exercise is linked to negative affective states and may discourage continued exercise participation or result in compensatory behaviors. Therefore, the purpose of this study was to determine if physical activity compensation occurred following a 10-week exercise intervention and to examine how compensation affective intervention variables examined. METHODS: 39 women aged 19-35 (25.4±4.5 years) completed a 10-week exercise training study consisting of SIT and resistance training three times a week for a total of 30 sessions. Pre and post assessments included body composition by DXA, VO_{2max} and accelerometer measured physical activity and sedentary behavior for seven days. Validated cut points determined the percentage of time spent in moderate to vigorous physical activity and sedentary behavior.

RESULTS: Participants spent on average 600 ± 50.5 minutes of each day (82%) of the day) in sedentary behavior prior to the intervention. After posttest, participants spent on average 530.4 ± 101.4 minutes (78%) of the day) in sedentary behavior, which is a 3.24% reduction (p<.001). There was no effect of MVPA on VO_{2max} (p = .421), however, participants who lost fat mass over the course of the study spent significantly more time (p<.008) in MVPA outside of the study. CONCLUSIONS: Overall, participants did not compensate following an exercise intervention by increasing their sedentary behavior. However, differences in MVPA outside of the study affected changes in fat mass.

Based on self-reported data, minority populations are often found to be less active compared to whites, which may contribute to overall health disparities. The Houston Travel Related Activity in Neighborhoods (TRAIN) Study provides an opportunity to examine differences in accelerometer-determined PA levels among a majority-minority sample of adults.

To describe and examine differences in accelerometer-determined PA and sedentary behavior among TRAIN participants at baseline, by race/ethnicity and sex.

METHODS: Study participants were part of an ongoing natural experiment of transportation-related PA. At baseline, a group of participants self-selected to wear an Actigraph wGT3X-BT monitor for 7 consecutive days during waking hours. Participants with >4 days with ≥ 10 hours/day were included in analysis. Freedon cutpoints were used to quantify time spent sedentary (min/d) and in light- and moderate and vigorous-intensity physical activity (MVPA) (min/d). Vector magnitude (VM) estimates are also reported. Kruiskal-Wallis tests were used to compare accelerometer based estimates by 1) race/ethnicity, and 2) sex and race/ethnicity groups.

RESULTS: 365 TRAIN participants had valid accelerometer data, 62.1% were female and 28.7% and 37.8% were black and Hispanic, respectively. There was a significant difference in VM (counts/min/day) across race/ethnicity groups with blacks and Hispanics having the highest and lowest median values, respectively (p<.005). There were also differences for intensity-specific estimates. Median sedentary time (min/d) was highest in whites (591.0) and lowest in blacks (533.3), light intensity PA (min/d) was highest in blacks (256.2) and lowest in Hispanics (211.4), and MVPA (min/d) was highest in whites (17.9) and lowest in Hispanics (10.8) (p<.005). Race/ethnicity differences were further stratified by sex. Among Hispanics, VM estimates were higher among men (461.5) than women (390.9) (p<.005), which was also reflected in MVPA (min/d). In blacks, MVPA was higher among men (21.3) than women (11.3) (p<.005). No other significant differences were noted.

CONCLUSIONS: For blacks, findings conflict with results typically found with self-reported data. Yet, findings for Hispanics align with existing literature, with the majority of disparity shown in women.
pain were self-reported three times during each position using validated 10-cm visual analog scales. Repeated measures ANOVA were used to assess differences in outcome variables across conditions.

**RESULTS:** VO₂ was significantly different among all conditions regardless of current standing desk use (SIT 3.13 ± 0.53; STAND 3.77 ± 0.48; BOARD 3.92 ± 0.54 mL/kg/min; p < 0.001). EE (kcal/min⁻¹) also differed (p < 0.001) among SIT (1.27 ± 0.22), STAND (1.42 ± 0.26) and BOARD (1.48 ± 0.29). Compared to sitting (67 ± 9 bpm), HR was higher in SIT (76 ± 11 bpm) and in STAND (76 ± 11 bpm; p < 0.001). Measures of productivity were similar across conditions (p = 0.05). Mean self-reported fatigue and pain levels were similar across conditions (p = 0.05). Fatigue progressively increased over each 30 min condition (p < 0.001) whereas pain in SIT and BOARD increased from min 10 to 20, then leveled off between min 20 to 30. For STAND, pain continued to increase over time.

**CONCLUSION:** Compared with sitting, a balance board may be effective for increasing EE without interfering with productivity in an occupational setting.

**References:**


**Keywords:** standing desk, sit-stand, productivity, EE, fatigue, pain.
examined the accuracy of activPAL and ActiGraph (AG) devices in differentiating sitting on a physio-ball, standing still, and sitting in a chair during a lecture-based classroom setting.

METHODS: A total of 28 males and females, aged 18-25 years, from two classes of the same 50-minute course participated in the study. Each participant wore activPAL3 on non-dominant thigh and AG GT3X-bt on right hip in three conditions, which were randomly ordered: 1) sitting on a physio-ball, 2) standing, or 3) sitting in a chair. For the purpose of the analyses, the first 5 minutes of the analyses were excluded from the analyses, thus, comparison of sitting and standing (min) between activPAL and AG devices was made during the mid-40 minutes of each class.

RESULTS: One participant missed a day of physio-ball, analyses involving values obtained during physio-ball consisted of 27 participants. During physio-ball sitting, activPAL detected the behavior as 38.33 ± 4.40 min of sitting and 1.35 ± 3.56 min of standing, while AG detected the behavior as 14.60 ± 12.97 min of sitting and 25.29 ± 13.02 minutes of standing. During standing, activPAL detected 38.43 ± 7.53 min of standing, while AG detecting 32.13 ± 10.28 min of standing. During sitting in a chair, activPAL measured 39.26 ± 1.44 min of sitting vs. AG measured 17.42 ± 15.50 min of sitting. Paired samples t-tests indicated significant differences in sitting on physio-ball, standing, and sitting in a chair between the two devices (p < 0.001, p < 0.020, and p < 0.001, respectively).

CONCLUSIONS: The activPAL devices were more accurate in identifying the three classroom postures. Further examination of the accuracy of AG worn on other body parts (e.g., wrist and thigh) in differentiating sitting vs. standing in a classroom or occupational setting is warranted.

2897 Board #180 June 1 2:00 PM - 3:30 PM
Sedentary Time And Steps Across Methods For Determining End Of Daytime During 24-hour ActiGraph Monitoring
Bethany Barone Gibbs, Melissa A. Jones, Tyler D. Quinn, Subashan Perera, Christopher E. Kline. University of Pittsburgh, Pittsburgh, PA.
(No relevant relationships reported)

PURPOSE: Best practices to identify daytime end during 24-hour activPAL monitoring are not clear.

METHODS: This study included 25 overweight/obese adults (64% male, mean (SD) age: 42 (12) yrs) from a randomized crossover study. Posture, activity (activPAL) and sleep (Actiwatch) were monitored for 24 hours on two simulated workdays (with/without use of a sit-stand desk) followed by free-living evening behavior. Average time spent sedentary and steps were calculated using four methods to determine daytime end: 1) criterion method using actigraphy and a standardized scoring algorithm to indicate bedtime, 2) standard 10PM bedtime, 3) participant diary-reported bedtime, or 4) hybrid approach combining activPAL data with participant diary. Validity between criterion and alternative methods was evaluated by calculating average magnitude of error, Pearson’s correlations, and Bland-Altman plots.

RESULTS: Criterion mean (SD, %) sedentary time was 11.5 (1.3, 72.1%) hr/day with 3.106 (t=2.19) step/day. Absolute estimates of sedentary time differed from criterion by 1.2 hr/day (10%) using a 10PM bedtime, 0.4 hr/day (3%) using the hybrid method, and 0.2 hr/day (2%) using the diary only. When normalized to wear time, sedentary time errors were small (10PM: 1.4%, hybrid: 0.6%; diary: 0.4%). Correlations between alternative and criterion estimates of absolute sedentary time were lowest for the 10PM bedtime (r=0.57, p<0.003), then hybrid (r=0.83, p<0.001), then diary (r=0.97, p<0.001), but all were highly correlated after normalizing for wear time (r=0.95, p<0.001). Bland-Altman plots showed no pattern of error and their use was positively associated with sedentary behavior but not physical activity. Specifically, high cell phone use reported 79 min/day or 15% greater sitting than low users. These associations were also independent of age and sex within this sample.

2898 Board #181 June 1 2:00 PM - 3:30 PM
The Relationship between Cell Phone Use, Physical Activity, and Sedentary Behavior in Adults Aged 18-80
Curtis Fennell1, Jacob E. Barkley2, Andrew Lepp2. 1University of Montevallo, Montevallo, AL. 2Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)
(No relevant relationships reported)

Previous research, using multiple samples of undergraduate college students, suggests cell phone use is primarily a leisure behavior which most often occurs while sitting. This same research has identified a positive relationship between cell phone use and sedentary behavior, but not physical activity. PURPOSE: To examine these relationships among individuals older than traditional college students. METHODS: An online survey was completed (N = 421; n = 255 females, 40 ± 16 years old) which assessed, using validated measures, total cell phone use, situational cell phone use (i.e. the cell phone being used for leisure or work purposes and while sitting, standing, or during physical activity), sedentary behavior (i.e., sitting time), and physical activity behavior. A tertile split was then performed and participants were placed into the following groups based upon their cell total phone use: high (n = 131, 174 ± 268 min/d), moderate (n = 138, 190 ± 36 min/d), or low (n = 152, 81 ± 33 min/d) users. RESULTS: Mean cell phone use for the entire sample was 239 ± 224 min/d. Participants reported that, on average, 61% of their cell phone use was for leisure purposes and 80% of their cell phone use occurs while seated. Linear regression found that cell use was positively associated with sedentary behavior (β = 0.157, p = 0.002), negatively associated with age (β = 0.012, p = 0.015), and not related to physical activity (β = 0.001, p = 0.068) or sex (β = 0.023, p = 0.038). Analysis of variance revealed the behavior in all phone use groups (521 ± 266 min/d) was significantly more (p = 0.006) sedentary behavior than low users (442 ± 214 min/d) with no differences (p = 0.1) between the moderate users (471 ± 253 min/d) and either the low or high use groups. CONCLUSION: Cell phone use in this sample of adults which on average were older than college age was similar to previous studies of college students. Participants reported that cell phones were primarily leisure devices and their use was positively associated with sedentary behavior but not physical activity. Specifically, high cell phone users reported 79 min/day or 15% greater sitting than low users. These associations were also independent of age and sex within this sample.
Sedentary time is ubiquitous and inversely associated with health and wellbeing. Full 24-hour objective monitoring is rare, yet necessary, to understand interrelationships between time spent asleep, sedentary and active and their influences on wellbeing.

**PURPOSE:** Our purpose was to use isotemporal substitution to examine the effects of replacing sedentary time (total and prolonged (> 30 min) bouts) with shorter sedentary bouts (< 30 min), activity, or sleep on mood and stress at baseline and changes in mood/stress over one year.

**METHODS:** Healthy young adults (age: 20-35; n=423 baseline; n=270 at one year; 48% women) wore a Sensewear ArmBand (SWA) 24 hours/day for 10 days and completed the Profile of Mood States (POMS) and the Perceived Stress Scale (PSS) at baseline and one year. Multiple linear regression models were used to measure statistically significant racial and ethnic differences for sitting while driving a vehicle. Total median time spent sitting during the weekday was 480 min/day, whereas time spent sitting during the weekend was 270 min/day. Our adjusted regression models indicated statistically significant racial and ethnic differences for sitting while talking on the phone and while watching television (Blacks = 73 and 131, Whites = 26 and 86 min/day). Total time spent sitting on the weekend was higher among Blacks than both Hispanics and Whites (Blacks = 541, Whites = 346, Hispanics = 306 min/day). However, both Blacks and Whites had higher median minutes spent in total sedentary time during the weekday than Hispanics. **CONCLUSION:** According to these data, racial and ethnic differences exist between various types of SB. Healthcare professionals should consider these differences when designing culturally tailored interventions designed to curve sedentary behavior. Supported by NIH Grants KO1CA158000, R03NR010291, and CA016672.
Sedentariness is associated with increased risks for cardiovascular diseases, cancer, type 2 diabetes, and mortality. In order to target sedentary behavior efficiently, we need to identify determinants of sedentary behavior.

**PURPOSE:** To identify subject- and lifestyle-related determinants for the domains of sedentary behavior (transportation, occupation, leisure-time).

**METHODS:** Subject characteristics (age, sex, weight, height, marital status, education level, employment, medical history) and lifestyle factors (sleep, smoking, alcohol consumption, physical activity) were collected via an online questionnaire. Sedentary time was assessed using the Sedentary Behavior Questionnaire and estimated for 9 different activities during weekdays and weekend days. Logistic regression calculated odds ratios and 95% confidence intervals (OR [95% CI]) of being sedentary during transportation, occupation and leisure time dichotomized at the 75th percentile (60 minutes/day, 275 minutes/day and 410 minutes/day, respectively).

**RESULTS:** This study included 7,648 participants (median age 55, 55% men). Being sedentary during transportation and work was associated with younger age (0.97 per year [0.96-0.98], 0.97 per year [0.96-0.97], respectively), men (1.97 [1.76-2.20], 1.58 [1.41-1.78], respectively) and employment (1.68 [1.45-1.93], 7:07 [5.54-9.03], respectively). Also BMI was associated with sedentary time (1.05 per kg/m^2 [1.04-1.07]) during transportation. Being sedentary during work was linked with a higher education level (5.29 [3.64-7.67]), and inversely related to former smoking (0.71 [0.54-0.93]) and being a cancer survivor (0.93 [0.86-0.96]). In contrast, higher amounts of sedentary time during leisure-time were associated with older age (1.03 per year [1.02-1.03]), unemployment (1.58 [1.38-1.81]), BMI (1.04 per kg/m^2 [1.02-1.06]), being unmarried (1.36 [1.18-1.56]) and worse health status (1.12 per grade [1.03-1.23]).

**CONCLUSION:** Several subject and lifestyle factors relate to a sedentary lifestyle, but characteristics markedly differ between different domains of sedentary time. Domain specific determinants should be included when designing new interventions to reduce sedentary behavior.

**INTRODUCTION:** The most recent American Diabetes Association (ADA) Physical Activity/Exercise position statement included specific guidelines to reduce sitting time and interrupt bouts of sitting at least every 30 minutes with light physical activity. In the experimental evidence underpinning these recommendations, the shortest breaks associated with health enhancement were 5 minutes of standing and 2 minutes of light/moderate ambulation. **PURPOSE:** We quantified the frequency of such health-enhancing breaks (HEBs) from sitting in the free-living environment, and characterized variations by gender, age, adiposity, and diabetes status. **METHODS:** Data were from a subsample of 727 AusDiab study (2011-12) wave 3 participants who wore the activPAL3 device for 24 days. A break (any upright event following sitting) was categorized as a HEB if it contained ≥5 minutes upright time (upright HEB) or ≥2 minutes stepping time (ambulatory HEB). Linearized variance estimation corrected for the multistage design and significance was set at p<0.05. **SUMMARY OF RESULTS:** On average (mean ± SD, per day), there were 53.1 ± 14.8 breaks in total, but only 19.7 ± 4.8 HEBs. 18.4 ± 4.5 upright HEBs and 13.6 ± 4.5 ambulatory HEBs, with many HEBs meeting both criteria. Older age, higher BMI and having diabetes were all significantly associated with fewer breaks of all types. After mutual adjustment, these associations remained significant except for the association between total breaks and diabetes, which was heavily attenuated (p=0.573). Women differed significantly from men only in having more upright HEBs; following adjustment, this association was borderline significant (p=0.050). Differences were mostly small-to-moderate (approximately 0.2 to 0.5 SD) with the greatest differences (≥0.5 SD) being for obesity and diabetes status. **DISCUSSION:** These findings in the free-living environment, using accurate accumulation measures, indicate that very few breaks from sitting are taken. This is crucial, as the accumulation of sedentary time is strongly related to health outcomes in adults.
Exercise-induced muscle damage (EIMD) symptoms may be attenuated through dietary polyphenol consumption by reducing acute inflammation and oxidative stress, protein degradation, and soreness. However, it is unclear if long-term supplementation of a multi-ingredient resveratrol-based polyphenolic compound mitigates EIMD symptoms and facilitates performance recovery. PURPOSE: To investigate the effects of a resveratrol-based polyphenolic supplement on indices of EIMD and performance recovery. METHODS: Male and female subjects completed a muscle damaging exercise protocol consisting of eccentric-loaded resistance exercise (ECRE) followed by four weeks of resveratrol-polyphenol (RES) (n=10) or placebo (CTL) (n=12) supplementation. Perceived soreness, pain threshold and tolerance, range of motion, and muscular performance were measured before and 24 and 48 hours after ECRE. RESULTS: CTL demonstrated increased resting soreness at 24 (p=0.02) and 48 hours (p=0.03) post-EIMD compared to baseline while RES reduced soreness by 24 hours post EIMD and by 48 hours soreness level returned to baseline (p=0.0003). CTL and RES demonstrated increased soreness under muscular tension at 24 (p<0.0005) and 48 hours (p=0.01) compared to baseline with no significant interaction. CTL exhibited decreased pain threshold from baseline to 24 hours post-EIMD (p=0.03). CTL also displayed decreased pain tolerance in the vastus intermedius from baseline to 24 hours post-EIMD (p=0.03) and the vastus lateralis from baseline to 24 hours post-EIMD (p=0.003) and 48 hours (p=0.003). There were no significant interactions for pain threshold or pain tolerance for any test site. In terms of lower-body power, CTL showed a significant decrease in mean power (p=0.04) and peak power (p=0.04) from baseline to 24 hours post-EIMD. There were no significant changes from baseline to 48 hours post-EIMD for CTL. RES demonstrated no changes from baseline for any post-EIMD time point. CONCLUSION: Multi-day supplementation of a resveratrol-based polyphenolic substance may support the attenuation of soreness and recovery of performance following EIMD, however its effects on skeletal muscle tissue healing and regeneration remains unknown.

FRIDAY, JUNE 1, 2018

2909 Board #192
June 1 3:30 PM - 5:00 PM
The Effects of 6 weeks of Cissus Quadrangularis Supplementation and High Intensity Exercise Training
Eric F. Noreen, Jaclyn Turet, Daniel Mallozzi. Gettysburg College, Gettysburg, PA.

Previous studies have shown that supplementation with Cissus Quadrangularis (CQ) can positively alter body composition in sedentary adults. However, it is unknown if this same effect is observed in active adults. PURPOSE: The purpose of this study was to determine the effects of 6 wks of supplementation with CQ on body composition and exercise performance in healthy adults enrolled in a crossfit class. METHODS: A total of 18 adults (9 males, 9 females, 40.2 ± 8.3 y; mean ±SD) completed this study. All subjects had been enrolled in crossfit classes prior to the study. Baseline body composition was assessed by whole body densitometry using air displacement plethysmography, and exercise performance was assessed using a time to completion 1000 m rowing test and a 3 repetition max for the standing press and back squat. Following baseline testing, subjects were randomly assigned in a double-blind manner into one of two groups: 3.2 g of CQ; or 3.2 g of a maltodextrin placebo (PL). Subjects consumed half of the daily dose at the start of the training session and the other half of the dose mid-way into the evening on an empty stomach. All testing was repeated following 6 wks of treatment. Pre to post differences were analyzed using a treatment by time repeated measures ANOVA. RESULTS: After 6 wks of treatment, there were no significant differences observed between the CQ or PL group for change in body weight (CQ: −0.2 ± 0.8 kg, PL: −0.07 ± 1.5 kg, p=0.77), fat mass (CQ: −1.12 ± 0.7 kg, PL: −1.01 ± 1.9 kg, p=0.06), fat free mass (CQ: +0.8 ± 0.7 kg, PL: −0.71 ± 5.1 kg, p=0.89), body fat % (CQ: −1.2 ± 0.7 % body fat, PL: −1.12 ± 1.9 % body fat, p=0.94), 3 rep max back squats (CQ=+16.7±11.5 lbs, PL=+16.7±13.2 lbs, p=1.0), 3 rep standing press (CQ=+8.3±6.1 lbs, PL=+7.3±1.6 lbs, p=0.08), or 1000 m rowing test (CQ=3.0±2.6 s, PL=3.9±2.3 s, p=0.81). CONCLUSION: Compared to the placebo, 6wk of supplementation with CQ did not alter the body composition or exercise performance adaptations to crossfit training in experienced crossfitters.

2910 Board #193
June 1 3:30 PM - 5:00 PM
The Effects Of Resveratrol-based Polyphenol Supplementation On Indices Of Exercise-induced Muscle Damage
Samantha Silva, Rachel Wes, Adam Osmond, Edward Jo. Cal Poly Pomona, Pomona, CA.

(No relevant relationships reported)

CONCLUSION: Multi-day supplementation of a resveratrol-based polyphenolic substance may support the attenuation of soreness and recovery of performance following EIMD, however its effects on skeletal muscle tissue healing and regeneration remains unknown.

2911 Board #194
June 1 3:30 PM - 5:00 PM
Dietary Antioxidants-contained Foods Promote Skeletal Muscle Adaptation And Reduce Fatigue Induced By Resistance Training
Aki Kawamura. Kyoto prefectoral university, Kyoto, Japan.

(No relevant relationships reported)

PURPOSE: To investigate the effects of antioxidants-contained foods on muscle adaptation and fatigue induced by resistance training. Here, we focused on three antioxidants which can promote protein synthesis.

METHODS: Twenty-six healthy men were divided into control (C) and antioxidant (A) groups. All subjects were performed a resistance training program twice a week for 10 weeks. Salmon flake, vegetable juice, and lingonberry jam which contain astaxanthin, β-carotene, and resveratrol, were provided for the A group. Body composition, nutritional intake, maximal voluntary contraction (MVC), oxygen consumption, subjective fatigue, and serum carbonylated protein were measured in pre- and post-intervention.

RESULTS: Lean body mass was significantly increased in both groups (p < 0.05). Intakes of astaxanthin, β-carotene, and resveratrol were significantly increased in the A group (p < 0.01). Although MVC (kg) of leg extension was significantly higher in post-intervention (C: 26.2 ± 1.7, A: 31.1 ± 2.1) than in pre-intervention (C: 24.2 ± 2.0, A: 25.3 ± 2.4) (C: p < 0.04, A: p < 0.005) in both groups, the degree of change was higher in the A group (C: 2.0 ± 0.8, A: 5.7 ± 1.5) (p < 0.065). Oxygen consumption (ml/kg/min) was significantly higher in post-intervention (3.6 ± 0.1) than in pre-intervention (3.4 ± 0.1) (p < 0.049) in the A group, but not changed in the C group. The degree of subjective fatigue was significantly lower in post-intervention (2.0 ± 0.4) than in pre-intervention (3.1 ± 0.6) (p < 0.028) in the A group, but not changed in the C group. In addition, serum carbonylated protein (nmol/ml) was significantly lower in post-exercise (0.12 ± 0.01) than in pre-exercise (0.15 ± 0.01) (p < 0.026) in post-intervention of the A group only.

CONCLUSIONS: Intakes of astaxanthin, β-carotene, and resveratrol may promote resistance training-induced muscle adaptation by reducing fatigue and oxidative stress, leading to higher muscle strength.

2912 Board #195
June 1 3:30 PM - 5:00 PM
Effect of New Zealand Blackcurrant Extract on Substrate Oxidation and Cycling Performance in Normobaric Hypoxia
Mark E. Willems,1 Tim Berendsen,2 Mehmet A. Sahin,3 Stephen D. Myers,4 Sam D. Blacker,4 Matthew D. Cook.1 1University of Chichester, Chichester, United Kingdom. 2Maastricht University, Maastricht, Netherlands. 3Haccettepe University, Ankara, Turkey.

(No relevant relationships reported)
km time-trial performance during cycling in normobaric hypoxia. Supplements were provided by Health Currancy Ltd (UK). Blackcurrants New Zealand Inc (NZ) provided funding for conference attendance.

Montomery tart cherries contain numerous polyphenols that have been shown to improve blood flow and blood pressure. These effects might be linked to increased nitric oxide (NO) synthesis and contribute to improved exercise performance, but this has yet to be investigated. PURPOSE: To investigate the effects of supplementation with Montomery tart cherry juice (MC) on plasma nitrite concentration ([NO$_{2}^{-}$/NO$_{3}^{-}$]), a sensitive NO biomarker, vascular function and exercise performance in trained cyclists.

METHODS: In a randomized, double blind, placebo-controlled, crossover study, 10 physically active males (mean ± SD age: 28 ± 7 years, stature 1.83 ± 0.06 m, body mass 78.0 ± 8.5 kg and VO$_{2}$peak 59.0 ± 7.0 ml/kg/min) acutely ingested 30 ml of either MC or Placebo (Pla) and completed a 6 min moderate- and severe-intensity cycling bout at 15.5$^\circ$C on two occasions for each experimental condition. The severe-intensity cycling test was continued to exhaustion on one occasion and immediately followed by a 60 s all-out sprint on the other occasion. Blood pressure, pulse wave measures, tissue oxygenation index and plasma NO$_{3}^{-}$/NO$_{2}^{-}$ were assessed pre and 1.5 h post MC and Pla ingestion.

RESULTS: Time to exhaustion was not different between conditions (P > 0.05), but peak power over the first 20 s (363 ± 42 vs. 330 ± 26 W) and total work completed during the 60 s all-out sprint (21 ± 3 vs. 19 ± 3 kJ) were 10% higher in the MC trial compared to the Pla trial (P < 0.05). Systolic blood pressure was 5 ± 2 mmHg lower 1.5 h post MC supplementation compared to Pla supplementation (P < 0.05). There were no differences in pulse wave measures, plasma NO$_{3}^{-}$/NO$_{2}^{-}$ concentration or tissue oxygenation index between the MC and Pla trials (P > 0.05).

CONCLUSIONS: These results suggest that acute supplementation with MC can lower blood pressure and improve some aspects of exercise performance, specifically end-sprint performance, in trained endurance cyclists. This data reveal a practical, non-pharmacological, dietary intervention that may have implications for enhancing vascular health and exercise performance in trained cyclists.

The consumption of blackcurrants has previously been shown to increase blood flow to the hands and eyes in humans at rest via vasodilatory mechanisms attributed to polyphenolics. While an increase in blood flow to the hands at rest may have health related benefits, such as improving resting circulation, it is unclear whether there is a benefit during fatiguing exercise. An increase in blood flow to contracting skeletal muscle during exercise may, in theory, delay the onset of fatigue by improving oxygen and nutrient delivery to the muscle while additionally increasing the rate at which metabolic waste products and biochemical agents of fatigue are removed.

PURPOSE: To investigate the effects of New Zealand blackcurrant extract on peripheral (forearm) blood flow and muscular endurance.

METHODS: Ten healthy males participated in two trials during which they ingested either blackcurrant extract (BC), delivering 1.87 mg anthocyanins/kg bodyweight, or a placebo powder (PP) containing equivalent amounts glucose, fructose and sucrose to BC; treatment allocation was randomly allocated in a balanced fashion and placebo (Pla) was used as a control. Experimental research design was adopted to analyse two versions of ginger drinks prepared with Montmorency tart cherry (MC) and Pla on plasma nitrite concentration ([NO$_{2}^{-}$/NO$_{3}^{-}$]), a sensitive NO biomarker, vascular function and exercise performance in trained cyclists.

RESULTS: There were no differences in pulse wave measures, plasma NO$_{3}^{-}$/NO$_{2}^{-}$ concentration or tissue oxygenation index between the MC and Pla trials (P > 0.05).

CONCLUSIONS: These results suggest that acute supplementation with MC can lower blood pressure and improve some aspects of exercise performance, specifically end-sprint performance, in trained endurance cyclists. This data reveal a practical, non-pharmacological, dietary intervention that may have implications for enhancing vascular health and exercise performance in trained cyclists.

PURPOSE: The purpose of this study was to examine the effects of acute golden root extract (GRE) supplementation on repeated Wingate exercise performance. METHODS: College aged female participants (age =19.0 yrs ± 0.63, height= 66.3 ± 1.8, weight= 152.8 lbs ± 19.9) were recruited for this study. In a within groups counterbalanced study design, participants were supplemented with either 1,500 mg/day of GRE or placebo (pl) over a 6 day period. RESULTS: Time to exhaustion and peak power was increased with GRE compared to Pla over the 6 day supplementation period. CONCLUSIONS: This study suggests that acute GRE supplementation improves repeated Wingate performance suggesting a role for GRE as an ergogenic aid.

PURPOSE: Sport and energy drinks for performance enhancement is a common practice among athletes. These supplements reportedly increases performance, dehydration, anxiety, headache, sleep disturbances, caffeine intoxication, withdrawal syndrome, dependence and over working of body systems leading to exploration of alternative traditional herbal supplements like ginger which has both dietary and medicinal values. The purpose of this study is to determine nutritional values of ginger drinks and ascertain their potentials for enhancing sport performance. METHODS: Experimental research design was adopted to analyse two versions of ginger drinks prepared with ginger rhizomes (Botanical Identification: U1/L001/1083) was obtained from an open market in Ilorin, Nigeria. Ethical clearance was obtained from the University of Ilorin Ethical Review Committee. The ginger rhizomes was used to prepare 2ml/98ml (H2O) and 3ml/97ml (H2O) of ginger concentration. Six samples; (i) 2ml & (ii) 3ml with 1 cube of sugar (1CS) each (iii) 2ml & (iv) 3ml with 2 cubes of sugar (2CS) each (v) 2ml & (vi) 3ml each with no sugar (NS) were prepared and subjected to proximate analysis at the Department of Industrial Chemistry, University of Ilorin, Nigeria. Statistical analysis was descriptive and nutritional components were reported as percentage per 100ml. RESULTS: Nutritional values of the ginger drinks were similar; all six samples contained protein, fat, carbohydrate, vitamins and essential minerals; the energyvalue was 168 kJ/100ml, which was richer than most energy/sport drinks commonly consumed in Nigeria. These indicated ginger drink might effectively enhance glucose supply for ATP synthesis, delay fatigue, reduce exercise-induced oxidative stress, boost recovery and energy (P < 0.05). Ginger drink containing 1CS had increased pHi100ml: 3.50% for both 2ml/98ml (H2O) and 3ml/97ml (H2O) but ginger drink containing 2CS had the same pH with NS ginger drink; 3.18% for 2ml/98ml (H2O) and 3.09% for 3ml/97ml (H2O).

CONCLUSIONS: Ginger drink is nutritious and might reliably enhance sport performance. Ginger drink with 2CS had less pH implying more potential for sport performance. A follow-up study is ongoing to ascertain the effects of ginger drink on anaerobic and aerobic capacity of athlete.
Curcumin has become a popular nutraceutical product used to decrease inflammation and recently in recovery from exercise. PURPOSE: To determine the effect of curcumin on inflammation and exercise induced muscle damage after plyometric exercise. METHODS: Participants (n=22; Age: 21.48 ± 1.63 years, Height: 176.37 ± 8.12 cm, Weight: 79.16 ± 11.30 kg) were given either curcumin (500 mg with 95% total curcuminoids) or placebo (maltodextrin) supplements twice daily for 9 days (5 days pre exercise, day of exercise and 3 days post exercise). Participants completed 5 sets of 20 drop jumps on day 6. Blood sampling and recovery tests were assessed at pre-supplementation, 24-hours pre-exercise and 0, 24, 48 and 72-hours post-exercise. Blood markers included creatinine kinase (CK) and erythrocyte sedimentation rate (ESR). Muscle damage symptoms were measured via thigh circumference, vertical jump and subjective measurement of pain (VAS) during a squat and a squat jump. RESULTS: Both groups experienced symptoms of muscle damage in the 24 hours post exercise with elevated CK (403 ± 390 ul), increased VAS pain scores with squatting (37 ± 30 mm), and pain with squat jump (36 ± 31 mm). Vertical jump also decreased over time in the placebo group (19.8 ± 4.8 inches vs. 21.4 ± 3.2 inches, placebo vs. curcumin; p = 0.01). There was no significant change over time or between groups in thigh circumference. CK was not significantly different between groups despite being ≥200 ul greater 24 hr post exercise in placebo vs. curcumin (528 ± 573 ul vs. 325 ± 178 ul, respectively). ESR was significantly greater immediately post exercise in the placebo vs. curcumin group (6.3 ± 5.6 vs. 3.4 ± 2.6 mm/hr), however these were within the normal range for this test. CONCLUSION: These data suggest curcumin may aid in pain reduction and potentially inflammation following plyometric exercise. However, future studies need to confirm the efficacy of curcumin for relieving signs and symptoms of exercise-induced muscle damage. Potential targets for future research include dosing protocols and strategies (i.e., daily dosage and required length to provide benefit). Study was supported by the Academy of Nutrition and Dietetics Foundation-McCormick Science Institute Research Award.

Blueberries have been reported to possess several anti-inflammatory properties. Previous studies examining the anti-inflammatory effect of blueberries on acute inflammation caused by exercise-induced muscle damage are largely inconclusive. This may be due to the dose used in these studies not accounting for an individual’s lean mass (LM), the compartment directly involved during exercise, when determining inflammation caused by exercise-induced muscle damage are largely inconclusive.

Rhodiola rosea is one of the most popular adaptogens claimed to promote physical/cognitive vitality, with ability to reduce the effects of prolonged and minor physical exhaustion that results in fatigue. PURPOSE: To determine the effects of Rhodiola rosea standardized extract supplementation on exercise tolerance and muscular recovery in rats submitted to a 8 weeks swimming training protocol. The study was designed to evaluate the interaction between the Rhodiola rosea supplementation and a physical training program in the variables of the enzymatic adaptations and their gene expressions related to the glycogen resynthesis after exercise. METHODS The study was conducted with 30 rats: Control group (n=10) Exercise group (n=10) and Rhodiola/exercise group (n=10). The training and supplementation protocol consisted in a 8 weeks period. In the Rhodiola/exercise group the animals received 50 mg/kg/day of the product by gavage (intragastric administration). The training protocol consisted in a swimming time of approximately 2h/day 5 days/week. The animals were also submitted to a fatigue evaluation test pre and post the 8 weeks program. The analyzed variables were: muscle and hepatic glycogen, gene expression of glycogen synthase and time to fatigue. RESULTS: Post exercise muscular glycogen content was lower in the Rhodiola+Exercise group (0,13±0,01 mg/100mg of tissue) compared with the exercise group (0,64±0,02 mg/100mg of tissue). Post exercise liver glycogen content was also lower in the Rhodiola+Exercise group (0,89±0,01 mg/100mg of tissue) compared with the exercise group (1,77±0,16 mg/100mg of tissue). Gene expression of mRNA of glycogen synthase was higher in the Rhodiola+Exercise group (1,29±0,43) compared with the exercise group (1,05±0,32). The time to exhaustion was higher in the Rhodiola+Exercise group (93,0±0,34 minutes) compared with the exercise group (71,8±0,43 minutes). CONCLUSION: 8 weeks of Rhodiola rosea supplementation improved the muscle and glycogen mobilization, increasing the time to fatigue. The Rhodiola rosea also increased the gene expression of the glycogen synthase which suggests its benefits on the recovery time after an intense exercise.

Strenuous exercise result in muscle damage. Oral curcumin appears to reduce pain associated with delayed onset muscle soreness and enhance recovery of muscle performance. PURPOSE: The purpose of this study was to examine the chronic effect of curcuma intake after a half-marathon run on indirect markers of muscle damage. METHODS: Twenty-eight men completed a double-blind randomized-controlled trial. Curcuma Longa L. extract (SG - 1,5g/ day) or placebo (PG - microcrystalline cellulose) was taken twice daily (two capsules during the lunch and one capsule during the dinner) for 4 weeks, then three capsules immediately before the half marathon. Measurements were made at baseline (M0), 20 days after supplementation (M1), immediately before (Pre), after the half marathon (Post), two hours after the half marathon (2 h post), 24 hours after the half marathon (24 h post), and 48 hours after the half marathon (48 h post), comprising: CK, LDH, ALT, AST, myoglobin and muscle soreness. RESULTS: SG decreased muscle soreness in palpation of biceps femoris 48-h after half-marathon run (P < 0.05). No difference between groups was observed in ALT, AST, CK, LDH. Myoglobin concentrations were lower after 2 h post competition in SG when compared to PG (62,1 ± 8.26 vs. 107.9 ± 18.5 mg/ L; P < 0.05). CONCLUSIONS: Curcuma Longa extract reduces muscle soreness and myoglobin concentration after a half-marathon run. Supported by CNPq Grant 484023/2013-6.
DIM is present in cruciferous vegetables and further produced after ingestion of crucifers. DIM has been studied for numerous potential health benefits. **PURPOSE:** Growing evidences indicate that a part of nutrients, such as amino acids and polyphenols, has an ability to induce mitochondrial biogenesis in skeletal muscle. We have recently developed a new strain fermented beverage (GFB) multiply containing carbohydrates, amino acids, citric acid, grain-derived phenolic acids, and so on. However, although we previously reported that post-exercise GFB intake promotes glycoenzyme supercompensation both in skeletal muscle and liver (Shibaguchi et al. 2017), the influence of this drink on mitochondrial biogenesis in skeletal muscle remain unknown. The aim of this study was to investigate the effects of GFB treatment on mitochondrial biogenesis in skeletal muscle cells.

**METHODS:** Mouse C2C12 myoblasts were grown in Dulbecco's modified Eagle's medium (DMEM) with 10% fetal bovine serum and differentiated in DMEM with 2% calf serum. After 5 days of differentiation, the myoblasts were treated with 3% sterilized water (control), 3% glucose solution (149 g/L), or 3% GFB (149 g/L glucose + fructose) containing DMEM with 2% calf serum for 72 h. Protein expression of mitochondrial-related proteins was analyzed by western blotting.

**RESULTS:** There were no significant differences in the total protein content in differentiated C2C12 cells among three groups. However, only GFB treatment tended to increase the protein level of COX-IV compared with the control (P = 0.07). A similar trend was also observed in VDAC contents, but not significant (P > 0.10).

**CONCLUSIONS:** Our results suggested that GFB treatment can induce mitochondrial biogenesis in skeletal muscle cells. Further studies are needed to clarify the mechanisms of these phenomena.
Although exercise has been shown as effective in lowering postprandial hyperglycemia in patients with type 2 diabetes, alternative approaches for those patients who face substantial barriers to physical activity remain less explored.

**PURPOSE**: The aim of this study is to compare the effects of bitter melon intake versus exercise on postprandial glucose responses in type 2 diabetic patients who receive hypoglycemic agents.

**METHODS**: Using a 2 x 2 randomized cross-over design, a total of 8 patients with type 2 diabetes were randomly assigned to two sequences of treatments, including 1) 100 ml of bitter melon juice administered 15 minutes prior to the 75-g oral glucose load; 2) 30 minutes of moderate-intensity walking performed 15 minutes after the oral glucose load. All participants completed 2-hour oral glucose tolerance test after bitter melon or exercise interventions. Linear mixed models were used to test the effects of treatment, time, and treatment x time interaction on postprandial glucose values after adjustment for covariates. General linear model was used to test incremental area under curve (IAUC) difference between bitter melon and exercise groups after adjustment for covariates.

**RESULTS**: The baseline glucose levels between bitter melon and waking conditions were similar (6.6±0.9 vs. 6.8±1.0 mmmol/L, P=0.57). There were no statistical differences for the mean glucose during the 2-h postprandial period (13.7±2.8 vs. 13.0±2.4 mmmol/L, P=0.56) and 2-h postprandial glucose IAUC (12.6±4.8 vs. 10.7±3.6 mmmol/L, h, P=0.38) between the bitter melon and waking conditions. There was no treatment x time interaction on glucose values (P=0.56). When comparing the glucose levels between the two conditions at each time point, there was also no statistical difference in glucose values at 30 minutes (12.4±2.1 vs 10.5±2.1 mmmol/L, P=0.86), at 60 minutes (14.5±2.8 vs 13.6±2.7 mmmol/L, P=0.56), 90 minutes (14.7±3.7 vs 14.4±3.3 mmmol/L, P=0.88), or 120 minutes (13.5±4.6 vs 13.4±3.9 mmmol/L, P=0.95), respectively, between bitter melon and waking conditions.

**CONCLUSIONS**: Our findings suggest that, among patients with type 2 diabetes, the intake of 100 ml of bitter melon juice can elicit similar postprandial glucose responses, as compared with performing 30 minutes of walking at moderate-intensity.

**PURPOSE**: The aim of this study was to examine the effects of long-term aerobic exercise training and ingesting pomegranate juice on selected plasma oxidative stress markers in middle-aged women with type II diabetes.

**METHODS**: In a randomized, parallel controlled design, 33 female participants (age=52±2 y; stature=157±6 cm; body mass=69.9±11.3 kg; body mass index=27.8±3.29 kg/m²; Control [CON]=11, supplement [SUP]=9, aerobic training [AT]=9, supplement-aerobic training n=8 [SAT]) participated in the study. Primary outcomes were total antioxidant capacity (TAC), superoxide dismutase (SOD), glutathione (GSH), and glutathione peroxidase (Gpx) which were measured at baseline and at week 6. All participants were asked to maintain their normal dietary intake during the study period. Participants in both AT and SAT groups were required to follow six weeks of aerobic exercise training program, three sessions a week for at least 45 min per session. Those involved in the SUP and SAT groups had a daily oral ingestion of pomegranate juice (150 ml) for a 6-week period [SUP, evening; SAT, an hour after exercise]. The CON group did not receive any intervention. Data were analyzed by GLM and presented as mean (SD).

**RESULTS**: We observed a significant increase in plasma TAC and Gpx only in SAT (p=0.001). There was a significant increase in plasma SOD in the SUP, AT, and SAT, but not in the CON (p=0.003). There was a significant improvement in plasma GSH in the SAT compared to the CON and SUP (0.034).

**CONCLUSIONS**: Our results indicate that combining aerobic exercise training and pomegranate juice supplementation can have beneficial impact on the antioxidant defense system of the body and reduce oxidative stress in middle-aged women with type II diabetes.

**Background**: Oxidative stress caused by the overproduction of reactive oxygen species (ROS) is considered to be responsible for the detrimental effects of traumatic brain injury (TBI), such as disruption of the membrane phospholipid architecture, DNA damage or dysfunction of brain-derived neurotrophic factor (BDNF). The objective of this study was to investigate whether allyl isothiocyanate (AITC) reduce inflammatory mediator levels, serum immunoglobulin G marker for blood-brain barrier and reduces edema and infarction progression in brain.

**Purpose**: We hypothesized that treatment of TBI with the antioxidant molecule, allyl isothiocyanate (AITC) in mustard oil, could provide beneficial health outcomes by alleviating the damage caused by ROS in the brain.

**Methods**: We induced TBI in male Balb/c mice using a liquid nitrogen-cooled copper probe for 60 seconds and immediately after the cold injury-induced trauma, animals were treated with either vehicle control or AITC (10 mg/kg, ActivaIT). Twenty-four hours after the injury, animals were sacrificed and tissues were collected. The volume of injury which was calculated from the cresyl violet stained coronal brain sections was significantly lower in the AITC group. BBB integrity was evaluated by serum IgG. Results: AITC significantly increased protein expressions of brain neuronal plasticity marker proteins; GAP-43, SCAM, Nrf2 and BDNF. Moreover, expressions of inflammation-related proteins; NF-kB, IL1B and IL6 and glial scar marker, GFAP, were significantly reduced in the AITC-treated group, suggesting a protective role of AITC in the neuro-inflammation processes.

**Conclusion**: In conclusion, our results demonstrate that the antioxidant molecule AITC when supplemented, significantly reduced the brain injury-induced edema, BBB integrity, and reduces the expression of inflammation-related proteins in TBI. The protective effect of AITC may be due to its antioxidant properties, which can help to reduce brain injury and improve outcome.
applied immediately after the TBI in mice, provides beneficial effects on inflammatory processes, while promoting the expressions of plasticity proteins and therefore, could be a candidate molecule for future clinical studies in human patients.

F-62 Free Communication/Poster - Ergogenic Aids VI - Other

FRI, June 1, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

2929 Board #212 June 1 3:30 PM - 5:00 PM
Carbohydrate Mouth Rinse Improves Peak Treadmill Speed and Time to Exhaustion in Overweight Adults
Moath F. Bataineh, Ayesha S. Al Dhaheri, H Khamehite University, Zarqa, Jordan. United Arab Emirates University, Al Ain, United Arab Emirates.

NO RELEVANT RELATIONSHIPS REPORTED

Mouth rinsing a carbohydrate solution improves exercise performance in athletes, but whether it benefits exercise performance in overweight adults is unknown. PURPOSE: This study determined the effect of carbohydrate mouth rinse on running performance and energy intake in overweight participants. METHODS: In a counterbalanced and placebo controlled design, 21 males (Age: 21.0 ± 1.8; BMI: 27.6 ± 1.1) with depleted glycogen stores, completed a graded treadmill exercise test to exhaustion following a 10-mg mouth rinse (CHO), placebo (PLA), or no rinse (CON), followed by standardized meal. Anthropometrics, 24-hour energy intake, heart rate (HR), oxygen consumption (VO2), and rating of perceived exertion (RPE) were measured. RESULTS: All participants completed the trials. Mean time to exhaustion in seconds per treatment was greater for CHO (1048.7 ± 91.8) versus PLA (1034.4 ± 83.6, p = 0.02), and CON (1012.2 ± 75.7, p = 0.001) (p = 0.40). Peak treadmill speed (km/h) was greater for CHO (11.5 ± 0.8) versus PLA (11.3 ± 0.7, p = 0.011), and CON (11.2 ± 0.6, p = 0.003) (p = 0.354). Subsequent trial energy intake (Kcal) was lower for CHO (575.7 ± 50.3) versus PLA (622.8 ± 78.3, p < 0.0001), and CON (615.2 ± 69.4, p < 0.0001) (p = 0.530). The 24-hour energy intake, HR, VO2, and RPE did not change (p > 0.05). CONCLUSION: Carbohydrate mouth rinse improves both running duration and speed in overweight adults with depleted glycogen stores.

2930 Board #213 June 1 3:30 PM - 5:00 PM
Short-term DHEA Intake And Hormonal Responses In Young Recreationally Trained Athletes
Katia Collomp, Corinne Buissen, Nicolas Gravisse, Soraya Belgherb, Zakaria Labsy, Manh-Cuong Do, Olivier Gagey, Sophie Dufay, Nancy Vibarel-Rebot, Michel Audran.
University of Orleans, Orleans, France. 
\textit{AFLD, Chatenay-Malabry, France.} 
\textit{University of Paris Sud, Orsay, France.} 
\textit{AGEPS, Paris, France.}

NO RELEVANT RELATIONSHIPS REPORTED

PURPOSE: Dehydroepiandrosterone (DHEA) figures on the World Anti-Doping Agency (WADA) list of prohibited substances in sport because it is assumed that athletes expect a significant increase in testosterone through DHEA administration. The literature on the hormonal effects of DHEA intake nevertheless appears to be very scant in healthy young subjects, especially women. We therefore propose to examine the effects of DHEA on adrenal and gonadal hormones in healthy young male and female recreationally trained volunteers.

METHODS: The study followed a double-blind, randomized-order crossover design. 10 healthy young men (n=10) and women (n=11), with all women using oral contraceptives, were treated daily with 100 mg of DHEA and placebo for 4 weeks. DHEA, DHEA-sulfate (DHEA-S), androstenedione, testosterone (Tes), free testosterone (fTes), dihydrotestosterone (DHT), SHBG, estrone, and cortisol were measured before, in the middle and at the end of each treatment, as were blood glucose, liver transaminases and lipid status.

RESULTS: As classically reported, the young male volunteers had significantly higher basal Tes, fTes, DHT (p<0.01) concentrations and a significantly lower SHBG concentration (p<0.05) than the young female volunteers before treatment. Women had higher cortisol and cholesterol values (p<0.05) than men. No significant change was observed for the other parameters. In the middle and at the end of DHEA treatment, we observed a significant increase in DHEA, DHEA-S, androstenedione, Tes, fTes, DHT and estrone in both men and women, but the increases in Tes and fTes were more marked in women (p<0.001) than men (p<0.05). No changes were found in the other parameters, irrespective of gender.

CONCLUSION: In young athletes, DHEA administration induces significant blood hormonal changes, some modulated by gender, which can be used as biomarkers of doping.

Grant: This project has been carried out with the support of WADA (World Anti-Doping Agency) and AFLD (French Anti-Doping Agency).

2931 Board #214 June 1 3:30 PM - 5:00 PM
Neuroprotective Effect of Omega-3 Fatty Acids on Head Trauma in American Football Athletes
K. Michele Kirk, David A. Gable, Jason D. Stone, Charity A. Anzalone, Stephanie M. Turner, Andy T. Askol, Joel A. Luedke, Andrew Jagim, Margaret T. Jones, FACSM, Jonathan M. Oliver, Texas Christian University, Fort Worth, TX. 
University of Wisconsin - La Crosse, La Crosse, TX.

Lindenwood University, St. Charles, MO. George Mason University, Fairfax, VA. (Sponsor: Margaret Jones, FACSM)

NO RELEVANT RELATIONSHIPS REPORTED

Repetitive head impacts sustained over the course of an American football season, even in the absence of a concussion diagnosis, results in a quantifiable pathophysiological response. Further, long-term exposure to repetitive head impacts may lead to neurological impairment, including the development of neurodegenerative disease. Prophylactic treatment with the omega 3 fatty acids (n-3FA) eicosapentaenoic (EPA) and docosahexaenoic (DHA) attenuates the pathophysiological response to head trauma in rodent models. PURPOSE: The purpose of this study was to examine the effect of n-3FA supplementation on a blood biomarker of head trauma over the course of an American football season. METHODS: Two National Collegiate Athletic Association American football teams volunteered for the study. Thirty-one athletes (n = 31) on one team ingested a highly bioavailable, proprietary formulation (Mindset®), containing n-3FA, including DHA (2,000 mg), EPA (560 mg), and 320mg docosapentaenoic acid (MS-Ω), over the course of an entire season. Thirty-three athletes (n = 33) from the other team served as the control. Neurofilament-light (Nf-L), a biomarker of axonal injury, was measured in blood samples obtained prior to the start of the season (T1), at the end of pre-season camp (T2), and over the course of the season (T3 - T6). Standardized magnitude based inference was used to define outcomes of interest. RESULTS: Relative to the control group (12.4 ± 5.3 pg•mL\(^{-1}\)), MS-Ω very likely attenuated Nf-L measured at the conclusion of Fall camp (8.9 ± 4.5 pg•mL\(^{-1}\)) (mean; ×/÷90% confidence limits; 1.5; ×/÷1.2 fold), a period of significant contact. Further, the attenuation relative to placebo was likely maintained at T3 (1.3; ×/÷1.2 fold), T4 (1.3; ×/÷1.2 fold), T5 (1.3; ×/÷1.3 fold), and T6 (1.2; ×/÷1.3 fold) corresponding to sampling time points during the competitive season. CONCLUSION: These data indicate that over the course of the season the head trauma sustained by American football athletes does result in a quantifiable pathophysiological response as measured by a biomarker of axonal injury. Further, administration of MS-Ω may impart neuroprotective qualities as evidenced by lower levels of Nf-L. FUNDING: This study was funded in part by STRUCt Nutrition, Missoula, MT, USA.

2932 Board #215 June 1 3:30 PM - 5:00 PM
A Pre-Workout Supplement Does Not Improve 400 M Sprint Running or Bicycle Wingate Test Performance in Recreationally Trained Individuals
Gregory A. Brown, FACSM,1 Brianna Jackson,2 Brian Szekely,3 Trevor Schramm,1 Brandon S. Shaw,1 Ina Shaw,1 The University of Nebraska at Kearney, Kearney, NE. 2 AT Still University, Mesa, AZ. 3 Georgia Southern University, Statesboro, GA. 4 Southern College of Optometry, Memphis, TN. 5 University of Zululand, Kwazulu-Natal, South Africa.

NO RELEVANT RELATIONSHIPS REPORTED

Pre-workout supplements are often consumed as a drink and are purported to delay the onset of fatigue, increase exercise performance, and are marketed to recreational and competitive athletes. Pre-workout supplements typically contain caffeine and other ingredients that are supposed to act as stimulants. However, previous research has been inconclusive on the effects of pre-workout nutritional supplements on exercise performance. PURPOSE: The purpose of this study was to evaluate the effects of a commonly used pre-workout supplement on 400 m sprint running and bicycle ergometer Wingate test performance in recreationally trained college age participants.

METHODS: For the Wingate testing, 60 minutes after consuming a pre-workout supplement or a similarly flavoured placebo eight recreationally trained college aged males engaged in a 30-second bicycle Wingate ergometer test. For the 400 m sprint running, 60 minutes after consuming a pre-workout supplement or a similarly flavoured placebo 16 college aged participants (9 male and 7 female) engaged in two 400 m running sprints on an indoor track with the sprints separated by 10 minutes of passive rest.

RESULTS: During the Wingate testing there were no differences in peak power (848.85 ± 210.26 W, 866.92 ± 212.99 W), decline in power (48.6 ± 12.2%, 45.0 ± 11.3%), or change in blood lactate concentrations (8.9 ± 5.4 mmol/L, 8.4 ± 6.4).
4.3 mmol/L) between the placebo and pre-workout, respectively. During the 400 m sprint running, there were no differences in time for the first (78.1 ± 16.1 sec, 80.0 ± 15.9 sec) or second (138.2 ± 22.0 sec, 138.0 ± 22.0 sec) trials for men between the placebo and pre-workout, respectively. During the 400 m sprint running, there were no differences in time for the first (97.3 ± 11.0 sec, 93.9 ± 10.4 sec) or second (96.4 ± 11.5 sec, 95.1 ± 12.4 sec) trials for women between the placebo and pre-workout, respectively.

**CONCLUSION:** In spite of containing ~120 mg of caffeine and other purported nutrient data indicate that consuming a common pre-workout supplement does not improve 400 m sprint running or bicycle Wingate test performance, or alter glycolytic metabolism, in recreationally trained individuals. The lack of ergogenic effect could be due to insufficient caffeine content combined with lack of stimulatory effects from the other ingredients.

**Results and discussion**

Consumption of various nutritive supplements in isolation have shown to enhance resistance training (RT) adaptations. What remains unclear is the efficacy by which a MIES blend of such ingredients facilitates improvements in skeletal muscle performance during RT. What remains unclear is the efficacy by which a MIES blend of such ingredients facilitates improvements in skeletal muscle performance during RT.

**PURPOSE:** To investigate the effects of a proprietary MIES comprised of BCAA, beta-alanine, creatine, glutamine, and black pepper fruit extract on adaptive changes in body composition during a high-volume RT regimen.

**METHODS:** Male and female subjects completed a 6-week periodized resistance training program consisting of 3 sessions per week with 48 hours of rest between each session. MIES and PLA consumed one serving of the MIES and placebo, respectively, immediately post-workout and before sleep on training days, and two servings during rest days. Subjects underwent laboratory assessments for maximum upper and lower body strength and power. A 7-point Likert scale (1 = low, 5 = high) questionnaire to determine feelings of fatigue immediately prior to ingesting the substance (baseline), 30 minutes post-ingestion (immediately pre-race), and 5 minutes post-race. For the second session, subjects ingested the opposite substance (placebo or placebo) and underwent the same testing procedures (including time of day) as the first session. Race times were compared between the supplement and placebo conditions using a paired-samples t-test. In addition, a two-way ANOVA with repeated measures was used to compare the feelings of fatigue among the conditions (supplement vs. placebo) at the common time points (baseline, pre-race, post-race).

**RESULTS:** The results indicated there was no significant (P > 0.05) difference in 5-km race time between the supplement (23.62 ± 2.08 min) and placebo (23.51 ± 1.97 min) conditions. For the feelings of fatigue, there was no significant condition x time interaction or main effect for condition, but there was a main effect for time. Specifically, the marginal means (collapsed across conditions) for fatigue were significantly (P < 0.05) greater post-race (3.3 ± 0.8) than at baseline (2.3 ± 0.7) and pre-race (2.4 ± 0.7).

**CONCLUSIONS:** The findings of the present investigation indicated that the pre-workout supplement provided no ergogenic effect on 5-km race time or feelings of fatigue when administered on an acute basis in recreationally-active males and females.
Firefighter personnel are trained to respond to emergencies and are essential to community safety. Though dietary supplementation use can improve overall health and performance, limited information exists on supplement use among firefighters. Understanding supplement use may aid in health and physical performance.

**PURPOSE:** To explore supplement use in volunteer firefighters.

**METHODS:** A national sample of 363 volunteer firefighters (aged 18-77, 38.1 ± 12.5 years, 79.3% male, 95% Caucasian) in a wellness program were surveyed on their frequency and reasons for supplement use over the past six months. Questions asked about supplements such as multivitamins/minerals, individual vitamins (e.g., Vitamin C, Vitamin D), individual minerals (calcium, iron), performance enhancers (glutamine, CoQ10), sports bars/gels, and energy drinks. Stata version 15 was used for data analysis.

**RESULTS:** Of those reporting supplement use, 78 reported using only one supplement, while 277 reported using multiple supplements. Performance enhancers were used by 31 participants (8.5%) at least twice a week; reasons for consumption included increased physical performance, improved overall health, and to prevent health problems. Multivitamin/mineral supplements were consumed by 132 firefighters (36.4%) at least twice a week; reasons for consumption included improved overall health, prevent health problems, and increase heart health (cholesterol/blood pressure). Sports bars/gels were used by 86 firefighters (23.7%) at least twice a week; reasons for sports included increased physical performance, improved overall health, and to lose weight. Energy drinks were consumed by 124 firefighters (34.2%) at least twice a week; reasons for consumption included increased physical performance, cognitive function, and relaxation/stress/mental health.

**CONCLUSIONS:** Overall, most firefighters who reported supplement use did so for improvements in overall health and to prevent health problems. Interestingly, firefighters in this study reported higher overall supplement use than other tactical adult populations (i.e., military personnel: 55-61%). Future investigations should examine the usage and effectiveness of performance-enhancing supplements on health and occupational performance in firefighters.

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**Official Journal of the American College of Sports Medicine**

**Board #220**

**June 1 3:30 PM - 5:00 PM**

**An Examination of Supplement Use in Volunteer Firefighters**

Melizita Ramirez, Brittany S. Hollerbach, 66502, Sara A. Jalneke, Christopher M. Karpusz, Katie M. Heinrich. *Kansas State University, Manhattan, KS. National Development and Research Institutes, Leawood, KS. 1University of Texas at Houston, Houston, TX.*

(No relevant relationships reported)

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**Board #221**

**June 1 3:30 PM - 5:00 PM**

**Use Of Analgesics For Exercise-associated Pain In Collegiate Athletes**

Christi Brewer. *Eastern Washington University, Cheney, WA.*

(No relevant relationships reported)

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**Board #222**

**June 1 3:30 PM - 5:00 PM**

**Specific Bioactive Collagen Peptides in Combination with Resistance Training Improve Body Composition in Untrained Subjects**

Steffen Oesser1, Denise Zdzieblik1, Michael Schunck1, Daniel König1. *Collagen Research Institute, Kiel, Germany. 2University of Freiburg, Freiburg, Germany.*

(No relevant relationships reported)

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**Board #223**

**June 1 3:30 PM - 5:00 PM**

**30 Days of Probiotic Supplementation: The Effect Up On Athletes Immunity After a Marathon Race**

Geovana SF Leite1, Edgar Tavares2, Helena AP Batatinha1, Ayane S. Resende1, Marília C. Scelacender1, Ricardo A. Fock1, José C R Neto2, Ronaldo V T dos Santos1, Antonio H. Lancha Junior2. *1University of São Paulo, São Paulo, Brazil. 2Federal University of São Paulo, São Paulo, Brazil.*

(No relevant relationships reported)

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Prolonged strenuous exercise cause an acute increase in leukocytes, including lymphocytes, neutrophils and monocytes. Evidences have suggested that probiotics can enhance athletes’ immunity. **PURPOSE:** Investigate the effect of a probiotic supplementation on white blood cells count after a marathon race. **METHODS:** Eight male athletes that participated in a marathon race were randomly assigned to either a probiotic group (PR) or placebo group (PL). It was collected blood samples before the supplementation period (baseline), one day before the marathon (BM), one hour after the race (AR), and 7 days after the marathon(7+)for white blood cells differential count. The data was analyzed using ANOVA with repeated measures and a Bonferroni’s post-hoc, p< 0.05. **RESULTS:** Leukocytes and Monocytes presented a significant increase AR (Leu: PR=11.20±2.94,PL=12.62±4.27 mm²; Neut=PR=11.20±2.94,PL=12.62±4.27 mm²).
MCTs. Future research should investigate potential supplementation effects over longer periods of time.

CONCLUSION: The ingested supplemental MCT intake reduced cognitive performance parameters, yet did not appear to benefit or harm executive cognitive function when taken up to 12 g/day. MCTs are likely not linked to rapid decision making and reaction time in sport.

PURPOSE: The present study was conducted to examine the effects of acute medium-chain triglyceride (MCT) consumption on behavioral cognitive function during a task often linked to rapid decision making and reaction time in sport.

METHODS: Thirty recreationally active college students (M=19, F=11) aged 18-25 participated in this study, which consisted of two experimental days, in a double-blind, randomized-order, crossover design. During each laboratory visit, subjects consumed a fruit smoothie, mixed with an MCT supplement, consisting primarily of coconut oil, or a placebo (the same smoothie, without the supplement). Executive cognitive function testing (using a modified Flanker task) was performed two hours later. To prevent any latent effects of the MCT supplement, trials were separated by at least 72 hours. Dependent variables included accuracy and reaction time on the executive cognitive function task.

RESULTS: Paired-sample T-tests were conducted for Flanker task accuracy and reaction time. MCT consumption did not affect response accuracy (Mdiff (SD)=9.11; Mconf (95% CI)=93.85; P<0.36) or reaction time (Mdiff (SD)=412.60 ms; Mconf (95% CI)=417.53 ms; P=0.71). Further separating the data into sub-sections, including the interference scores between congruent and deviant response accuracies (Mdiff (SD)=12.13; Mconf (95% CI)=172.03; P=0.22), and the interference scores between congruent and deviant reaction times (Mdiff (SD)=46.73 ms; Mconf (95% CI)=46.39 ms; P=0.29), also did not yield any significant results.

CONCLUSIONS: Acute medium-chain triglyceride (coconut oil) consumption did not appear to benefit or harm executive cognitive function when taken up to two hours before a cognitive task, beyond the effects associated with carbohydrate supplementation (in the form of a fruit smoothie), especially if consumption did not lead to gastrointestinal distress. This implies that physical activities relying on rapid decision making and reaction time are unlikely to be affected by a single bolus of MCTs. Future research should investigate potential supplementation effects over longer periods of time, or in clinical populations that may benefit from MCT consumption.

Molecular hydrogen (H2) improves body composition, metabolic profiles and mitochondrial function in overweight women, yet no studies so far evaluated the effectiveness of H2 for improving exercise capacity in this population.

PURPOSE: To examine the effects of 28-days supplementation with 1 L per day of hydrogen-rich water on exercise capacity and quality of life in overweight mid-age women.

METHODS: Twelve women (age 53.8±13.0 years, BMI 28.8±3.3 kg/m², VO2max 22.3±3.7 ml/kg/min) participated in this randomized, placebo-controlled, cross-over, repeated-measure interventional study. All participants were allocated in a double-blind design to receive two randomly assigned trials: first group received 1 L per day of HRW (supplying ~9 ppm of H2), while the second group received placebo (tap water). Participants were evaluated at baseline, and following 28 days of intervention. The primary endpoint was the change in cardiorespiratory endurance (VO2max) assessed at baseline and at 28 days follow-up. Secondary outcomes included change from baseline to end of treatment in values for work capacity, impact of weight on quality of life (IWOQI), and hematological biomarkers. Participants were asked to maintain their usual lifestyle, dietary intake and not to use other dietary supplements during the study. RESULTS: HRW intervention significantly improved VO2max, as compared to placebo at 28-day follow-up (26.2±4.8 ml/kg/min vs. 24.2±4.1 ml/kg/min; P<0.03). Differences were found for time to exhaustion and total work completed during an incremental exercise, with HRW resulting in improvement of both variables as compared to placebo (P<0.05). IWOQI scores and hematological markers were not affected by either intervention (P>0.05). Results indicate that HRW can be used as an alternative hydration formulation to positively affect exercise performance in mid-age overweight women.

Supported by the Serbian Ministry of Education, Science and Technological Development (175037), the Provincial Secretariat for Higher Education and Scientific Research (141-451-710), the University of Novi Sad Faculty of Sport and PE (2015 Award) and HRW Natural Health Products Inc, New Westminster, BC, Canada. Clinical trial registration www.clinicaltrials.gov, ID number NCT02832219.
Sickle cell disease has a detrimental impact upon health-related quality of life (HRQL). No study has determined if vitamin D supplementation can improve HRQL in this population using the Pediatric Patient-Reported Outcomes Measurement Information System (PROMIS). PURPOSE: To assess the impact of vitamin D supplementation on HRQL over a 12-week period in 5- to 17-year-old African American children with sickle cell disease (SCD-SS). METHODS: Subjects were randomized to oral daily doses (400 vs. 7000 IU) of cholecalciferol (T) and evaluated at 6 and 12 weeks for changes in vit D status (serum 25(OH)D) and HRQL using PROMIS pediatric short forms. For PROMIS assessment of item response theory-based T-scores (population mean of 50 and SD of 10) in the depressive symptoms, fatigue, and pain domains, a higher T score indicates a worse outcome and in the mobility, peer relationships, and upper-extremity function domains a lower T score indicates a worse outcome. RESULTS: The mean 25(OH)D at baseline was 19.2±7.2 in subjects with SCD-SS and 22.3±9.3 in healthy subjects. After 12 weeks of supplementation, the mean increase in 25(OH)D was 25.6±22.3 ng/mL in subjects with SCD-SS and 20.5±17.5 ng/mL in healthy subjects (both P<0.05). In subjects with SCD-SS by 12-wks (n=20), significant (all P<0.05) reductions in pain (54.4±13.3 vs. 48.4±14.8), fatigue (51.7±11.4 vs. 46.4±14.0) and depressive symptoms (43.1±8.1 vs. 39.1±7.3) and improvement in upper-extremity function (56.1±9.2, 45.9±10.9 vs. 51.2±8.7) were observed, with no difference (both P>0.05) in mobility (53.1±6.2 vs. 55.7±5.4) or peer relationships (56.9±7.7 vs. 57.8±11.0). In healthy subjects by 12 weeks, there were no differences (P>0.05) in pain (48.6±8.7 vs. 48.9±7.3), depressive symptoms (41.5±8.2 vs. 39.9±9.4), mobility (57.3±3.3 vs. 57.3±3.7) or peer relationships (56.0±7.3 vs. 56.1±9.2), but significant (P<0.05) reductions in fatigue (40.3±10.3 vs. 36.3±10.0) and improvement in upper-extremity function (50.6±8.8 vs. 53.2±8.8). CONCLUSIONS: Daily high-dose vitamin D supplementation for African American children with and without SCD-SS improved HRQL. Supported by K12 (KL2RR024132), K23 (K23HL114637), (UL1TR000033), CHOP RAG Pilot Grant, GI Research and Education Fund, and Nutrition Center.
PURPOSE: To assess the relationships between measures of fitness and injury risk in EOD operators.

METHODS: Fifty-one active duty men (ages 35.6 ± 10.9 years) were evaluated for body fat percentage (BF%) by dual-energy x-ray absorptiometry, CRF (maximum volume of oxygen uptake [VO_{2max}]), muscular strength (one-repetition max [1-RM]), back squat and bench press, and injury risk assessments (FMS, YBT). A quartile split for VO_{2max} established the bottommost, low, high, and topmost VO_{2max} groups. ANOVA and Pearson product-moment correlations were used to evaluate fitness and injury risk associations.

RESULTS: Means ± SE were as follows: BF% = 17.9 ± 0.5, VO_{2max} = 47.0 ± 0.9 mL/kg/min, time on treadmill (TT) = 12.2 ± 0.2 min, time of ventilatory threshold (VT) = 6.2 ± 0.2 min, FMS total score = 15.8 ± 0.3, and YBT left composite (LC) = 99.0 ± 1.0% and right composite (RC) = 98.8 ± 1.0%. Mean FMS scores were different between quartiles (F[3,47] = 5.182, p < .01), where the bottommost VO_{2max} group had the lowest scores. YBT was also different between quartiles: LC (F[3,47] = 3.704, p < .05) and RC (F[3,47] = 2.899, p < .05), where the highest VO_{2max} group had the greatest values. Associations with FMS were BF% (r = −.33, p < .05), TT (r = −.35, p < .05), and VT (r = −.30, p < .05). Correlations with LC and RC were BF% (r = −.37 for both, p < .01) and YBT (r = −.37, p < .01). No associations with 1-RM were observed.

CONCLUSION: This study is consistent with accruing data that indicate more fit individuals have a lower injury risk. While strength is a critical element of overall fitness, CRF and BF% may better predict MSKI risk. Due to their unique and arduous operational demands, the EOD operator can further reduce injury risk by maintaining peak physical condition.

2949 Board #232 June 1 3:30 PM - 5:00 PM
Adrenal Stress and Performance during Military Survival Training
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(NO relevant relationships reported)

PURPOSE: The purpose of this research study was to evaluate neuroendocrine and physical performance responses in sailors and Marines undergoing U.S. Navy Survival, Evasion, Resistance and Escape (SERE) training.

METHODS: 20 men (Age: 25.3 ± 3.6 years; Height: 178.1 ± 6.1 cm; Weight: 83.7 ± 12.6 kg) took part in the study. Men were further split into high fit (n=10) and low fit (n=10) subgroups based on physical fitness test scores. Blood samples were obtained at three timepoints (T1: baseline, T2: stress, T3: recovery), and were analyzed for plasma epinephrine, plasma norepinephrine, plasma dopamine, serum cortisol, serum testosterone, and plasma neuropeptide Y. Vertical jump and handgrip tests were performed at T1 and T2.

RESULTS: For the group as a whole (n=20), stress hormone concentrations were significantly elevated at T2, with a concomitant reduction in testosterone concentrations. NPY concentrations did not increase at T2, but decreased significantly at T3. Subjects maintained performance on the vertical jump and handgrip tests from T1 to T2. Significant between group differences were observed in norepinephrine (high fit: 3530.6 ± 2146.54 pmol/L, low fit: 907.16 ± 3020.85 pmol/L) and NPY (high fit: 169.2 ± 58.59 pmol/L, low fit: 123.02 ± 88.86 pmol/L) responses at recovery (T3).

CONCLUSIONS: This study revealed that despite differential catecholamine and NPY responses during recovery, the SERE training course resulted in significant increases in stress hormone concentrations in all subjects regardless of physical fitness level, with no reductions in physical performance measures.

2950 Board #233 June 1 3:30 PM - 5:00 PM
Differences between U.S. Army Trainees and Active Duty Soldiers in Physically Demanding Occupational Tasks
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(NO relevant relationships reported)

The training implemented during initial entry training (IET) for combat arms trainees (up to 16 weeks) is designed to sufficiently optimize performance of physically demanding occupational tasks. Trainees must be physically capable of performing the tasks within their jobs to the minimal acceptable performance standard, as delineated by U.S. Army Training and Doctrine Command. PURPOSE: To compare U.S. Army trainees to active duty soldiers performing physically demanding occupational tasks. METHODS: 192 U.S. Army male combat arms trainees (TRs) at the end of their IET and 369 active duty male combat arms soldiers (ADs) both performed the sandbag carry (SBC), casualty drag (CD) and move under direct fire (MUF) tasks. During the MUF tasks, subjects wore personal protective equipment (PPE; ~32 kg) while lifting and carrying 16 pre-filled 18-kg sandbags a distance of 10m to build a fighting position (4 long x 2 wide x 2 high). For the CD subject wore PPE, and a weapon while dragging a 123-kg simulated casualty 15m as fast as possible (60-sec time limit). Time was recorded and later calculated as velocity (m/s). During MUF subjects wore PPE and a weapon to perform a series of combat rushes covering 100m as fast as possible (min).

CONCLUSIONS: Although majority of the TRs met the minimal acceptable performance standards on the three tasks, ADs performed the SBC and CD faster. This could be due to ADs having more experience performing the tasks. While further training occurs at TRs first duty station, TRs may benefit from additional occupational task training during IET. 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.

2951 Board #234 June 1 3:30 PM - 5:00 PM
Effect of a Simulated Tactical Occupational Stressor on Physiological Stress Index and Blood Pressure
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(NO relevant relationships reported)

PURPOSE: As a firefighter performs in live-fire suppression, it is critical to understand to the degree their physiological stress is exacerbated by the physical work they are required to conduct to reach a potential victim of an emergency. The purpose of this study was to evaluate physiological stress index (PSI) in response to a simulated firefighting occupation workload.

METHODS: Ten healthy male adults participated in this study. While wearing proper testing attire, participants completed a simulated fire stair climb (SFSC) by completing two consecutive 3-min workloads on a Matrix ClimbMill (Matrix Fitness USA, Cottage Grove, WI) at a stepping rate of 60 steps/min. The participants completed this protocol under four conditions, with some conditions including the wearing of a 34.04 kg (75 lbs) weighted vest to simulate the wearing of personal protective equipment (PPE) typically worn by a firefighter. Some conditions involved the inclusion of a color-word interference test (CWIT) as a distracting mechanism.

PSI was evaluated by continuously monitoring HR and core temperature by using CorTemp® ingestible thermometers and radio receiver (HQ, Inc., Palmetto, FL). PSI was calculated using a previously published and validated equation (Moran et al., 1998). Blood pressure was measured pre-exercise, following initial 3 min workload, and following completion of total workload.

RESULTS: A repeated-measures ANOVA showed that there was a significantly different PSI when comparing conditions (p = 0.001). A significantly elevated PSI per min was exhibited during all six minutes of exercise for both the weighted vest and weighted vest + CWIT conditions compared to exercise conditions without the vest. Systolic blood pressure also exhibited a significantly different degree of elevation in the same manner (p = 0.006).

CONCLUSIONS: Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly elevates PSI above what would be expected by the exercise alone. These findings suggest that firefighters are potentially at a substantial degree of physiological stress from the exercise and weight of gear alone. Further work should be conducted to further evaluate the usefulness of PSI as a means to monitor firefighters during actual or simulated fire suppression.
followed by a task requiring substantial cognitive attention. The purpose of this study was to evaluate rating of perceived exertion (RPE) and markers of physiological stress in response to a simulated firefighting occupation workload.

METHODS: Ten healthy male adults participated in this study. While wearing proper testing attire, participants completed a simulated fire stair climb (SFSC) by completing two consecutive 3-min workloads on a Matrix C7xe ClimbMill (Matrix Fitness USA, Cottage Grove, WI, USA) at a stepping rate of 60 steps/min. The participants completed this protocol under four conditions, with some conditions including the wearing of a 34.04 kg (75 lbs) weighted vest to simulate the wearing of personal protective equipment (PPE) typically worn by a firefighter. Some conditions involved the inclusion of a color-word interference test (CWIT) as a distracting mechanism. RPE was measured each minute during exercise using Borg’s 15-point (6 – 20) scale (Borg, 1982; Borg, 1998). Blood lactate was measured following initial 3 min workload and following completion of total workload.

RESULTS: A repeated-measures ANOVA showed that there was a significantly different RPE when comparing conditions (p < 0.0005). A significantly elevated RPE was obtained in the final 20 s of each workload.

CONCLUSIONS: Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly raises RPE above what would be expected by the exercise alone. Blood lactate levels mirrored these results. These findings suggest that firefighters are potentially at a substantial degree of perceived stress from the exercise and weight of gear alone.

2953 Board #236 June 1 3:30 PM - 5:00 PM
Effect of a Simulated Tactical Occupation Stressor on Inflammatory Immune System Markers of Physiological Stress and Inflammation
Ariel S. Tomes, N. Anderson, Andrew J. Hussey, Wesly A. Neal, Damon M. Wilcoxen, William J. Bradshaw, Dana N. Lucas, Harish Chander, Scott W. Arnett, Western Kentucky University, Bowling Green, KY, Mississippi State University, Mississippi State, MS. (Sponsor: Scott Lyons, FACSM)

PURPOSE: Further work needs to be conducted on the effects exercise or physical exertion has on the body in regards to reaction time (RT). This becomes especially important to occupations who must complete a strenuous physiological workload while making potential life-and-death decisions that require a quick response. The purpose of this study was to evaluate RT in response to a simulated firefighting occupation workload.

METHODS: Ten healthy male adults participated in this study. While wearing proper testing attire, participants completed a simulated fire stair climb (SFSC) by completing two consecutive 3-min workloads on a Matrix C7xe ClimbMill (Matrix Fitness USA, Cottage Grove, WI, USA) at a stepping rate of 60 steps/min. The participants completed this protocol under four conditions, with some conditions including the wearing of a 34.04 kg (75 lbs) weighted vest to simulate the wearing of personal protective equipment (PPE) typically worn by a firefighter. RT was evaluated by employing a color-word interference test (CWIT) to evaluate how quickly a participant could react to distracting or incorrect visual stimuli to provide a response. The ability to answer quickly as well as accurately was assessed during the CWIT.

RESULTS: A repeated-measures ANOVA showed that there was a significantly different overall RT (p < 0.001) during the SFSC while wearing the weighted vest being significantly worse than baseline (p = 0.016). This difference was mirrored in RT during correct responses (p = 0.025) exhibiting a slowed RT while wearing the weighted vest (p = 0.106). CWIT accuracy (p = 0.159) or RT during incorrect responses (p = 0.630) was not shown to be significantly different from baseline.

CONCLUSIONS: Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly impairs RT. These findings suggest that the decision-making ability of tactical-style occupations could be hampered in response to such a workload-induced physiological stress, exposing themselves and potential victims they are attempting to help to further harm.
CONCLUSIONS: %HRR distinguished among external loads carried on an experimenter-paced task (FM). %HRR did not vary with load on a self-paced maximal effort task (OC), but, in conjunction with completion times, %HRR provided critical data on soldiers’ physical exertion.

Chronic exposure to multifactorial stress, such as that endured by elite military operators, may lead to overtaining syndrome and negatively impact hormonal regulation. In acute settings (<6 mos), military training has been shown to lead to hormonal dysfunction; however, less is known about the consequences of long-term military training. PURPOSE: The purpose of this study was to determine the chronic effects of military operations and training on the hormone profile of elite military operators. METHODS: Active-duty elite US military operators (n = 65, age = 29.8 ± 1.0 yrs, height = 178.4 ± 0.7 cm, weight = 85.1 ± 2.0 kg) concomitantly engaged in rigorous physical training were recruited to participate in the study. Basal plasma concentrations of luteinizing hormone (LH), total testosterone (TT), free testosterone (FT), sex-hormone binding globulin (SHBG), cortisol, thyroid stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4) were obtained between 0600-1000 hrs. Data were analyzed for correlations and compared against normative reference values; all data are presented as mean ± SE. RESULTS: Mean LH, TT, FT, SHBG, cortisol, TSH, T3, and T4 for all subjects were: 3.4 ± 0.2 IU/L; T3, 13.5 ± 0.9 mmol · L⁻¹; 28.2 ± 1.2 pmol · L⁻¹; T4, 94.2 ± 6.4 mmol · L⁻¹; 441 ± 26.4 mmol · L⁻¹; 3.5 ± 0.7 mIU · L⁻¹; 150 ± 0.9 ng · dL⁻¹; and 7.6 ± 0.2 ng · dL⁻¹, respectively. There was a significant positive correlation between TT and cortisol (R² = 0.07; y = 0.0993 ± 9.3564; P < 0.05). In addition, 43% of the participants (n = 28) had TT below age-based normative reference ranges. Those with lower than normal TT (8.2 ± 0.3 vs. 17.6 ± 1.3 mmol · L⁻¹; P < 0.01), also had lower FT (24.4 ± 1.9 vs. 31.1 ± 1.4 pmol · L⁻¹; P < 0.01), cortisol (389 ± 39.1 vs. 497.2 ± 33.2 pmol · L⁻¹; P < 0.05) and TSH (1.57 ± 0.22 vs. 1.54 ± 0.66; P < 0.05) averaged factors (AF) of positive hardiness and lower on alienation (control, commitment and challenge) and three negative (alienation, powerlessness and secondary gain) subscales. CONCLUSION: These results indicate that military operations and training may place a large burden on the operators and depress or alter the hypothalamic pituitary, adrenal, gonadal and thyroid axes. Further research need be conducted to determine what, if any, consequences these differences may cause.

CONCLUSIONS: Recent research has suggested that the role of countermeasures to overcome the heat stress exposure during military operations and training may be of great importance. Egyptian military men are exposed to the environment temperature up to 30°C, and relative humidity reaches to 60% during their training time. PURPOSE: To assess the effect of heat stress on the performance and physical properties of military men during their training. METHODS: Thirty healthy military men (age: 22 ± 0.7 yrs) completed a 20-mile march on a hot day (25°C ± 3°C; 25% RH). They were divided into two groups; in the control group, participants maintained their physical activity (PA) in a natural environment, and in the experimental group, they were exposed to heat stress during the march. RESULTS: There were no significant differences in the distance covered (control: 28.8 ± 1.79 km vs. experimental: 28.7 ± 1.86 km; P > 0.05), average speed (control: 4.67 ± 0.14 km/h vs. experimental: 5.09 ± 0.20 km/h; P > 0.05), and running time (control: 3.95 ± 0.12 h vs. experimental: 3.96 ± 0.13 h; P > 0.05). However, there were significant differences in the heart rate (control: 176 ± 7.6 bpm vs. experimental: 196 ± 9.2 bpm; P < 0.05), and mean blood pressure (control: 122 ± 9.6 mm Hg vs. experimental: 132 ± 9.8 mm Hg; P < 0.05), and VO2max (control: 43.8 ± 2.1 ml/kg/min vs. experimental: 42.3 ± 2.0 ml/kg/min; P < 0.05). CONCLUSION: The results of this study suggest that the heat stress during military training may be a factor that affects the performance and physical properties of military men.
levels. RESULTS: Baseline EDA values for high, medium, and low CE did not differ (p > 0.05). From 25% to 100% VO_{2max} mean percent changes in EDA from baseline were +85.2 to +121.6%, with a subsequent decline in seated recovery (+105.8%) (p < 0.001, n² = -0.28). An interaction between CE and exercise workload was observed (p = 0.022, n² = -0.13). Specifically, low CE displayed a steep linear increase in EDA from 25% to 100% VO_{2max}, followed by a steady decrease into recovery. In contrast, the high CE EDA response was blunted, with a peak occurring at 75% VO_{2max} after which it declined through 100% VO_{2max}. The medium CE EDA response mirrored low CE until 75% VO_{2max} and then declined through seated recovery. CONCLUSION: Dose-dependent effects of CE were demonstrated on EDA response to exercise stress. The low-CE pattern is consistent with the literature characterizing healthy plasma catecholamine responses during exercise stress, as well as with our prior research illustrating EDA responses in aerobically fit individuals. High-CE individuals, by contrast, exhibit a less adaptive response. Collectively, these findings imply that CE disrupts the sympathetic response to acute exercise stress.

Field march performance (FMP) is an important skill of ground combat forces. Aerobic ability, "GRIT", over strength & perhaps lean body mass are important factors influencing FMP. PURPOSE: Investigate factors impacting FMP in a military school selection process of U.S. Service Academy Cadets. METHODS: 230 relatively fit subjects participated in a one-day military school selection tryout culminating with an ~8.5 mile FMP carrying ~35-lb load on terrain including several elevation changes each ~500 ft. Specific multiple regression analysis investigating factors influencing the top & bottom 10% FMP (n = 46) of the larger sample. RESULTS: Analysis revealed that service academy career run time was the most potent factor impacting FMP; multiple R = .79, adjusted R² = .62. Threshold measures appear present; 12:30 or faster 2MR (13 vs 0 subjects) and 12:30 or faster on an indoor obstacle course test (IOCT; 15 vs 2 subjects) reside in the Top 10% fastest FMP group. Body mass (adjusted R² = .02) and pull-ups (adjusted R² = .02; a questionable surrogate for strength) did not impact FMP. Descriptive data: 87.9 ± 8.8 yrs; height = 69.5 ± 1.2 in; mass = 112 ± 7.8 lbs. CONCLUSION: To quantify changes in ethical decision-making following MCMAP. We would suggest future work not only examine the transient changes in decision making in response to an acute stressor, but also examine how time in service changes the individuals ethical decision-making process. Supported by a grant through the Office of Naval Research.

Lowest extremity (LE) musculoskeletal injuries (MSI) are a common and costly occurrence in US NAVY Sea, Air, and Land (SEALs) Operators. Understanding the risk factors associated with LE MSI is an important step in designing injury prevention programs. PURPOSE: To develop a robust mathematical model to predict LE MSI in SEAL Operators. METHODS: 285 subjects (age: 26 ± 5 yrs, height: 179 ± 7 cm, weight: 85 ± 9 kg) participated in testing, including: LE muscular strength and flexibility; balance; body composition; anaerobic power/capacity; and aerobic capacity (VO2max). Medical charts were reviewed for LE MSI 365 days following laboratory testing. The correlated variable sets were identified using Hierarchical Clustering Analysis (HCA). Important features then were selected from the clusters and modeled with regression trees wherein output (predictions) were interpreted as the probability of injury for each individual. To classify observations, a decision threshold was defined that minimized the false positive rate (FPR) conditional on a true positive rate (TPR) of approximately 90% whenever all available variables were utilized. Individuals with predicted probabilities above this threshold were classified as injured. Variables selected in the final models were chosen in a forward fashion, with individual predictors that reduced the FPR without significantly lowering the TPR added to the model. The procedure stopped when no remaining predictor variables were able to produce a model that outperformed the current iteration. RESULTS: With this method, it was possible to predict 13/285 or 4.5% of the injuries. Each cluster of feature sets from the HCA consisted of variables mostly from the same laboratory test category. The final regression tree model contained knee flexion and left knee extension strength (normalized to body weight), fat-free mass (kg), and hamstring flexibility, as the best predictors (TPR of 92.3% and FPR of 2.9%). CONCLUSION: Knee strength, fat-free mass, and hamstring flexibility were important risk factors identified in the machine learning algorithm that accurately classified SEAL Operators with LE MSI. Alternative high prediction models also can be created using this modeling framework on different variable sets. Supported by ONR N00014-11-1-0492.

Abdominal obesity is a major risk factor for multiple diseases including Type II diabetes, hypertension, heart disease, and stroke. One of the quickest and most economical means of measuring abdominal obesity is abdominal circumference (AC). Current recommendations for AC, based on sex and age, are 34 inches for AC (between IC and lowest rib), umbilicus (UMB), and the smallest region of the waist. Circumference at the IC is the current site used by the US Navy for those sailors who
do not pass height and weight standards. However, use of a more easily defined site, such as the UMB, may improve reliability, especially on sailors whose IC may be difficult to palpate.

**Purpose:** The purpose of this study was to determine if obtaining circumference at the UMB is a valid measure for AC in the US Navy active duty population.

**Method:** UMB and IC circumference measurements were taken on 115 subjects, (79 male and 36 female), using a retractable tape measure on the skin. Trained researchers took measurements at end of expiration with the tape parallel to the floor while ensuring tape tension did not cause indentation of the skin. Three measurements were taken at both sites per individual by the same researcher. Averages were calculated and used for analysis.

**Results:** Mean circumference for males was 35.3 ± 3.8 inches at UMB and 35.7 ± 3.6 inches at IC. Mean circumference for females was 33.8 ± 4.1 inches at UMB and 35.3 ± 3.8 inches at IC. There was a high correlation between UMB and IC measurements ($r^2 = .981$ and .966 for males and females, respectively). For intra-rater reliability, interclass correlation coefficients (ICC) for the three measurements for males were ICC = .996 at both UMB and IC. For females correlations were ICC = .992 at UMB and .986 at IC.

**Conclusion:** High correlation between sites suggests UMB can be a valid substitute for IC when measuring AC. The high ICC for both sites supports reproducibility of AC measures at these sites. The ease of locating the UMB eliminates the need to palpate correct IC measurement site. Based on these results, use of the UMB as the Navy standard to obtain an AC measurement may be preferable as it can be less intrusive and more easily located.

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**Board #247 June 1 3:30 PM - 5:00 PM**

**Evaluation of The US Navy’s Physiological Heat Exposure Limits during Deployment in The Persian Gulf**

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The U.S. Navy uses Physiological Heat Exposure Limits (PHEL curves) to reduce heat stress casualties aboard naval vessels. The PHEL curves, established in the 1960s, have not been examined over several decades of advancements in shipboard technology. PHEL curves ranging from I to VI (low to high metabolic work), are assigned to each job which, in combination with ambient workspace conditions, determine allowable stay times in a particular workspace. Due to advancements in shipboard design, it is probable that the metabolic rate while performing certain shipboard duties has changed, which could reduce the accuracy of current PHEL assignments.

**Purpose:** To compare predicted and measured metabolic rates of scullery personnel abroad an aircraft carrier deployed in the Persian Gulf. Predicted and measured VO\textsubscript{max} recordings, converted to watts (W), were taken at both sites per individual by the same researcher. Averages were calculated and used for analysis.

**Results:** VO\textsubscript{max} was significantly higher than those actually measured (240 ± 22 vs 227 ± 28 W; $p = .03$). VO\textsubscript{max} was 47.9 ± 5.5 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}, a BMD of 1.3 ± 0.1 g·cm\textsuperscript{-3} and a T-Score for BMD of 1.06 ± 1.15. Absolute and relative 1RM on the bench press were 120.9 ± 14.5 kg and 1.35 ± 0.22 kg·kg\textsuperscript{-1}, respectively. VO\textsubscript{max} was 47.9 ± 5.5 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}, a BMD of 1.3 ± 0.1 g·cm\textsuperscript{-3} and a T-Score for BMD of 1.06 ± 1.15. Absolute and relative 1RM on the bench press were 120.9 ± 14.5 kg and 1.35 ± 0.22 kg·kg\textsuperscript{-1}, respectively. VO\textsubscript{max} was 47.9 ± 5.5 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}, a BMD of 1.3 ± 0.1 g·cm\textsuperscript{-3} and a T-Score for BMD of 1.06 ± 1.15. Absolute and relative 1RM on the bench press were 120.9 ± 14.5 kg and 1.35 ± 0.22 kg·kg\textsuperscript{-1}, respectively.

**Conclusion:** The job demands of members in Special Weapons and Tactics (SWAT) teams of law enforcement agencies involve heavy exertion, yet it remains uncertain whether this special population has adequate fitness levels to sustain high intensity work efforts. PHEL curves, established in the 1960s, have not been examined over several decades of advancements in shipboard technology. PHEL curves ranging from I to VI (low to high metabolic work), are assigned to each job which, in combination with ambient workspace conditions, determine allowable stay times in a particular workspace. Due to advancements in shipboard design, it is probable that the metabolic rate while performing certain shipboard duties has changed, which could reduce the accuracy of current PHEL assignments.

**PURPOSE:** To examine the fitness and body composition characteristics of SWAT members. METHODS: Fourteen healthy men (mean ± SD; age = 33.1 ± 5.7 years; height = 180.7 ± 5.4 cm; mass = 90.6 ± 10.0 kg) from SWAT teams of local law enforcement agencies completed five health-related fitness assessments. These included 1) total body dual-energy x-ray absorptiometry (DEXA) scan to determine lean body mass (LBM), fat mass (FM), bone mass (BM), percent body fat (%body fat), bone mineral density (BMD), and a BMD T-score; 2) a one-repetition maximum (1RM) test of upper body strength on a bench press; 3) a graded exercise test on a treadmill to measure maximum oxygen uptake (VO\textsubscript{max}); 4) a YMCA submaximal bench press test to measure upper-body muscular endurance; and 5) the Canadian trunk forward flexion test to measure hamstring flexibility. RESULTS: Participants had an LBM of 70.1 ± 7.2 kg, FM of 17.2 ± 5.5 kg, BM of 3.7 ± 0.6 kg, %body fat of 18.7 ± 4.7%, a BMD of 1.3 ± 0.1 g·cm\textsuperscript{-3} and a T-Score for BMD of 1.06 ± 1.15. Absolute and relative 1RM on the bench press were 120.9 ± 14.5 kg and 1.35 ± 0.22 kg·kg\textsuperscript{-1}, respectively. VO\textsubscript{max} was 47.9 ± 5.5 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}. Participants completed 52 ± 15 repetitions on the YMCA submaximal bench press test. Distance reached on the Canadian trunk forward flexion test was 30.7 ± 5.7 cm. CONCLUSION: According to ACSM normative data for 30-39-year-old males, participants’ body fat percentage is classified as fair. According to normative data from the World Health Organization, this population displayed a higher-than-average BMD T-score compared to other 30-year-old men. Participants demonstrated very good to excellent levels of cardiorespiratory fitness, muscular strength, muscular endurance, and flexibility, suggesting their fitness levels are appropriate for the vigorous exertions involved in this occupation. This information is beneficial for fitness professionals who train the tactical population. Partially Supported by NIGMS Training Grant GM083883.
The US Air Force has expanded its research and development efforts of occupationally specific, operationally relevant (OSOR) physical fitness tests and standards.

Knowledge of factors affecting success on OSOR physical tasks can provide valuable information for selection, training and operations. METHODS: We compared the morphological characteristics associated with success and non-success on operational physical tasks to inform targeted selection processes and training programs for physically demanding career fields. Analysis identified operationally-required critical physical tasks, which provided the basis for developing physical task simulations (PTs). Career field senior leaders and experience operators reviewed PTs data to determine an operationally relevant minimum effective time (MET) for task success. Measures of morphology (stature, body mass, body mass index, and fat-free mass, fat mass, and relative body fat from both bioelectric impedance and skinfolds) and performance on 14 PTs were recorded (n = 171, 62 female; age, 28.5 ± 5.6 yrs). Performance was successful if the subject both completed the PTs and met the MET. RESULTS: Successful performers were significantly different than non-successful performers for all morphological characteristics measured (stature 156.7 cm vs 167.8 cm, body mass 82.3 kg vs. 70.8 kg, body mass index 26.3 kg/m² - 25.1 kg/m², fat-free mass 69.6 kg vs 55.2 kg, fat mass 12.7 kg vs. 15.7 kg, and relative body fat 15.2% vs. 22.2%) across nearly all PTs. Number of PTs success (p < 0.01) reached equals: stature 14 of 14 PTs, body mass 13, body mass index 10, fat-free mass 14, fat mass 10, and relative body fat 1. CONCLUSION: The study showed that significant differences in morphological traits exist between US Airmen who successfully complete and those that do not complete operational physical tasks inherent to physically demanding military occupations such as USAF Battlefield Airmen.

Enhancing recovery from firefighting is paramount due to the high cardiovascular strain associated with firefighting compounded by the encapsulating personal protective equipment (PPE), which can result in severe fatigue and/or cardiac incidents. Recent work suggests that wrist cooling via DhamasPORT™ band might enhance recovery from live firefighting, but work in a controlled setting with measures of core temperature is needed. PURPOSE: To determine the effects of the DhamasPORT™ cooling band on recovery from Exercise-Induced Heat Stress associated with wearing PPE. METHODS: In 11 male participants (23±5 years old, 176±4 cm tall, 84±12 kg mass, BMI 27±3 kg/m²) we measured heart rate (HR), core temperature (T_core), thermal sensation (TS), and rating of perceived exertion (RPE) during 30 min of walking exercise (3 mi/hr, 5% grade) in full PPE and SCBA (~20kg), and in a single blind, counterbalanced, crossover design, we assessed the recovery from exercise with a DhamasPORT™ cooling band placed on their wrist but only activated during one trial (control vs. cool). Pre-exercise, and at recovery, heart rate variability (HRV; log transformed root mean square of successive differences; LnRMSSD) and fatigue (visual analog scale; VAS) were recorded. RESULTS: At rest no differences were observed between trials for HR, HRV, VAS, TS, or T_core. During exercise, HR (145±22 vs. 148±19 bpm), TS (37.8±0.3 vs. 37.8±0.3 °C), T_core (6.4±0.8 vs. 6.5±0.4), or RPE (4.9±1 vs. 5.0±1) were not different between trials (all, p > 0.05, control vs. cool). Time to 50% recovery (46±1 vs. 43±1 sec) and time to complete recovery (519±275 vs. 624±289 sec) were not significantly different with the band active (both, p > 0.05, control vs. cool). During recovery, there was no significant differences in T_core or HR (p > 0.05). At recovery, T_core (37.6±0.3 vs. 37.8±0.3 °C, p > 0.07), HR (70±10 vs. 75±11 bpm, p = 0.06), and fatigue VAS (2.9±2.0 vs. 2.5±2.5, p = 0.08) tended to be lower, while HRV (LnRMSSD; 4.1±0.9 vs. 4.2±1.0, and TS (3.7±0.8 vs. 3.8±0.8) were relatively similar with the band active (p > 0.05, control vs. cool). CONCLUSION: Use of the DhamasPORT™ cooling band after exercise-induced heat stress might enhance recovery of core temperature, fatigue, and HR, without notable impact on heart rate variability or thermal sensation. Supported by: DhamasUSA.

Research has demonstrated a link between dynamic balance ability, assessed via the star excursion balance test (SEBT), and musculoskeletal injury (MSK) risk. Previous research also suggests that changes in health and fitness occur among firefighter recruits as they progress from their training academy to active-duty service. However, similar longitudinal changes in dynamic balance ability have yet to be examined. PURPOSE: To observe longitudinal changes in dynamic balance ability among firefighter recruits. METHODS: 27 male firefighter recruits enrolled in the same training academy volunteered to participate in the current study (mean ± SD, age = 29.9 ± 4.1 yrs; height = 179.8 ± 4.6 cm; body mass = 87.2 ± 9.7 kg). SEBT data were collected at the beginning (W1) and end (W14) of their firefighter training academy, as well as at the end of their probationary period (W18). SEBT reach distances were normalized to limb length and averaged between right and left reaches in the anterior (SEBT_anterior), posterostralateral (SEBT_plateral), permedial (SEBT_pm) and mediolateral (SEBT_ml) directions. rm = 0.05 determined statistical significance for all analyses. RESULTS: An omnibus RM MANOVA revealed a significant and large effect of time on dynamic balance ability (F_anterior,4,160 = 13.463, λ = 0.306, η² = 0.447, P < 0.001). Results of the post hoc RM
ANOVAs demonstrated significant main effects of time on SEBT
\( \text{VO}_2\max \) \((F_{1,21} = 29.280, P < 0.001)\), SEBT\(_L\) \((F_{1,21} = 12.836, P < 0.001)\), and SEBT\(_H\) \((F_{1,21} = 4.460, P = 0.026)\) reaches. Follow-up pairwise comparisons further revealed that from W1 to W14, SEBT\(_L\) and SEBT\(_H\) significantly increased, while a significant change was not observed in SEBT\(_N\). From W14 to W38, significant decreases were observed in all three SEBT reach directions. From W1 to W38, a significant decrease was observed in SEBT\(_N\) but no significant changes were observed in the SEBT\(_H\) and SEBT\(_L\).

**Conclusions**: Results indicate that this firefighter recruitment training academy yielded significant improvements in dynamic balance ability, particularly in SEBT\(_N\) and SEBT\(_H\) reach directions. However, these adaptations were lost before recruits finished their probationary period. Job challenges may influence the capability for new firefighters to maintain the improvements in dynamic balance ability gained during their recruit training academy, increasing their MSKI risk.

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Sudden cardiac death is a common cause of mortality in the firefighting (FF) community. This population has many lifestyle and health risk factors that contribute to cardiovascular disease development; therefore, it is necessary to focus on cardiovascular variables and stress in this population. PURPOSE: To examine multiple cardiovascular variables in a firefighting cohort during recovery from firefighting exercises to investigate the relationships between recovery time and heat stress as well as body temperatures and indices of arterial stiffness. METHODS: A 20-minute exercise bout consisting of aerobic and resistance exercise was performed by 15 healthy career firefighters (age=32.0±7.2 yr; ht=1.8±0.1 m; wt=92.7±18.4 kg; VO\(_2\max\)=40.8±6.5 mL kg\(^{-1}\) min\(^{-1}\)) while wearing personal protective equipment (PPE). Two conditions were studied: HOT=40°C, 30% humidity; CON=16°C, 78% humidity. Electrocardiography, arterial stiffness, HR, blood pressure, core \(T_e\) skin \(T_s\), temperature gradient \(T_{grad}\) measurements were obtained pre-exercise at 5,10,20,40,60 min post-exercise. Subjects sat for a 60-min recovery while measurements were taken. A repeated measures ANOVA was used to test for differences between the conditions and over time. RESULTS: HR was not different at rest between conditions (p=0.577). HOT HR was higher than CON at 5 and 10 min into recovery (p=0.003, p=0.009). HOT T\(_{grad}\) was higher than pre (70±18 ppm) throughout recovery (80±12 ppm) while CON remained constant (p=0.035). Aortic Augmentation Index (AIX) showed a time effect at 5, 20 min of recovery (p=0.019, p=0.005). Subendocardial Viability Ratio (myocardial perfusion) did not change in either condition over time. The T\(_{grad}\) showed a time effect with CON showing the highest \(T_{grad}\) lower than pre throughout exercise and HOT \(T_{grad}\) lower than pre throughout exercise and 5 min into recovery (p=0.05). CONCLUSION: The increased HR and convergence of \(T_e\) and \(T_s\) seen in this short bout of exercise and in one stage of recovery with relatively mild heat stress suggest a need for further investigation in this population and PPE. Specifically, it is necessary to relate body temperature and arterial
stiffness as cardiovascular risk factors while performing multiple bouts of exercise with shorter recovery times in higher environmental temperatures while wearing PPE to better simulate live FF.

2974  Board #257  June 1 3:30 PM - 5:00 PM  
Effectiveness Of Cold, Wet Towels As A Cooling Modality For Fireground Rehab

Rebecca L. Stansbery, Lindsey N. Russo, David Hostler, FACSM. University at Buffalo, BUFFALO, NY. (Sponsor: Dave Hostler, FACSM)  

(No relevant relationships reported)

Firefighters experience a rise in body temperature during exertion. The use of active cooling modalities during fireground rehab is necessary to lower elevated core body temperatures in order to avoid heat stress related incidents. The use of cold, wet towels placed around the head and neck are listed as an effective cooling modality in the NFPA standard in spite of limited evidence of effectiveness. PURPOSE: We tested the hypothesis that the thermal transfer of cold, wet towels placed around the head and neck would be ineffective at promoting recovery of core body temperature when compared to forearm immersion in 10°C water.  

METHODS: Fourteen healthy subjects (6 female) aged 22.1 ± 1.6 y completed two separate experimental trials counterbalanced for cooling modalities of cold, wet towels (CT) and forearm immersion (FI). Subjects were full firefighters turn-out gear while completing two rounds of a firefighting-based exercise circuit in 40°C and 60% relative humidity. Five minutes following each condition, subjects were cooled for 30 min with the assigned modality in the hot, humid environment. Heart rate, core body temperature, blood pressure, and perceptual scales were recorded at various time points from baseline through the completion of active cooling.  

RESULTS: Heart rate (CT: -6.5±4.6 to 6.88 bpm, FI: -28.3±10.37 bpm, p<0.01) and core temperature (CT: -0.05 ± 0.17°C, FI: -0.60 ± 0.50°C, p=0.01) decreased more during FI. At the end of the cooling period, ratings of perceived recovery (p<0.05), thermal sensation (p=0.01), thermal comfort (p=0.01), and sweating sensation (p=0.01) improved for both cooling modalities but favored forearm immersion.  

CONCLUSIONS: Cold, wet towels placed around the head and neck following exertional heat did not provide adequate recovery of heat rate or core temperature in a hot humid setting.

2997  Board #254  June 1 3:30 PM - 5:00 PM  
Prediction Of Heat Strain Using Trunk Posture While Wearing Personal Protective Clothing: A Pilot Study


(No relevant relationships reported)

PURPOSE: Many occupations, such as firefighting and emergency healthcare response, require the use of personal protective equipment (PPE) in hot and humid environments. Increased core body temperature (Tco) and muscular fatigue from the physiological demands of the job have been well characterized with total energy expenditure (EE) often exceeding 5000 kcal/day. PURPOSE: The purpose of this study was to evaluate changes in core temperature in the upper body (XT), body composition, and blood lipids over a 5-month fire season. METHODS: Wildland firefighters (N=27, 25 M, 2 F, 27±1 years, N=15 hotshots, N=12 type II crew) were recruited from the Fairbanks, AK area prior to the 2017 fire season. Total and regional lean mass (LTM) and fat mass (FM) were quantified from dual x-ray absorptiometry (DXA), while XT was calculated from magnetic resonance imaging (MRI). Pre- and post-season ≥3-hour fasted blood samples were collected for measures of total cholesterol (CHOL), high density lipoprotein (HDL), and low-density lipoproteins (LDL).  

Results were analyzed using paired t-tests, presented as means/SEM and considered significant at p<0.05. RESULTS: The 27 participants averaged a total of 63±10 days on wildfire assignments. There was an increase in total body mass (78.5±2.5 kg and 79.7±2.4 kg) and body mass index (23.9±0.5 kg and 24.5±0.5 kg) from pre- to post-season, respectively (N=27). There was also an increase in total FM (12.4±1.9 kg and 13.9±1.0 kg), arm FM (1.4±0.1 kg and 1.5±0.1 kg), leg FM (4.1±0.4 kg and 4.7±0.3 kg), and visceral FM (318±47 g and 419±48 g) from pre- to post-season, respectively (N=27). Total LTM, arm LTM, and leg LTM (N=27), were unchanged. MRI analysis revealed no changes in XT in the fire season (N=27). Only 27 of the 27 participants completed DXA and MRI scans, 18 completed blood sampling. There was an increase in CHOL (160±18 and 176±18) and LDL (83±6 and 96±9 mg/dL) from pre- to post-season, respectively (N=18). HDL remained unchanged. CONCLUSION: Increased FM and blood lipids may reflect the occupational consequences of seasonal wildland fire operations. Despite previously reported high levels of EE in this cohort, these concomitant alterations in adipose tissue and blood lipids may indicate the detrimental influence of dietary and/or environmental factors. Supported by a grant from the United States Forest Service, Missoula Technology and Development Center, BC, RY, 2016.
INTRODUCTION: Studies have shown that employee productivity and satisfaction decline with number of hours worked [1,2]. However, most of these studies looked at sedentary career fields when many careers require long hours of standing or/and walking.

METHODS: The purpose of this study was to determine if repeated breaks from walking has an effect on productivity and satisfaction.

RESULTS: Continuous group walked significantly more laps total and more laps per hour (mean 58.8±5.9 vs. 49.6±4.21 mean total laps, p < 0.001). However, there was no difference in number of laps per relative hours walked (9.8±0.89 vs. 9.4±0.84 laps/hr, p = 0.894). Although a decline in feeling scale from hour one to hour 6 was observed, it was not similar for both groups (Continuous p=0.039, Intermittent p=0.032). No significant differences were observed between groups in HR, Systolic BP or Diastolic BP.

CONCLUSIONS: Individuals walked the furthest distance when walking continuously. Six hours may not be enough time to see a significant decline in walking performance measures. The test environment may have been more enjoyable than a usual work environment.

INTRODUCTION: Between the different types of play and individual needs must be considered in a safe and effective way. With a simple computer with internet, it seems feasible to use these video games to reduce employee sedentary time and explore the possibilities and limitations to using this video game type as part of an employee based health program. The aim of this pilot project is to compare energy expenditure of three methods to play dance active video games to reduce employee sedentary time and explore the possibilities and limitations to using this video game type as part of an employee based health program.

METHODS: A total of 8 desk based worker participants (men, 26 ± 5 years) were recruited to perform 3 types of active video games using original instructions and a modification to allow individuals with limitations to play. The 3 dances were Party Rock Anthem, Land of 1000 Dances, and No limit (JustDance, Ubisoft, France). The 3 dances were modiﬁed to allow individuals with limitations to play. The 3 dances were modiﬁed to allow individuals with limitations to play. The 3 dances were modiﬁed to allow individuals with limitations to play. The 3 dances were modiﬁed to allow individuals with limitations to play. The 3 dances were modiﬁed to allow individuals with limitations to play.

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Both VIT-D insufficiency and deficiency were low in SA RU athletes. Seasonal differences in VIT-D and skin score were demonstrated, likely due to changes in the length of sunlight exposure that effects endogenous VIT-D production.

Conclusion: Although these results were not significant, there was a decrease in % body fat and a minimal increase in lean body mass from pre to post season in Division II male lacrosse players. These changes do not demonstrate negative energy balance throughout the competitive season as previous research suggests.

Body composition changes differ in all sports due to specific training. In the off season teams participate in strength training programs, however during the competitive season, training is often replaced with team sport training. Lacrosse players in previous studies showed better performance with decreased body fat percentage and increased lean body mass. However, its common during the competitive season to show an increase in % body fat and a minimal increase in lean body mass from pre to post season in Division II male lacrosse players. These changes do not demonstrate negative energy balance throughout the competitive season as previous research suggests.

Purpose: To examine body composition changes in male collegiate lacrosse players from preseason to post season

Methods: We examined 12 male NCAA Division II lacrosse players (age 19.6±1.72 years) pre-season (January and May). Subjects completed a body composition assessment using dual-energy X-ray absorptiometry.

Results: Using descriptive statistics and a 2 way t-test, there was a decrease in overall total mass of 8.7 lbs. (179.9±33.2 vs. 171.2±28.2, P=0.02). Body fat % decreased by 2.5% (15.7±5.8 vs. 13.2±5.6, P=0.05). Lean body mass increased by 1.5 lbs. (133.9±16.4 vs. 135.3±15.3).

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2986 Board #269 June 1 3:30 PM - 5:00 PM
Cardiometabolic Changes During the Hormonal Transition Of A Male-to-female Athlete: A Case Study
Shannon L. Wilson1, Andrew C. D’Lagos2, Theresa M. Jorgensen1, Joanna Harper2, Corrie M. Whisner1, Jared M. Dickinson, FACSMD, Glenn A. Gaesser, FACSMD, Siddhartha Angadi, FACSMD, 1Arizona State University, Phoenix, AZ. 2Providence Portland Hospital, Portland, OR. (No relevant relationships reported)

PURPOSE: To assess the cardiometabolic changes during estrogen treatment for gender reassignment in an aerobically trained, male-to-female transgender athlete.

METHODS: Subject is a biologically male distance runner (age 27) that initiated gender reassignment. Social male-to-female transition was completed prior to testing. The following assessments were performed: anthropology, DXA (dual energy x-ray absorptiometry) scan (1st, 3rd, and 4th visit only), resting echocardiogram, treadmill-based VO2peak, resting carotid-femoral pulse wave velocity (cf-PWV), resting peripheral/central blood pressures and augmentation index (normalized at heart rate of 75 bpm; AIX@75). Baseline assessments were made during two separate visits completed prior to estrogen treatment (visits were averaged). Subsequent assessments were made at 2 and 6 weeks following the initiation of the estrogen treatment (10 mg estradiol valerate s.c. once per week).

RESULTS:

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<th>Baseline</th>
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<td>AIX@75</td>
<td>4.75</td>
<td>-13</td>
<td>-6</td>
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RHR: Resting heart rate; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; cSBP: Central systolic blood pressure; cDBP: central diastolic blood pressure; cf-PWV: carotid-femoral pulse wave velocity; AIX@75: Augmentation index normalized at a heart rate of 75

2988 Board #271 June 1 3:30 PM - 5:00 PM
Reflected Ultraviolet Radiation Exposure in Athletes
Charlotte Adams1, Brian Adams2, 1Walnut Hills High School, Cincinnati, OH. 2University of Cincinnati, Cincinnati, OH. (Sponsor: Jon Divine, FACSMD) (No relevant relationships reported)

Abstract

Background: Ultraviolet (UV) radiation harms skin causing deadly skin cancer, however many athletes fail to use sun safe practices. No studies have examined the potential threat of a "second sun" created by UV radiation reflected off different outdoor playing surfaces.

Aim: This study hypothesized that athletic surfaces would reflect UV radiation and that this UV radiation would be greatest at lower heights and from smooth light-colored surfaces.

Methods: To evaluate this hypothesis, UVA and UVB radiation and reflected UV radiation were measured with UV dosimeters on various outdoor playing surfaces.

Results: All surfaces reflected UVA radiation (0.4 - 8% of direct UVA exposure), while only the smooth and light-colored playing surfaces (clay court, light asphalt, and concrete) reflected any UVB radiation (5 - 8%) and only at the lowest measured height.

Conclusion: Reflective UV radiation threatens outdoor athletes and spectators. Tennis players, infield baseball and softball players, those who play on concrete surfaces, and coaches and others in the stands are at greatest risk and should be particularly vigilant with sun safety.
The International Olympic Committee (IOC) proposed the term Relative Energy Deficiency in Sport (RED-S) to describe the health and performance consequences beyond the well-established Female Athlete Triad (Triad). Both the IOC and the Triad Coalition have developed return-to-play (RTP) criteria to guide clinical decision making on clearance for participation in sports based on health assessment.

**PURPOSE:** To determine the agreement between the RED-S Clinical Assessment Tool (RED-S CAT) and Triad risk assessment criteria (Triad-RA) for sports participation clearance levels for female athletes.

**METHODS:** 1000 female athletes (ages 15-30 years) presenting to a sports medicine clinic completed a comprehensive, 400+ question survey covering topics related to RED-S, including Triad risk factors, and sports participation. Clearance level/risk assessment for each athlete was assigned according to each syndrome’s model as low (green light), moderate (yellow light), or high risk (red light). Clearance level by each model was compared with each athlete.

**RESULTS:** Using the RED-S CAT, 26.6% of athletes were green light (full clearance), 29.7% were yellow light (provisional/limited clearance), and 43.7% were red light (fully restricted). Using the Triad-RA, 30.2% of athletes were low risk, 61.9% were moderate risk, and 7.9% were high risk. Overall, the models agreed that 86% of the athletes were at elevated risk. Moderate or high risk was most discordant for athletes deemed to be at high risk by RED-S CAT, but moderate risk by Triad-RA; these athletes accounted for 37.3% of all subjects. The Triad-RA cleared 8.8% of the sample for full participation that the RED-S CAT categorized as elevated risk; the RED-S CAT cleared 5.2% of the sample for full participation that the Triad-RA categorized as elevated risk.

**CONCLUSIONS:** Most female athletes surveyed met elevated risk categories using both RED-S CAT and Triad-RA. The RTP criteria for both syndromes should be further refined for use in primary care settings as part of pre-participation examinations to appropriately categorize athletes needing further medical care and potential restriction from sport.

Sport and exercise can improve cardiovascular health for someone with type 1 diabetes mellitus (T1DM), but it must be performed safely. Blood glucose control in adolescent athletes can influence glucose fluctuations in athletes with T1DM. This was confirmed by additional analysis that included values from 3 other GD CGM readings.

**PURPOSE:** Long distance runners pursue leanness to improve performance. Losing fat mass is achieved by chronic negative energy balance, and it would increase the risk of developing anemia. The purpose of this study was to assess the association between change in %fat and decreases in hemoglobin (Hb) and ferritin levels among long distance runners.

**METHODS:** A cohort of 40 Japanese competitive male runners of the same university team was analyzed retrospectively. Blood test and body composition analysis (DXA) were performed twice a year: pre-season in March and peak-season in August. The least significant change in %fat was calculated (LSC: 0.11) and the subjects were dichotomized into 2 groups: change in %fat from pre-to peak-seasons with +/- LSC (constant: CNT, n=14), and change in %fat exceeded LSC (decrease: DCR, n=26). No runners increased %fat. Body compositions were compared by paired t-test. RESULTS: Only fat mass (FM) and %fat were significantly different between CNT and DCR: pre-season (3.4 ± 4.4 kg and 6.3 ± 8.1 %, respectively), other variables (age, lean soft tissue mass [LM], Hb, and ferritin) were not (20.3 ± 19.9 vs 31.5 ± 51.2, 43.3 ± 60.7 mg/dL, respectively). Total running mileage (March - July) was not significantly different between CNT and DCR (3193 ± 3171 km). FM, LM and %fat significantly decreased from pre- to peak-seasons in DCR (3.4 kg, 50.6 kg, and 5.9 %, respectively); other variables in CNT (3.6 kg, 51.4 kg, and 6.2 %, respectively). Two-way repeated measures ANOVA showed that there was a significant main effect of the seasonal phase of training on Hb (CNT: 14.9 ± 14.3 g/dl; DCR: 13.5 ± 14.4 g/dl) and ferritin (CNT: 43.3 ± 32.9 mg/dL; DCR: 60.7 ± 48.5 mg/dL). No significant interaction effect was observed between the seasonal phase of training and the change in %fat.

**CONCLUSIONS:** Hb and ferritin significantly decreased from pre-peak seasons with or without decrease in %fat among lean runners. It is recommended to conduct blood test periodically for recognizing development of anemia which would impair performance.

Mechanically overloaded muscle and its subsequent damage are strong stimuli for eliciting acute hormonal changes, and muscle adaptation following exercise-induced muscle damage may be complex. Hormonal responses before and after exercise are important markers of the completion of muscle regeneration. PURPOSE: This study investigated systemic responses of thyroid-stimulating hormone (TSH), free thyroxine (FT4) and prolactin (PRL) for several days after eccentric exercise-induced muscle damage in humans. METHODS: Nine healthy men (age 25.7 ± 1.7 years, height 180.4 ± 1.7 cm, body mass 77.2 ± 2.7 kg, body mass index 23.7 ± 0.6) performed 50 maximal eccentric muscle actions using the knee extensor muscles of both legs on an isokinetic dynamometer. Blood samples were withdrawn before and at 6, 48 and 120 hrs post-exercise, and serum levels of TSH, FT4 and PRL were measured by ELISA using commercially available kits. Myoglobin (Mb) concentration and lactate dehydrogenase (LDH) activity were also evaluated as indirect markers of muscle damage. One-way ANOVA was used for statistics. RESULTS: Significant alterations in Mb and LDH were observed over time after eccentric exercise (p<0.05-0.001). Serum FT4 levels exhibited a gradual increase reaching statistical significance at 48 and 120 hrs following the muscle damaging exercise (1.25 ± 0.05 ng/dl, 1.29 ± 0.04 ng/dl, and 1.26 ± 0.05 ng/dl at 6, 48 and 120 hours after exercise, respectively, compared to 1.13 ± 0.02 ng/dl at baseline; mean±SE, p=0.05). Both PRL and TSH showed also a gradual increase up to 33% at 48 hrs and 120 hrs post exercise, respectively, however they failed to reach statistical significance due to a large variability shown between the subjects’ responses (PRL: 23.4 ± 3.1 ng/ml, 28.1 ± 4.7 ng/ml, 30.2 ± 4.1 ng/ml and 25.7 ± 4.6 ng/ml; TSH: 1.09 ± 0.14 μIU/mL, 1.27 ± 0.15 μIU/mL, 1.76 ± 0.20 μIU/mL, and 1.33 ± 0.17 μIU/mL at baseline, 6, 48 and 120 hours post-exercise, respectively, mean±SE, p>0.05). CONCLUSION: The late elevated levels of TSH and PRL, and particularly of FT4, during the recovery period after muscle damage may suggest functional interactions between those.
The largest age group of breast cancer survivors (BCS) in the U.S. is comprised of women ages 65+, who are susceptible to age-related decrements in physical function accelerated by cancer treatment toxicities. Though exercise is known to reverse age-related functional limitations, older BCS may be heterogeneous in baseline functioning which may affect the efficacy of exercise to reverse functional declines. PURPOSE: Determine the efficacy of each aerobic and resistance training to improve physical function in older BCS, considering baseline physical functioning. METHODS: Older, early-stage, BCS (mean age 72), who underwent chemo- or radiotherapy in the previous 2 years were randomized to 12 months of supervised, group aerobic (AER) or resistance (RES) training or control (CON) flexibility exercise, followed by 6 months of home-based training. Physical function was assessed by the Physical Performance Battery (PPB), 5x chair stand time (sec), maximum bench and leg press (kg), and 4-meter usual walk speed (m/sec) tests and self-reported lower-body function with the Late-Life Function and Disability Instrument (LLFDI). A linear mixed effects model was used to assess function after 12 and 18 months on the full sample and only in BCS with PPB scores ≥ 9. RESULTS: 114 BCS were enrolled and randomized to AER (n=37), RES (n=39), or CON (n=38). Within the full sample there was a significant improvement in bench press strength at 12 months (p<0.03) and PPB at 18 months in RES vs CON. After removing participants with low baseline physical functioning (n=79), the following additional significant differences were found between: 1) RES (mean±2.7±1.7) and CON (mean±3.0±2.0) for self-report physical function at both 12 (p=0.04) and 18 months (p=0.005), 2) AER (mean±0.4±0.0) and RES (mean±0.3±0.0) at 12-months for average walk speed and, 3) AER (mean±0.3±0.0) and RES (mean±0.0±0.2) at 18 months, for chair time (p=0.05). CONCLUSIONS: Although AE and RT are efficacious in improving physical function in older BCS across a range of baseline physical functioning, broader improvements may only be possible among women with better functioning and thus capable of achieving a greater dose of exercise. Older BCS may need to be stratified into groups based on their initial functioning, then matched to appropriate training.

Background and Objective: The purpose of this study was to examine the relationship between preoperative 6MWD and symptoms, quality of life in patients who underwent lung resection for primary lung cancer. Material and Methods: Patients of cohort included were those scheduled to undergo lung cancer surgery, at participating hospitals in the Seoul of South Korea. In total, 364 persons(mean age, 63.51±11.66) attended from March 2016 to September 2017. Exclusion criteria of a cohorts of lung cancer study included ECOG PS >1 and neoadjuvant therapy, Multiple cancer, recurrent lung cancer. Patients planned for lung cancer surgery filled out a questionnaire and performed before surgery. Cardiorespiratory fitness (CRF) was assessed six minute walk distance using the 6-minute walk test (6MWT). The symptoms were assessed the mMSC and CAT questionnaires. The quality of life was assessed using the EORTC Quality of Life, Core30 and lung cancer 30 questionnaires. Data from were summarized according to the 6MWT recorded (lower and higher) estimated using 6MWD (cut-point 450m).
then performed at 60% of peak power. Beginning at end-exercise, time-resolved blood flow (popliteal vein, phase contrast MRI) and venous oxygen saturation (\(S_O_2\), susceptibility-based oximetry using deoxyhemoglobin as an intrinsic contrast agent) were measured with custom methods. These values were used to calculate lower leg \(V_O_2\) using the Fick equation with [hemoglobin] (hb) extracted from clinical records and \(S_O_2\) measured via pulse oximetry.

RESULTS: Twelve patients have completed both scans. Preliminary analyses were of change over groups with both groups combined. Peak power did not change (15.7 ± 3.0 to 16.6 ± 3.8 W, p=0.227). After treatment, oxygen carrying capacity of the blood (hb*1.34*S_O_2) was significantly decreased (median change = -17%, p=0.004) due to reduced hemoglobin (13.5 ± 11.2 to 13 g/dL). Exercise blood flow increased (438 ± 119 to 633 ± 167 ml/min, median change=-44%, p<0.001) out of proportion to this reduction. \(S_O_2\) and hb did not change appreciably (~98% and 60%, respectively). As a result there was a small but non-significant increase in leg \(V_O_2\) (30 ± 9 to 35 ± 13 ml/min, median change = -16%, p=0.165). Exercise mean arterial pressure decreased and heart rate increased after treatment (p=0.007, p=0.017).

CONCLUSIONS: Our preliminary findings indicate that chemotherapy for breast cancer does not reduce oxygen extraction with isolated muscle exercise. Local blood flow increases partly in response to reduced oxygen-carrying capacity of the blood, but mechanisms for the remaining hyperemia response are unknown.

**F-67 Basic Science World Congress/Poster - Skeletal Muscle II**

**2997 Board #280**
**June 1 3:30 PM - 5:00 PM**

Assessing Body Composition With Dual-energy X-ray Absorptiometry And Bio-electrical Impedance In Breast Cancer Survivors

Kyuwan Lee, Nathalie Sami, Christina Dieli-Conwright, FACSM. U of Southern California, Los Angeles, CA. (Sponsor: Christina Dieli-Conwright, FACSM)

(Purpose: to compare DXA and BIA measures of body composition (BC) in breast cancer survivors (BCS) and to examine the accuracy of these measures when compared to each other). BCS (Stage I-III) randomly assigned to the Bio-electrical Impedance Analysis (BIA) or Dual Energy X-ray Absorptiometry (DXA) measures of body composition. DXA (n=28), overweight (n=21), and obese (n=23) group. Significant differences were found for DXA and BIA measures of body composition including: body fat percentage (BFP), lean body mass (LBM) and fat mass (FM) in BCS. Further examined whether our results differed by BMI category.

METHODS: BCS (Stage I-III) who had completed cancer-related treatment within the previous 6 months were included in this study. BF, LB, and FM were estimated using BIA (InBody 520) and followed immediately by DXA (GE Lunar) by trained technicians. Testing was performed between 7:00-11:00 AM following a minimum 4-hour fast. BMI categories used were based on the World Health Organization: normal (18.0-24.99 kg/m^2), overweight (25.0-29.9 kg/m^2), and severely obese (>35.0 kg/m^2). Agreement between the devices was assessed by Bland-Altman analysis.

RESULTS: Our study population included a total of 89 BCS (57.2±10.4 years), predominantly Hispanic (63.6%), with BMI of 29.2±5.6 kg/m^2. There was no agreement between the two devices for BF (BF: DXA: 44.2±6.2 vs. BIA: 40.4±7.8%, LBM: DXA: 39.1±7.6 vs. BIA: 42.9±5.9kg/m^2) and FM (DXA: 32.4±10.8 vs. BIA: 30.6±11.0kg/m^2). DXA provided significantly higher estimates of BFP and FM, with a lower estimate of LBM compared to BIA (P<0.001). These findings held true among BCS in the normal (n=28), overweight (n=21), and obese group (n=23). However, there was agreement between the two devices for FM (DXA: 48.7±7.2 vs. BIA: 47.9±5.7kg/m^2 in severely obese BCS (n=17; p=0.12).

CONCLUSIONS: BIA may underestimate BFP and FM and overestimate LBM, compared to DXA in BCS. However, BIA and DXA provide similar FM in severely obese BCS, suggesting that BIA can be alternative to estimate FM. Future studies are warranted to assess the utilization of these 2 devices in a larger cohort of BCS across BMI categories.

**2998 Board #281**
**June 1 3:30 PM - 5:00 PM**

Muscle Strength and Fasting Insulin Levels Following a Combined Exercise Intervention in Breast Cancer Survivors

Nathalie Sami, Kaylie Zapanta, Kyuwan Lee, Christina Dieli-Conwright, FACSM. University of Southern California, Los Angeles, CA.

(Purpose: to examine the effects of sex and ACLR status on the volume of MVP among BCS in which an individual engages as well as the likelihood that an individual will meet national guidelines for weekly MVP. Methods: 31 individuals with a history of ACLR (Sex = 22F/9M, Age = 20.3 ± 1.7 years, BMI = 23.3 ± 2.8kg/m^2, Time since surgery = 28.2 ± 17.1mo) and 32 healthy individuals (Sex = 22F/10M, Age = 20.8 ± 1.6 years, BMI = 23.3 ± 3.0kg/m^2) enrolled in this study. Objective MVP in Freedom bouts (min/wk) were assessed with an ActiGraph GT3X-BT accelerometer worn on an elastic belt at the hip over a period of 7 days with a minimum of 4 days of wear with ≥ 10 hours per day. Wear time (min/day) was validated using recommendations of Choi et al. Between group (ACLR, Healthy) and sex (F/M) differences in MVP at freedom bouts were investigated using a 2 (group) x 2 (sex) ANOVA. Fischer’s exact test was utilized to assess the sex-based difference in meeting national MVP recommendations (MVP > 150 min/wk) among individuals with ACLR. Results: Overall, individuals with ACLR (MVP = 114±95 min/week) participated in less MVP in Freedom bouts per week as compared to healthy individuals (MVP = 212±138 min/wk, p = 0.002). Males (MVP = 184±133 min/wk) were more active than females (MVP = 116±102 min/wk, p = 0.02). There was no meaningful interaction between group and sex (p = 0.06) but females with ACLR (72.0%) were more likely to meet MVP guidelines when compared to males (36.3%, p = 0.05). Conclusion: Individuals with ACLR participate in less MVP than those with no history of knee injury which is consistent with previous findings. While no interaction was present between sex and history of ACLR, females with ACLR were more likely to meeting MVP guidelines which may have implications for long term health risks associated with ACLR.

Females are more likely to experience poor knee-related outcomes and are less likely to return to pre-injury levels of return to sport following ACLR as compared to males of the same age and pre-injury activity level. Evidence has shown that young adults with ACLR participate in significantly less moderate-to-vigorous physical activity (MVPA) as compared to healthy matched. However, it is not clear if an individual’s sex is a factor in their determining the likelihood of engagement in healthy levels of MVPA following ACLR. Purpose: To examine the effects of sex and ACLR status on the volume of MVP which an individual engages as well as the likelihood that an individual will meet national guidelines for weekly MVP. Methods: 31 individuals with a history of ACLR (Sex = 22F/9M, Age = 20.3 ± 1.7 years, BMI = 23.3 ± 2.8kg/m^2, Time since surgery = 28.2 ± 17.1mo) and 32 healthy individuals (Sex = 22F/10M, Age = 20.8 ± 1.6 years, BMI = 23.3 ± 3.0kg/m^2) enrolled in this study. Objective MVP in Freedom bouts (min/wk) were assessed with an ActiGraph GT3X-BT accelerometer worn on an elastic belt at the hip over a period of 7 days with a minimum of 4 days of wear with ≥ 10 hours per day. Wear time (min/day) was validated using recommendations of Choi et al. Between group (ACLR, Healthy) and sex (F/M) differences in MVP at freedom bouts were investigated using a 2 (group) x 2 (sex) ANOVA. Fischer’s exact test was utilized to assess the sex-based difference in meeting national MVP recommendations (MVP > 150 min/wk) among individuals with ACLR. Results: Overall, individuals with ACLR (MVP = 114±95 min/week) participated in less MVP in Freedom bouts per week as compared to healthy individuals (MVP = 212±138 min/wk, p = 0.002). Males (MVP = 184±133 min/wk) were more active than females (MVP = 116±102 min/wk, p = 0.02). There was no meaningful interaction between group and sex (p = 0.06) but females with ACLR (72.0%) were more likely to meet MVP guidelines when compared to males (36.3%, p = 0.05). Conclusion: Individuals with ACLR participate in less MVP than those with no history of knee injury which is consistent with previous findings. While no interaction was present between sex and history of ACLR, females with ACLR were more likely to meeting MVP guidelines which may have implications for long term health risks associated with ACLR.

Abstracts were prepared by the authors and printed as submitted.
The saddle is an integral part of riding a bicycle, however research examining determinants of cycling saddle preference/comfort is limited. PURPOSE: To determine if trained cyclists can differentiate between road bicycle saddle shapes and whether preferences are related to anatomy and/or cycling position variables.

METHODS: Cyclists riding 5-12 h/wk for a training event participated (21 M and 21 F). Pelvic anatomy (composition plus ischial tuberosity width) and overall body composition were determined by DXA. Cycling position variables were determined using 3D motion capture. Subjects then completed 3 separate saddle evaluations using identical cycling shorts while riding 3 differently shaped saddles (flat, convex wide/narrow and concave lengthwise). The 1st and 2nd evaluations were identical and occurred in the lab on an ergometer adjusted to the subject’s personal cycling position. In a blinded, randomized design, subjects rode each saddle twice for 5 min. A 6-item visual analog comfort questionnaire (0=100 with 100 being extreme comfort) was completed after each bout. For evaluation 2, subjects rode each saddle for 1 wk on their road bike while maintaining normal riding hours with comfort assessed at the end of each week. Upon study completion, subjects chose a preferred saddle, which was collected independent of comfort ratings. RESULTS: For evaluations 1 and 3, comfort ratings were not different between saddles or across evaluation sessions. With prolonged testing, significant (p<0.05) differences were observed for overall comfort for convex vs. concave (72.5 ± 18.0 and 61.2 ± 17.9) and flat vs. concave (70.7 ± 19.1 and 61.2 ± 17.9). Evaluation 2 comfort ratings matched preferred saddle choice, but did not improve subjects’ ability to differentiate saddles during evaluation 3. No relationships were observed between saddle comfort and any anatomy or cycling position variables. CONCLUSION: Trained cyclists in an acute, blinded setting cannot differentiate saddle shapes even when accustomed to the saddle. With longer exposure, cyclists that have examined associations of intracortical facilitation and inhibition of the soleus muscles are associated with popliteal venous flow. These findings indicate that trained cyclists can differentiate saddle shapes and demonstrate a preference that aligns with comfort ratings. However, no relationship was found between measured variables and saddle preference/comfort.

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Board #285
June 1 3:30 PM - 5:00 PM
Agreement Of Heart Rate Monitoring With A Smartwatch In Persons Using Wheelchairs
Daniel Moreno, Evan Glasheen, Antoniette Domingo, Brian Panagilan, Jochen Kressler. San Diego State University, San Diego, CA.

(NO relevant relationships reported)

Purpose: To validate heart rate (HR) from a fitness smartwatch (SW) designed to measure values in wheelchair users against standard heart rate monitoring. Valid HR tracking will be useful tool for monitoring exercise intensities for wheelchair users. METHODS: 5 wheelchair users (age=50.0 (5.6), and 3 able-bodied (age=25.3(3.2)) participated completed several tasks; wheelchair treadmill propulsion at 30, 45, and 60 strokes per minute (spm), arm cycle ergometry (ACE) at 45, 60, and 80 revolutions per minute (rpm), and ACE VO2max test at 50rpm with wattage(W) increments of 15/20(female/male) per min during stage until failure. Participants wore the SW on their dominant hand, and a heart rate monitor strap around their chest. Average steady state HRs from SW and HR strap were compared by Bland-Altman analysis. RESULTS: Combined resting HRs from the SW were 78(11) bpm for resting HR. Bland-Altman analysis showed high agreement between SW and HR strap (mean difference -0.04 bpm, limits of agreement (LoA) ±6 bpm). Mean absolute percent error (MAPE) for resting state was 2.5%. Reported average HRs by SW for treadmill task at 30, 45, and 60spm were 54(44), 76(48) and 62(58) bpm, respectively. HR strap measurement were 76(12), 102(25), and 110 (14) bpm. Poor agreement was seen for the treadmill task at 30mpm (-49(-171-73)), 45mpm (-25(-116-66)), and 60smpm (-48(-160-65)), with MAPEs of 42.2%, 27.6% and 43.9%, respectively. For ACE, average HRs reported by SW at 45, 60, and 80rpm were 89(12), 88(38), and 101(47)bpm; HR strap measurements were 85(12), 90(18), and 93(15)bpm. Mean differences (LoA) were -7(-74-83), -2(-19-76), and 99(-93-112), with MAPEs of 30.6%, 31.3%, and 43.3%, respectively. Average HRs reported by SW for stages 1, 2, 3, 4, and 5 of ACE VO2max were 82(9), 91(42), 113(112), 85(67) and 41(82)bpm, respectively. HR strap measurements were 83(10), 95(6), 115(7), 143(12), and 169(43)bpm. Good agreement was seen at first three stages -4(-7.6), 2.2%, -4(-88- 79) 21.2%, and -2(-16-12) 3.1%. Agreement declined at higher stages 4 and 5, and -58(-207-92) 38.5% and -12(-28) 76.3%, respectively. CONCLUSION: SW shows good validity at measuring HR at rest and only at lower frequencies/stages of ACE based exercises. The SW was poor at tracking HR for the treadmill tasks.

Board #286
June 1 3:30 PM - 5:00 PM
Maturation-Related Change in Neuromuscular Component of Force Production in Trained and Untrained Girls
Rana Fayazmilian1, Aynaz Pourmortahari1
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Abstract: The purpose of the present study was to investigate the maturation-related change in neuromuscular components of force production in gymnasts and untrained girls during the maximal voluntary isometric contraction (MVC). METHOD: 60 girls, in two groups of gymnasts and untrained were divided into three subgroups of preadolescents, adolescents, and adults according to Tanner’s scale. All aspects of study were explained and clarified to all subjects. Then, informed consent forms were completed by subjects (in the child’s group by their parents). After familiarization and initial measurements, each subject performed three maximal voluntary isometric contractions (MVC) of the knee extensor at five different angles to determine the optimal angle of force production. The rate of force development (RFD) was calculated using the torque data. The EMG signal of the rectus femoris muscle was recorded during the MVC test to measure voluntary activation (RMS). Results: The normalization of torque based on body weight eliminated the difference in force between the age groups. These results were similarly observed in the level of RMS and RFD. However, there was a significant difference between the gymnasts and the untrained groups in all variables. Conclusion: It seems that the differences in body size are more likely to justify absolute force differences than the neural factors. This is partly supported by the results of RMS and the RFD.

Keywords: Preadolescents, Electromyography (EMG), Rate of Force Development (RFD), Maximum Voluntary contraction (MVC)

Footnotes
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Board #287
June 1 3:30 PM - 5:00 PM
Intracortical Facilitation and Inhibition of the Soleus with Popliteal Venous Flow
Masafumi Terada, Keisuke Senoo, Kaede Kaneda, Syunuske Nonoyama, Tadao Isaka. Ritsumeikan University, Kusatsu, Japan.

(NO relevant relationships reported)

Associations of Intracortical Facilitation and Inhibition of the Soleus with Popliteal Venous Flow
Masafumi Terada, Keisuke Senoo, Kaede Kaneda, Syunuske Nonoyama, Tadao Isaka. Ritsumeikan University, Kusatsu, Japan.

The soleus muscle is functionally important to maintain venous return and consequently cardiac output by compressing underlying veins in order to increase blood flow back to the heart. Previous literature has reported that soleus dysfunction may contribute reduced venous return. Soleus dysfunction has been attributed to altered intracortical excitability within the central nervous system. However, there is little investigation that has examined associations of intracortical facilitation and inhibition of the soleus with venous flow in the popliteal vein. Determining these associations may help to establish neurophysiological mechanisms that cause altered venous return. PURPOSE: Determine if intracortical facilitation and inhibition of the soleus are associated with popliteal venous flow. METHODS: Ten participants (5M, 2F; 20.3±0.9yrs; 165.0±7.6cm; 61.0±5.4kg) were enrolled in this current study. Pared-pulse transcranial magnetic stimulation was used to assess intracortical facilitation (ICF) and short-interval intracortical inhibition (SICI) in the soleus muscle. Blood flow velocities in the popliteal vein were measured using Doppler ultrasound in a standing position variables. Subgroups of preadolescents, adolescents, and adults according to Tanner’s scale. 60 girls, in two groups of gymnasts and untrained were divided into three subgroups of preadolescents, adolescents, and adults according to Tanner’s scale. All aspects of study were explained and clarified to all subjects. Then, informed consent forms were completed by subjects (in the child’s group by their parents). After familiarization and initial measurements, each subject performed three maximal voluntary isometric contractions (MVC) of the knee extensor at five different angles to determine the optimal angle of force production. The rate of force development (RFD) was calculated using the torque data. The EMG signal of the rectus femoris muscle was recorded during the MVC test to measure voluntary activation (RMS). Results: The normalization of torque based on body weight eliminated the difference in force between the age groups. These results were similarly observed in the level of RMS and RFD. However, there was a significant difference between the gymnasts and the untrained groups in all variables. Conclusion: It seems that the differences in body size are more likely to justify absolute force differences than the neural factors. This is partly supported by the results of RMS and the RFD.

Keywords: Preadolescents, Electromyography (EMG), Rate of Force Development (RFD), Maximum Voluntary contraction (MVC)

Footnotes
1Corresponding Author (faculty member of Shahid Beheshti University, Tehran Province, Tehran, District 1, Daneshjou Boulevard, 1983969411)
Effects Of High Intensity Interval & Eccentric Training On Irisin and Myostatin Levels In Rats

Neda Khaledi, Heidar Hadavand, Milad Azad, Farnoosh Bidgoli.
Kharazmi University, Tehran, Iran, Islamic Republic of.

(No relevant relationships reported)

Some myokines such as irisin and myostatin have considerable effects on energy metabolism in addition to the musculoskeletal system. PURPOSE: Our aim was to investigate the effects of 9 weeks different training methods on circulating irisin and myostatin. METHODS: For this purpose, 20 Sprague Dawley rats with the weight range of (130±30gr) were divided into three groups: control (n=7), high intensity interval training (n=6), and eccentric training (n=7). They were held in the dark: light of 12:12. 48 hours after the last exercise session, protein measurement was performed using enzyme-linked immunosorbent assays (ELISA) test. RESULTS: Serum myostatin and irisin levels increased significantly following eccentric but they decreased following high intensity interval training. CONCLUSIONS: Despite these differences both myokines indicated significant relationship following 9 weeks of eccentric and high intensity interval training. Given the markedly increase in circulating myokines after eccentric training sessions these data suggest that eccentric training is probably more effective to stimulate skeletal muscle metabolic regulation.