

F-05 Thematic Poster - Fitness Assessment

Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower Level L100C

2476 **Chair:** Kimberly Reich. *High Point University, Burlington, NC.*

(No relevant relationships reported)

2477 **Board #1** June 1 1:00 PM - 3:00 PM
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 Eschker, Tamara Hew-Butler, FACSM, Charles R.C. Marks, Myung D. Choi, Kristin R. Landis-Piwowar, Elise C. Brown. *Oakland University, Rochester, MI.*

(No relevant relationships reported)

Although most of the data linking physical fitness to cardiometabolic (CMB) health explores assessments related to body composition and cardiorespiratory fitness, emerging evidence suggests muscular fitness also plays a key role in the pathogenesis and prevention of CMB 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 CMB 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 (1 RM) back squat, press, and deadlift], muscular endurance, muscular power, and VO₂max. A composite muscular strength index was calculated by dividing individual 1 RM 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 CMB risk variables. Statistical significance was set a priori at P ≤ 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 = -0.523, P = 0.02), and VO₂max and resting heart rate (ρ = -0.664, P = 0.001). No significant associations were found between muscular endurance and CMB 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 CMB disease.

2478 **Board #2** June 1 1:00 PM - 3:00 PM
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 interrelationship of four commonly used exercise thresholds: critical power (CP), the respiratory compensation point (RCP) and BPs in muscle (m[HHb]_{BP}) and brain (c[O₂Hb]_{BP}) 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[HHb]_{BP} and c[O₂Hb]_{BP} and four constant work rate (WR) tests to calculate CP. **Results:** WRs associated with CP, RCP, m[HHb]_{BP} and c[O₂Hb]_{BP} 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: 281±28W, post: 318±36W) and c[O₂Hb]_{BP} (pre: 283±36W, post: 313±32W) which occurred concomitantly (P = 0.683). M[HHb]_{BP} occurred at the highest WR and differed from all others (pre: 313±23W, post: 344±32W) (P < 0.05). Training-induced WR differences (ΔWR) 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 ΔWR were not interrelated (P > 0.05).

Conclusion: Results of the present study strongly question true equivalence and interchangeability of whole-body thresholds and BPs in the local oxygenation response during RI exercise, thereby suggesting that BPs in muscle and brain oxygenation should not be used as a replacement for classical threshold concepts.

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 ± 5.4cm vs. 6.8 ± 5.6cm, p = 0.00; TOR: 24.7 ± 6.5° vs. 17.8 ± 8.8°, p = 0.00), while HW significantly increased (0.54 ± 0.06cm vs. 0.56 ± 0.05cm, p = 0.01). **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).

2480 **Board #4** June 1 1:00 PM - 3:00 PM
Free Weight Bench Press Muscular Fitness Normative Data for Adults Aged 20-29 Years

Young Sub Kwon¹, Robert A. Robergs², Hosung So³, Christine M. Mermier⁴. 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 convenient 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 yr, height= 177±7cm, body mass=83±16kg) and 255 females (age=23±3 yr, height=167±6cm, body mass=67±11.3kg) 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 volumes of the 1st set and 4 sets of 65% of 1 RM 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 1. %tile rank for bench press muscular fitness for men and women				
%tile rank	1RM (kg)		Total Training Volume (kg)	
	Men	Women	Men	Women
75	119	54	2480	1115
50	98	49	1795	925
25	81	41	1500	684

2481 Board #5 June 1 1:00 PM - 3:00 PM
Lower Limb Peak Power As A Predictor Of Radial Trabecular Bone Strength
 Priscilla Franson, Kimberly D. Espartero, Andrew Denys, Maria G. Alvarez, Arianna M. Mazzarini, Rebekkah J. Reichert, Vanessa R. Yingling, FACSM. *California State University, East Bay, Hayward, CA.* (Sponsor: Vanessa R Yingling, FACSM)
(No relevant relationships reported)

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 radial 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 test using a Vertec. Peak Power (PP) was calculated from vertical jump height and combined relative grip strength was calculated. Trabecular Bone Mineral Content (vBMC.tb), Trabecular Bone Mineral Density (vBMD.tb), Total Area (T.Ar.tb), and Bone Strength in compression (BSIc) 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 R^2 values for all measurements: vBMC.tb (RGS [$R^2=0.1233$] PP [$R^2=0.5085$]), vBMD.tb (RGS [$R^2=0.1051$] PP [$R^2=0.3012$]), T.Ar.tb (RGS [$R^2=0.1227$] PP [$R^2=0.4162$]), BSIc (RGS [$R^2=0.1713$] PP [$R^2=0.5240$]). **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.

2482 Board #6 June 1 1:00 PM - 3:00 PM
Hemodynamic and Metabolic Responses to Self-Paced and Ramp Graded Exercise Protocols
 Nicholas Beltz¹, Fabiano T. Amorim², Ann L. Gibson, FACSM², Jeffrey M. Janot¹, Len Kravitz², Christine M. Mermier², Nathan Cole², Terence A. Moriarty², Tony P. Nunez³, Sam Trigg², Lance C. Dalleck⁴. ¹University of Wisconsin-Eau Claire, Eau Claire, WI. ²University of New Mexico, Albuquerque, NM. ³Metropolitan State University of Denver, Denver, CO. ⁴Western State Colorado University, Gunnison, CO.
(No relevant relationships reported)

PURPOSE: 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 RPE₆₋₂₀ scale. RAMP increased speed by 0.16 km/hr every 15 s until volitional exhaustion. All testing was performed at 3% incline. Oxygen consumption (VO_2) was measured via indirect calorimetry; hemodynamic function was measured via thoracic impedance, and blood lactate (BLa) was measured via portable lactate analyzer. Differences between SP and RAMP protocols were analyzed as group means by using paired samples t-tests (R Core Team (2017)).

RESULTS: Maximal values for SP and RAMP were similar ($p > 0.05$) for VO_2 (47.1 ± 3.4 vs. 47.4 ± 3.4 mL \cdot kg⁻¹ \cdot min⁻¹), heart rate (198 ± 5 vs. 200 ± 6 beats \cdot min⁻¹), ventilation (158.8 ± 20.7 vs. 159.3 ± 19.0 L \cdot min⁻¹), cardiac output (26.9 ± 5.5 vs. 27.9 ± 4.2 L \cdot min⁻¹), stroke volume (145.9 ± 29.2 vs. 149.8 ± 25.3 mL \cdot beat⁻¹), arteriovenous oxygen difference (18.5 ± 3.1 vs. 19.7 ± 3.1 mL \cdot dL⁻¹), and peak BLa (11.7 ± 2.3 vs. 11.5 ± 2.4 mM \cdot L⁻¹), respectively.

CONCLUSIONS: SP elicits similar maximal metabolic and hemodynamic responses in comparison to RAMP for our sample. These results support SP as a feasible GXT protocol. Electing to utilize SP may benefit clinicians and researchers from a time-management perspective.

2483 Board #7 June 1 1:00 PM - 3:00 PM
Revisiting The ACSM Metabolic Equation For Walking: Development Of A Cadence (steps/min) Metabolic Equation
 Christopher C. Moore¹, Scott W. Ducharme¹, Elroy J. Aguair¹, John Staudenmayer¹, Stuart R. Chipkin¹, John M. Schuna Jr.², Tiago V. Barreira³, Catrine Tudor-Locke, FACSM¹. ¹University of Massachusetts Amherst, Amherst, MA. ²Oregon State University, Corvallis, OR. ³Syracuse University, Syracuse, NY.
 (Sponsor: Catrine Tudor-Locke, FACSM)
(No relevant relationships reported)

The ACSM has long published a metabolic equation using walking speed and grade to predict oxygen consumption. The small homogeneous sample ($n=3$, trained men) used to derive the 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 (VO_2 ; 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 \pm SD age=30.0 \pm 5.6 years, BMI=24.6 \pm 3.3 kg/m²) completed 5-min treadmill bouts separated by 2-min rest at four speeds: 53.6, 67.1, 80.5, and 93.9 m/min (2.0, 2.5, 3.0, 3.5 mph). The cadence- VO_2 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 [VO_2 (mL/kg/min) = $0.0021 \cdot C^2 - 0.24 \cdot C + 15.4$, where C = cadence]. The RMSE [$\pm 95\%$ CI] from the LOOCV of the cadence metabolic equation was 2.5 [± 1.0] mL/kg/min and its bias [$\pm 95\%$ CI] was 0.6 [± 0.3] mL/kg/min. The RMSE from applying the ACSM walking metabolic equation to this data was 3.1 [± 1.2] mL/kg/min, with a bias of -2.5 [± 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.

2484 Board #8 June 1 1:00 PM - 3:00 PM
Validity of My Jump App to Measure Vertical Jump Height of the Elderly
 Iransé Oliveira-Silva¹, Rejane M. Cruvinel-Cabra², André R. Medeiros², Daniel A. Boullosa². ¹UnieVANGÉLICA, Anápolis, Brazil. ²UCB, Brasília, Brazil. (Sponsor: Carl Foster, FACSM)
(No relevant relationships reported)

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 showed 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 sample of young individuals therefore its validity for evaluation of the elderly is unknown. **PURPOSE:** To verify the validity of the iPhone App "My Jump" for evaluation of counter movement jump (CMJ) height of the elderly. **METHODS:** Forty-one elderly (29 women), 71 \pm 7 years old, 66.5 \pm 12.4 kg of body mass, volunteered to participate in this study. After evaluation of body mass, all participants performed 3 CMJs between 8:00 and 10:00 h. Every participant performed the jumps on a contact mat connected to a computer with a specific software (Chronojump, v. 1.6.2, Boscossystem, Spain). At the same time, the jump was recorded with a mobile (iPhone 7, Apple, USA) at a sampling rate of 240 Hz, using the My Jump App. The best jump was used for further analyses. The intraclass correlation coefficient (ICC), and the coefficient of variation (CV%) were used to verify the relative and absolute reliability. Pearson's correlation coefficient was used to verify the strength of the relationship between both evaluations. **RESULTS:** CMJ height was 10.78 \pm 5.23 cm when recorded with contact mat, and 10.87 \pm 5.32 when recorded with My jump App. The ICC was 0.997, and the CV% was 1.77. There was a nearly perfect correlation between methods ($r=0.999$; $p=0.000$). **CONCLUSION:** Our results suggest that My Jump App is a valid method to evaluate vertical jump performance in the elderly when using a contact mat as the reference method.

F-06 Thematic Poster - Nutritional Status of Athletes II

Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Mezzanine M100C

2485 **Chair:** Enette Larson Meyer. *University of Wyoming.*
(No relevant relationships reported)

2486 **Board #1** June 1 1:00 PM - 3:00 PM
The Effects Of Intensive Weight Loss On Metabolome In Female Fitness Competitors

Heikki Sarin¹, Anni Joensuu¹, Matti Jauhiainen¹, Katja Borodulin¹, Satu Männistö¹, Joseph Lee², Ville Isola³, Juha Ahtiainen³, Keijo Häkkinen³, Kati Kristiansson¹, Juha Hulmi³, Markus Perola¹. ¹National Institute for Health and Welfare, Helsinki, Finland. ²University of Columbia, New York City, NY. ³University of Jyväskylä, Jyväskylä, Finland.
(No relevant relationships reported)

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 related 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 17.5±2.6 weeks of recovery period (POST). Control-group was instructed to maintain their usual fitness lifestyle, exercise levels and energy intake constant during the study. NMR-platform was used for the determination of metabolome. Data analysis was performed using R and significance threshold was set to 2.1×10^{-3} .

RESULTS: Intensive weight loss in the Diet-group was composed of mainly large (~51 %) decreases in total body fat mass ($p < 0.001$) waist circumference (~8 %) and the android region (~70 %) reflecting visceral fat mass ($p < 0.001$). This was accomplished by decreased energy intake (~18 %) and increased total amount (METH) of exercise (~15 %). Weight loss affected significantly on several inflammation related biomarkers such as α_2 -acid glycoprotein ($p=2.47 \times 10^{-9}$) and various HDL-metabolites ($p=8.22 \times 10^{-12}$). The reduction of visceral fat mass was significantly associated 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 serum metabolome in fitness/physique athletes. Decrease in visceral fat mass seem 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. 269517 to MP), Finnish Fitness Sports Association and Department of Biology of Physical Activity.

2487 **Board #2** June 1 1:00 PM - 3:00 PM
Evaluation of Dietary Intake & Training Volume During Army Initial Entry Training

Jeremy McAdam, Kaitlin McGinnis, JoEllen Sefton. *Auburn University, Auburn, AL.*
(No relevant relationships reported)

PURPOSE: Evaluate training volume and dietary intake, and estimate energy balance in Army Initial Entry Training (IET) soldiers.

METHODS: Dietary intake was assessed by collecting diet logs for 3 meals on each of 3, non-consecutive days during the first week of IET. Training volume was measured across 12 weeks using Actigraph wGT3X accelerometers. A total of 96 (Age = 18.7 yrs. Sd. \pm 1.9, Wt. = 71.6 sd. \pm 12.4 kg) male trainees were monitored and completed diet logs; monitoring occurred at all time, with 12 soldiers assessed each week. Energy expenditure estimates were calculated using metabolic equivalents and actigraph reported intensities and duration.

RESULTS: On average IET soldiers daily accumulated 183 (sd. \pm 16) min low, 89 (sd. \pm 16) min moderate, 17 (sd. \pm 6) min vigorous, and 4 (sd. \pm 1) min of very vigorous intensity physical activity across 12 weeks. Estimated overall energy expenditure was 3,154 (\pm 187) calories per week with a negative net energy balance of -482 (\pm 187) calories. Regression analysis revealed body weight was a significant predictor (adj. $R^2 = 0.5512$, $p < 0.001$) for negative energy balance. For every 1-kilogram increase in body mass, energy balance became more negative by 52.4 calories.

CONCLUSIONS: IET is a physically demanding environment with large volumes of training and high energy expenditures. IET soldiers are likely exposed to chronic net negative energy balance, those weighing more are at an elevated risk. Nutritional strategies including supplementation may be needed to meet the calorie demands of training.

2488 **Board #3** June 1 1:00 PM - 3:00 PM
Leptin and Ghrelin Predict Resting Metabolic Rate and Energy Expenditure in Female Collegiate Runners

Mindy Patterson, Dina Acosta, Jenna Lin, Rita DelloStritto, Alexis Ortiz, FACSM. *Texas Woman's University, Houston, TX.*
(Sponsor: Alexis Ortiz, FACSM)
(No relevant relationships reported)

Leptin and ghrelin are counterregulatory hormones that maintain energy balance through food intake and energy expenditure through hypothalamic signaling. Leptin circulates in the blood proportional to fat mass (FM) and decreases food intake and promotes energy expenditure through hypothalamic signaling. Ghrelin is released from the stomach to stimulate food intake also via hypothalamic actions.

PURPOSE: To examine the relationship of leptin and ghrelin with resting metabolic rate (RMR) and total energy expenditure (TEE) in female collegiate runners and inactive females.

METHODS: Outcomes were compared between female collegiate runners (n=12; age 22.2±3.3 years) logging a minimum of 30 miles per week and inactive females (n=14; age 25.3±1.9 years) using a cross-sectional study design. RMR and TEE were measured by air displacement plethysmography (BOD POD®). Fasting leptin and fasting ghrelin were quantified using enzyme-linked immunosorbent assay. Fat mass (FM) and lean mass (LM) were determined by dual-energy X-ray absorptiometry. Stepwise regression predicted the association of fasting concentrations of leptin and ghrelin on RMR and TEE in each group.

RESULTS: BMI (runners: 19.8±1.4 kg/m²; inactive: 22.6±2.8 kg/m²; $p = .004$), FM (runners: 10.76 kg; inactive: 18.32 kg, $p \leq .001$) and TEE (runners: 2,420 kcal/d; inactive: 1,469 kcal/d; $p \leq .001$) differed between groups, but not LM and RMR. In runners only, higher leptin predicted higher RMR ($Beta = .338$; $p = .004$), but to a lesser extent than LM ($Beta = .685$; $p \leq .001$). Together leptin and LM strongly, positively contributed to the variance of RMR (adj. $R^2 = .99$). Leptin ($Beta = .337$; $p = .004$) and LM ($Beta = .686$; $p \leq .001$) predicted TEE in the same manner as RMR in runners only. Ghrelin negatively predicted RMR and TEE ($Beta = -.72$; $p = .019$) similarly. In inactive females, neither leptin nor ghrelin predicted RMR or TEE.

CONCLUSION: LM was the strongest predictor of RMR and TEE in collegiate female runners. Higher leptin and lower ghrelin also predicted higher RMR and TEE indicating both biomarkers impact hypothalamic signaling to influence energy expenditure to maintain energy homeostasis in endurance trained females.

2489 **Board #4** June 1 1:00 PM - 3:00 PM
Energy Balance, Body Composition, and Bone Health in Female Lacrosse Players

Hannah Zabriskie, Brad Currier, Patrick Harty, Richard Stecker, Andrew Jagim, Chad Kerksick, FACSM. *Lindenwood University, St. Charles, MO.*
(No relevant relationships reported)

In female athletes, prolonged energy deficits increase the risk of a syndrome known as the female athlete triad; characterized by dysmenorrhea, disordered eating, and reduced bone mineral density (BMD). This syndrome is more common in endurance or aesthetic sports, and has yet to be explored in some team sports. **PURPOSE:** The purpose of this study was to evaluate the relationship between energy status, body composition, and bone health in Division II female lacrosse players. **METHODS:** Twenty-two female lacrosse players (20.4 \pm 1.8 years, 69.1 \pm 8.7 kg, 168 \pm 6.3 cm, 28.1 \pm 2.99% fat, 1.03 \pm 0.06 g/cm² BMD) wore a physical activity monitor and recorded diet over a four-day period approximately four months prior to starting NCAA season play. The physical activity monitor measured total daily energy expenditure, activity energy expenditure, and physical activity level (PAL). Each player completed a DEXA scan and a resting metabolic rate (RMR) test. Correlations and linear regression with backward selection were utilized for analysis. **RESULTS:** Players presented with an average RMR of 1542.20 kcal/day (SD = 145.97), a PAL of 2.24 (SD = 0.42), and an energy deficit of 1,186.85 kcal (SD = 813.09). Those with greater fat free mass (FFM) ($r = 0.602$, $p = 0.003$) and greater fat mass (FM) ($r = 0.656$, $p = 0.0009$) had a higher RMR. Total body mass was found to have stronger influence on RMR than FFM or FM ($p = 0.007$). Players with greater energy deficit had more absolute ($r = -0.447$, $p = 0.037$) and relative ($r = -0.445$, $p = 0.038$) FM. Bone mineral content tended to worsen with increased energy deficit ($p = 0.0693$) though energy balance had no relationship with BMD ($p = 0.8742$). **CONCLUSIONS:** Our results imply that total body size is the strongest predictor of RMR. Furthermore, players with greater absolute and relative FM tended to display greater energy deficits, possibly reflecting attempts to lose weight by cutting calories and increasing activity, thereby inducing an energy deficit. This behavior may be a symptom of disordered

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.

2490 Board #5 June 1 1:00 PM - 3:00 PM
Higher Activity Energy Expenditure And Lower Resting Energy Expenditure Among Healthy Female Athletes

Kazuko Ishikawa-Takata¹, Motoko Taguchi², Suguru Torii².
¹National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. ²Waseda University, Saitama, Japan.
(No relevant relationships reported)

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 (Pontzer, 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 PAL 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, PAEE and TIEE were significantly positively correlated with PAL ($r=0.636$, 0.848 , and 0.425 , $p<0.001$, $p<0.001$, and $p=0.001$). Adjusted REE and the difference between REE and eREE were significantly negatively correlated with PAL ($r=-0.531$ and -0.468 , $p<0.001$ 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.

2491 Board #6 June 1 1:00 PM - 3:00 PM
Examination of Male Athlete Triad Symptoms in Endurance Trained Athletes

Erin M. Moore¹, Toni M. Torres-McGehee¹, Clemens Drenowatz², Dave F. Stoddan¹, Justin M. Goins¹, Thaddeus C. Broderick¹, Brittany T. Williams¹. ¹University of South Carolina, Columbia, SC. ²Pädagogische Hochschule Oberösterreich, Linz, Austria.
(No relevant relationships reported)

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. **PURPOSE:** Examine 2 components of MT: 1) energy availability (EA) and 2) BMD in endurance-trained male athletes. Secondly 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 ± 5.6 kg; height: 179.3 ± 4.6 cm; VO_{2max} of 63 ± 6.7 ml⁻¹kg⁻¹min) was used. Inclusion criterion included participants training for competition, have $\leq 12\%$ body fat and a $VO_{2max} \geq 41$ ml⁻¹kg⁻¹min. Data was collected across 2 training weeks (high volume [HV] and low volume [LV]) and included: dietary logs, exercise logs, and BMD via Dual-Energy X-Ray Absorptiometry. Sense-Wear Armbands calculated EEE and EA was calculated as $EA = ([EI-EEE]/FFM)$. Macronutrients were assessed using ACSM recommendations. LEA was defined as ≤ 20 kcal⁻¹kg⁻¹FFM. **RESULTS:** Overall, EI = 2929.4 ± 244.4 kcal; EEE = 1263.4 ± 107.3 kcal; and EA = 25.6 ± 3.2 kcal⁻¹kg⁻¹FFM. A 2 (week) X 7 (days) ANOVA revealed a main effect between the weeks for EA $F(1,13)=62.81$ ($p<0.01$, $\eta^2=0.83$), EI $F(1,13) 143.6$ ($p<0.01$, $\eta^2=0.92$) and EEE $F(1,10) 138.5$ ($p<0.001$, $\eta^2=0.93$). A significant interaction was found between days and EA ($p<0.01$; $\eta^2=0.35$), and EEE ($p<0.01$; $\eta^2=0.50$), as well as the 2 weeks and EEE ($p=0.002$, $\eta^2=0.41$). 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⁻¹kg⁻¹FFM 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. Cut points for LEA need to be established in the future.

2492 Board #7 June 1 1:00 PM - 3:00 PM
Is Disordered Eating Related To Muscle-enhancing Supplement Use And Exercise Context in Adolescents?

Kethe M. E. Engen¹, Christine Sundgot-Borgen¹, Monica K. Torstveit², Jan H. Rosenvinge³, Oddgeir Friberg³, Gunn Pettersen³, Solfrid Bratland-Sanda⁴, Elin Kolle¹, Jorunn Sundgot-Borgen, FACSM¹. ¹Norwegian School of Sport Sciences, Oslo, Norway. ²University of Agder, Kristiansand, Norway. ³University of Tromsø, Tromsø, Norway. ⁴Telemark University College, Bø, Norway. (Sponsor: Jorunn Sundgot-Borgen, FACSM)
(No relevant relationships reported)

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 dependent on these two exercise contexts in adolescents is not known. **Purpose:** To study how participation in sport or/and a gym context and SU relates to DE in adolescents. **Method:** Participants were 599 boys and 1038 girls enrolled in a RCT to promote a positive body image and prevent DE in high schools. The "Eating Disorder Examination Questionnaire" (EDEQ) short form measured DE. Participants provided information about exercise context (1 = gym + sport, 2 = gym only, 3 = neither sport or gym, 4 = sport only) and SU (1 = protein and creatine (PSU+CSU), 2 = protein only (PSU), and 3 = no SU). ANCOVA was used to examine main and interaction effects of SU and sport context. Effects were considered significant when F test was $p < .05$. The analyses were stratified for gender. **Results:** Among boys, PSU+CSU was associated with higher EDEQ-score ($b = 1.31$, $p < .01$). In addition, reporting either sport, gym, or gym + sport context was associated with lower EDEQ-score ($b = -1.16$, $p = .01$) in boys. In girls, higher EDEQ-score was associated with reporting gym or gym + sport context ($b = .77$, $p < .01$ and $b = .68$, $p < .01$), while higher score was associated with sport context ($b = -.33$, $p = .02$). Effects were found for the covariates body mass index (boys, $b = 1.05$, $p < .01$, girls, $b = .18$, $p = .01$) and studying sport program (boys, $b = -1.21$, $p < .01$). 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.

2493 Board #8 June 1 1:00 PM - 3:00 PM
Examination of Female Athlete Triad Components in Collegiate Equestrian Athletes

Toni M. Torres-McGehee¹, Kyra Dodson¹, Dawn M. Emerson², Kelly Pritchett³, Erin M. Moore¹, Monica Kimmel¹. ¹University of South Carolina, Columbia, SC. ²University of Kansas, Lawrence, KS. ³Central Washington University, Ellensburg, WA.
(No relevant relationships reported)

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 NCAA 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), proteins (PRO), and fats. **METHODS:** Female NCAA 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 (MedGem). Exercise energy expenditure was calculated using Ainsworth equation and EA was calculated by $EA = (EI-EEE)/\text{free fat mass}$. 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. Overall risk for LEA was 82.1% ($n = 23$); 64.3% ($n = 18$) of 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⁻¹FFM/

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. *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 used to examine: i) main effects of time (baseline vs 24 weeks), intervention group (M4 vs M2) and gender (men vs women); ii) interactions of time x intervention group, and time x gender.

Results: At 24 weeks, 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 ($p = .02$).

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 ($p = .05$), 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

Tongjian You, FACSM, Elisa F. Ogawa, Yurun Cai, Ling Shi, Suzanne G. Leveille. *University of Massachusetts Boston, Boston, MA.*

(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 levels of 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 AG043883)

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 \pm 8 years, 1.6 \pm .1 m, 82.1 \pm 21.7 kg; 71 \pm 7 years, 1.6 \pm .1 m, 80 \pm 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 ($p < .05$). LLS improved from pre to post for TLM (pre=14.3 \pm 7, post=20.2 \pm 8.1) and SAIL (pre=20.9 \pm 6.2, post=18.2 \pm 6.5). Only main effects were attained for remaining variables ($p < .05$). All participants were faster (TUG, pre=9.1 \pm 4, post=8.2 \pm 3.1), improved FRT (pre=336 \pm 91, post=327 \pm 101) & HRT (pre=282 \pm 87, post=277 \pm 86). Faster HRT and FRT were seen for SAIL (319 \pm 96, 269 \pm 87) compared to TLM (356 \pm 90, 298 \pm 83). RLS & LLS increased from pre (16.4 \pm 7, 16.8 \pm 6.9) to post (20.7 \pm 7.5, 20.6 \pm 6.9). Leg strength was greater in SAIL (RLS=19.3 \pm 7, LLS=19.4 \pm 6.4) than TLM (RLS=16.6 \pm 8.2, LLS=16.9 \pm 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

Erin M. Shellington, Dawn P. Gill, Sonja M. Reichert, Matthew Heath, Robert J. Petrella, FACSM. *University of Western Ontario, London, ON, Canada.*

(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 determine if a SSE intervention improves cognitive and mobility in older adults with chronic disease (i.e., knee osteoarthritis [KOA]; type 2 diabetes mellitus [T2DM] with self-reported cognitive complaints [sCC]; and dementia), compared to control groups.

Methods: We conducted three pilot randomized controlled trials, with 12- and 24-week intervention periods, compared to wait-list control groups. Assessments focused on: mobility (i.e., 30-second chair stand, and walking speed) for adults with KOA;

cognition [i.e., Cambridge Brain Sciences, antisaccade reaction time (RT)] for adults with T2DM with sCC; and mood and behaviours questionnaire (i.e., Neuropsychiatric Inventory Questionnaire; NPIQ) for adults with dementia.

Results: KOA participants showed trends toward improved 30-second chair stand at 12-weeks ($F=1.8, p=0.12, \eta_p^2=0.16$) and 24-weeks ($F=3.4, p=0.09, \eta_p^2=0.18$), and walking speed at 24-weeks ($F=2.4, p=0.14, \eta_p^2=0.14$), compared to controls after adjusting for baseline. T2DM with sCC improved on planning change scores from 12 to 24-weeks ($F=5.8, p=0.03, \eta_p^2=0.28$) compared to controls, and a non-significant improvement in antisaccade RT of 38 ms (SD 16). Adults with dementia improved on NPIQ scores (i.e. symptoms) at 12-weeks (total: $F=7.3, p=0.01, \eta_p^2=0.25$; frequency: $F=9.4, p=0.01, \eta_p^2=0.30$; and severity: $F=7.0, p=0.02, \eta_p^2=0.24$), compared to controls. Conclusions: In our pilot trials, SSE showed promise for improving mobility and cognition in adults with chronic disease and demonstrates the potential for its use in adults with diverse mobility and cognitive impairments.

Funding: Supported by the Department of Family Medicine, University of Western Ontario, Mitacs Accelerate, Ontario Graduate Scholarship, and Schlegel - University of Waterloo Research Institute for Aging.

2499 Board #5 June 1 1:00 PM - 3:00 PM
Physical Activity, Physical Fitness Related To Quality Of Life For Older Adults In Beijing China
 CAILIANG ZHOU, Hong REN. *BEIJING SPORT UNIVERSITY, BEIJING, China.*
(No relevant relationships reported)

Physical activity, physical fitness related to quality of life for older adults in Beijing China
 Cailiang ZHOU, Hong REN
 College of Sport Sciences, Beijing Sport University
Purpose: To explore the relationships between physical activity, physical fitness and quality of life for the elderly population. **Methods:** We included in our study 105 older adults (≥ 60 years old) from three community in Beijing, China. Data of physical activity was collected by physical activity survey for the elderly (PASE). Items of physical fitness included grip strength, flexibility and balance, assessing according to the measurement manual of National Physical Fitness Surveillance in China. T score (ranging from 0-100) was calculated for each physical fitness item and added up to a total score. Quality of life was measured by the Medical Outcome Study 36-item short form health survey (SF-36). Subscales of SF-36 were summarized into two subdomains of physical component summary regarding physical health, and mental component summary for mental health. Multivariable linear regression was used to explore the relationship between physical activity, physical fitness and quality of life. **Results:** Among the study population physical activity and total score of all 3 items of physical fitness were the most important impact factors for physical component summary (standardized regression coefficients were 0.39 and 0.33, respectively). As regarded to mental component summary, total score of all 3 items of physical fitness, but not physical activity, was the major influencing factor (standardized regression coefficient was 0.24). No interactions were found between physical activity and physical fitness in relation to two subdomains of quality of life ($P>0.05$). **Conclusion:** Both physical activity and physical fitness had independent effects on quality of life for older adults in Beijing, China. Physical activity was the most important factor that associated with physical health, but not with mental health. The summary condition of grip strength, flexibility and balance was positively correlated with both physical and mental health.

Keywords: Physical activities, Physical fitness, Quality of life

2500 Board #6 June 1 1:00 PM - 3:00 PM
Physical Fitness Performance and Normative Score of Elderly Male Rural Dwellers
 PEI-SUNG CHIN¹, Meng-Tzu Hou², Chih-Hsing Wu³.
¹University of Taipei, Taipei, Taiwan. ²National Yang-Ming University, Taipei, Taiwan. ³Department of Family Medicine, National Cheng Kung University Hospital, Taipei, Taiwan.
(No relevant relationships reported)

PURPOSE: In Taiwan, there is no national consensus on the normative score for assessing physical fitness performance in elderly people living in rural communities. The study thus endeavored to set up the normative score and to understand the current status of physical fitness of elderly male rural dwellers in Taiwan.

METHODS: The study first surveyed the 1,033 men aged 65 and over in Tianliao township of Kaohsiung County. After an entire township sampling, 414 subjects were selected to receive examination, resulting in a response rate of 60.8%. Twelve of the 414 subjects were excluded due to use of assistive devices or severe joint disease, leaving a total of 402 subjects enrolled for formal analysis. Each subject had completed questionnaires and received physical fitness assessment. All of the subjects were divided into five 5-year age subgroups. The normative physical fitness scores were listed by nine-rank percentile distribution (in the order of 5%, 10%, 25%, 30%, 50%, 70%, 75%, 90%, 95% respectively).

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 such as body mass index 24.1 kg/m², percent body fat 20.6%, grasp test of dominant hand 33.3kg, 5-time sit and stand 11.2 sec, 30-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 fitness as 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.

2501 Board #7 June 1 1:00 PM - 3:00 PM
Efficacy of High-Intensity Resistance and Sprint Interval Training in Older Adults
 Scarlett L. Barnes, Kenneth L. Robertson, Boyi Dai, Marci L. Smith, Gretchen M. Sewczak-Claude, Derek T. Smith.
University of Wyoming, Laramie, WY.
(No relevant relationships reported)

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 (VO₂max), body composition, functional movement screen (FMS), floor-transfer-time (FTT), timed-up-and-go (TUG), balance, and flexibility. Subjective measures were: satisfaction with physical function, mobility, and physical activity enjoyment (PACES). Data analysis: repeated measure ANOVA and paired-t tests ($P<0.05$). **RESULTS:** VO₂max improved similarly in all groups (SIT 2.2 ± 0.3 ; HIRT 3.5 ± 0.7 ; MICE 2.1 ± 0.5 ml/kg/min, $P<0.01$ for all). Both high-intensity groups improved in FTT (HIRT=17%, $P<0.01$; SIT=12%, $P<0.05$) and FMS (HIRT=17%, SIT=10%, $P<0.01$). Only HIRT improved in TUG (10.6%) and balance (9%). Perceived satisfaction with physical function improved in all groups (HIRT=389%; SIT=266%; MICE=167%; all $P<0.01$) with 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.

2502 Board #8 June 1 1:00 PM - 3:00 PM
Heart Rate Increase and Recovery as Predictors of Mobility Decline in Well-Functioning Older Adults
 Eleanor M. Simonsick¹, Gerald J. Jerome, FACSM², Jennifer A. Schrack³, Stephanie A. Studenski¹, Luigi Ferrucci¹. ¹National Institute on Aging, Baltimore, MD. ²Towson University, Towson, MD. ³Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. (Sponsor: Gerald J. Jerome, FACSM)
(No relevant relationships reported)

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 400m 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-pace 400m walk and HR recovery (HR-R; HR decline 2-minutes post-test completion) in relation to 400m time, usual gait speed and reported ability to walk ¼ 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 ($b=-1.02$; $p \< .001$) and HR-R ($b=-1.12$; $p \< .001$) in separate models were negatively associated with 400m time; that is higher HR was associated with better performance; whereas, for a given 400m time, higher HR-I and HR-R were associated with worse baseline reported walking ability ($b=-.007$; $p=.011$ and $-.011$; $p=.002$). Longitudinally, higher HR-I and HR-R predicted slower follow-up 400m time and poorer reported walking ability independent of baseline values ($b=.19$; $p=.039$ and $b=.24$; $p=.037$; $b=-.010$; $p=.007$ and $-.011$; $p=.011$). 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.

F-08 Thematic Poster - Thermoregulatory Sweating

Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100F

2503 **Chair:** James M. Carter, FACSM. *Gatorade Sports Science Institute, Barrington, IL.*
(No relevant relationships reported)

2504 Board #1 June 1 1:00 PM - 3:00 PM
Relation between Regional and Whole Body Sweat Sodium Concentration and the Effect of Exercise Intensity

Lindsay B. Baker, FACSM, Corey T. Ungaro, Bridget C. Sopena, Ryan P. Nuccio, Adam J. Reimel, Kelly A. Barnes. *Gatorade Sports Science Institute, Barrington, IL.*

Reported Relationships: L.B. Baker: Salary; This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

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 HR_{max} (LOW, 109±20 Watts) or 85% of HR_{max} (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 forearms, 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 consistent diet for 48-h 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.

RESULTS: WB sweat rate (0.516±0.077 g/cm²/min vs. 0.764±0.133 g/cm²/min; p<0.001) and WB sweat $[Na^+]$ (32.6±14.3 mmol/L vs. 52.7±14.6 mmol/L; p<0.01) 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<0.05) 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 WB sweat $[Na^+]$ from most REG sites irrespective of intensity when exercising between 65 and 85% HR_{max} .

2505 Board #2 June 1 1:00 PM - 3:00 PM
Sport Specific Normative Data for Sweating Rate and Sweat Sodium Loss in Athletes: An Update

Kelly A. Barnes¹, James M. Carter, FACSM¹, Melissa L. Anderson², John R. Stofan¹, Matthew D. Pahnke¹, Rebecca K. Randell³, Lindsay B. Baker, FACSM¹. ¹Gatorade Sports Science Institute; PepsiCo, Inc, Barrington, IL. ²Gatorade Sports Science Institute; PepsiCo, Inc, Bradenton, FL. ³Gatorade Sports Science Institute; PepsiCo, Inc, Beaumont Park, United Kingdom.

Reported Relationships: K.A. Barnes: Salary; This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the

position or policy of PepsiCo, Inc. Ownership Interest (Stocks, Bonds); This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

Previously, we published sweating rate (SR) and sweat sodium concentration ($[Na^+]$) normative data in 506 athletes. **PURPOSE:** The purpose of this study was to expand the data set and analyses to establish sport-specific normative data for SR and rate of sweat Na^+ loss. **METHODS:** Data from 1303 athletes (1103 male, 200 female) were compiled from field and lab testing. SR was calculated from the difference in pre- to post-exercise body mass, correcting for food/fluid intake and urine/stool loss. A standardized absorbent sweat patch technique was used to determine local sweat $[Na^+]$ and normalized to whole body sweat $[Na^+]$ using published regression equations. Rate of sweat Na^+ loss was determined from the product of whole body sweat $[Na^+]$ and SR. The sport-specific analysis included sports with n>100; endurance (n=255), soccer (n=268), basketball (n=196), American football (n=271), and baseball (n=161). **RESULTS:** Data are mean ± SD. SR differed significantly between sports (ANOVA, Tukey's post hoc; p<0.05); American football displayed the highest SR (1.5 ± 0.7 L/h), followed by endurance (1.3 ± 0.6 L/h), basketball (1.0 ± 0.4 L/h), soccer (0.9 ± 0.4 L/h) and baseball (0.8 ± 0.3 L/h). The rate of sweat Na^+ loss was higher in American football (55.9 ± 36.8 mmol/h) and endurance (51.7 ± 27.8 mmol/h) compared with soccer (34.6 ± 19.2 mmol/h), basketball (34.5 ± 21.2 mmol/h), and baseball (27.2 ± 14.7 mmol/h). The rate of sweat Na^+ loss was higher in soccer than baseball. After accounting for the impact of covariates (age, sex, body mass, temperature, humidity, season, and intensity), there were still significant differences (ANCOVA, Tukey's post hoc; p<0.05) in the adjusted means for SR and rate of sweat Na^+ loss; endurance (1.2 L/h, 43.1 mmol/h), football (1.0 L/h, 38.2 mmol/h) and soccer (1.0 L/h, 35.4 mmol/h) were higher than baseball (0.8 L/h, 25.5 mmol/h), and endurance was higher than basketball (0.9 L/h, 32.0 mmol/h). **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.

2506 Board #3 June 1 1:00 PM - 3:00 PM
Body Sweat Mapping of Untrained Males during Exercise-Induced Hyperthermia

Caroline J. Smith¹, George Havenith, FACSM². ¹Appalachian State University, Boone, NC. ²Loughborough University, Loughborough, United Kingdom. (Sponsor: George Havenith, FACSM)

(No relevant relationships reported)

Aerobic 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 (22 ± 3 yrs, VO_{2max} 42.7 ± 7.2 ml.kg⁻¹.min⁻¹) and nine aerobically trained male athletes (23 ± 3 yrs, VO_{2max} 70.2 ± 13 ml.kg⁻¹.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 (I1, 60% VO_{2max} ; I2, 75% VO_{2max}) 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 (I1: TR 365 ± 84, UT 157 ± 66 g.m⁻².h⁻¹, P<0.001; I2 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 out of 35 regions at I2. Highest RSR were observed on the central mid back in both groups (I1 TR 797 ± 250, UT 277 ± 120 g.m⁻².h⁻¹; I2 TR 1139 ± 364, UT 365 ± 148 g.m⁻².h⁻¹), with lowest values on the palms in TR (I1 98 ± 58, I2 126 ± 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.

2507 Board #4 June 1 1:00 PM - 3:00 PM

Trapped Sweat in Various Sports Uniforms During Sport-Specific, Laboratory-Based ExerciseBridget C. Sopena, Kelly A. Barnes, Ryan P. Nuccio, Adam J. Reimel, John R. Stofan, Lindsay B. Baker, FACSM. *Gatorade Sports Science Institute, BARRINGTON, IL.***Reported Relationships:** B.C. Sopena: Salary; This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

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 exercise. **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/or 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: $82 \pm 5\%$ HR_{max}, RPE 13 \pm 2; football: $75 \pm 10\%$ HR_{max}, RPE 13 \pm 1; soccer: $77 \pm 10\%$ HR_{max}, RPE 12 \pm 1; basketball: $66 \pm 12\%$ HR_{max}, RPE 10 \pm 2; and baseball/softball: $59 \pm 3\%$ HR_{max}, RPE 9 \pm 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 \pm SD. **Results:** There were significant differences in SL between sports ($p<0.0001$): 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) and baseball/softball (1.19 ± 0.38 kg). There were also significant differences in TS ($p<0.0001$): football (0.58 ± 0.14 kg) > endurance (0.28 ± 0.16 kg) and soccer (0.24 ± 0.18 kg) > basketball (0.11 ± 0.08 kg) and baseball/softball (0.15 ± 0.12 kg). TS as a percentage of SL was significantly ($p<0.0001$) higher in football ($22.5 \pm 3.8\%$) than endurance ($12.2 \pm 4.7\%$), soccer ($10.9 \pm 3.4\%$), basketball ($9.2 \pm 4.4\%$), and baseball/softball ($10.8 \pm 6.2\%$). **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.

2508 Board #5 June 1 1:00 PM - 3:00 PM

Prolonged Work in the Heat Impairs Heat Loss on the Next day in Older MenSean R. Ntley, Robert D. Meade, Andrew W. D'Souza, Brian J. Friesen, Glen P. Kenny. *University of Ottawa, Ottawa, ON, Canada.*

(No relevant relationships reported)

Performing prolonged, arduous occupational work in the heat is associated with considerable heat strain, which may be exacerbated on the next work day. Recently, we showed that whole-body heat loss was not modified by prolonged work in the heat on the preceding day in young habitually active men. However, it is unclear whether prolonged heat strain may reduce heat loss on the next day in older workers, who display impaired thermoregulatory function and who recover more slowly from exercise-induced stress compared to young adults. **Purpose:** To determine whether prolonged work in the heat impairs whole-body heat loss and exacerbates heat storage on the next day in older men. **Methods:** Changes in whole-body heat exchange and heat storage were assessed in six older (60 years (SD 5)) men during heat stress tests performed on the same day prior to (Day 1), and on the day following (Day 2), a prolonged work simulation. Each heat stress test involved three, 30-min bouts of cycling performed at increasing, fixed rates of metabolic heat production of 150 (Ex1), 200 (Ex2) and 250 W/m² (Ex3), each separated by 15-min recovery, in hot-dry conditions (40°C , 20% relative humidity (RH)). The work simulation (7.5 h) involved three moderate intensity intermittent work bouts (2 h) each separated by 30-min rest breaks in hot-dry conditions (38°C , 34% RH). Total heat loss (evaporative \pm dry heat exchange) and metabolic heat production were measured using direct and indirect calorimetry, respectively. Body heat storage was quantified as the temporal summation of heat production and loss. **Results:** Total heat loss (mean \pm 95% CI) during Ex1 did not differ between Day 1 (149 ± 8 W/m²) and Day 2 (143 ± 6 W/m²; $P=0.29$), but decreased on Day 2 during Ex2 (181 ± 7 W/m²) and Ex3 (219 ± 10 W/m²) relative to Day 1 (191 ± 7 and 230 ± 14 W/m², respectively; both $P<0.01$). As a result, body heat storage across all exercise bouts was 19% greater on Day 2 (364 ± 74 kJ) than on Day 1 (295 ± 50 kJ; $P=0.02$). **Conclusions:** Prolonged work in the heat impairs whole-body heat loss and exacerbates body heat storage during moderate-to-high intensity work on the next day in older men. These outcomes indicate that older workers may be more vulnerable to heat-related illness when performing consecutive, arduous work shifts.

Supported by the Natural Sciences and Engineering Research Council of Canada.

2509 Board #6 June 1 1:00 PM - 3:00 PM

Heart Failure Modulates Thermoregulatory Control Independently Of Differences In Physical Characteristics And Metabolic Heat ProductionSurendran Sabapathy¹, Bryce N. Balmain¹, Ollie Jay, FACSM², Kenji Shiino¹, Glenn M. Stewart, FACSM³, Rohan Jayasinghe⁴, Jonathan Chan⁴, Norman R. Morris¹. ¹Griffith University, Gold Coast, Australia. ²University of Sydney, Sydney, Australia. ³Mayo Clinic, Rochester, MN. ⁴Gold Coast University Hospital, Gold Coast, Australia.

(No relevant relationships reported)

PURPOSE: Heart failure (HF) patients appear to exhibit altered thermoregulatory responses during exercise in the heat. However, the extent to which these responses are altered due to physiological impairments independently of biophysical factors associated with differences in metabolic heat production (H_{prod}), evaporative heat balance requirements (E_{req}) and/or body size, is presently unclear. Therefore, we examined thermoregulatory responses in 10 HF and 10 age-matched controls (CON) similar in body size during exercise at a fixed rate of H_{prod} and thus E_{req} in a 30°C environment.

METHODS: Rectal temperature (T_{rec}), local sweat rate (LSR), and cutaneous vascular conductance (CVC) were measured during 60-min of cycle ergometry. Whole-body sweat rate (WBSR) was estimated from pre-post nude body weight corrected for fluid intake. H_{prod} and E_{req} , as well as dry heat loss (H_{dry}) and evaporative heat loss from the skin (E_{sk}) — assuming all secreted sweat evaporated, were calculated using partitioned calorimetry. **RESULTS:** Despite exercising at the same rate of H_{prod} (HF: 338 ± 43 ; CON: 323 ± 31 W, $p=0.25$), T_{rec} was greater ($p<0.01$) in HF ($0.81 \pm 0.16^\circ\text{C}$) than CON ($0.49 \pm 0.27^\circ\text{C}$). In keeping with a similar E_{req} (HF: 285 ± 40 ; CON: 274 ± 28 W, $p=0.35$), no differences in WBSR (HF: 0.45 ± 0.11 ; CON: 0.41 ± 0.07 L/h, $p=0.38$) or LSR (HF: 0.96 ± 0.17 ; CON: 0.79 ± 0.15 mg/cm²/min, $p=0.50$) were observed between groups. Similarly, H_{dry} was comparable between groups (HF: 22.9 ± 3.2 ; CON: 20.4 ± 5.0 W, $p=0.14$). Consequently, the cumulative body heat storage was similar between groups (HF: 154 ± 106 ; CON: 196 ± 174 kJ, $p=0.44$). Furthermore, CVC was lower in HF than CON (HF: 0.83 ± 0.42 ; CON: 2.10 ± 0.79 au/mmHg, $p<0.01$). **CONCLUSIONS:** Collectively, these findings demonstrate that HF patients exhibit an impaired skin blood flow response, but no differences in sweating. Given that HF had similar body heat storage to CON at the same H_{prod} , their greater rise in core temperature can be attributed to a less uniform internal distribution of heat between the body core and periphery.

2510 Board #7 June 1 1:00 PM - 3:00 PM

No Evidence Of Thermoregulatory Impairment In Donor Skin During Exercise-induced HyperthermiaMatthew N. Cramer, Gilbert Moralez, Mu Huang, Craig G. Crandall, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Craig Crandall, FACSM)

(No relevant relationships reported)

According to the US Army's Standards of Medical Fitness (AR 40-501), "Prior burn injury (to include donor sites) involving a total body surface area of 40 percent or more does not meet the standard". While the Standard implies that elevations in skin blood flow and sweating are impaired within donor skin during an exercise-induced hyperthermic challenge, this has not been experimentally verified. **Purpose:** This study tested the hypothesis that human donor skin retains the capability to increase skin blood flow and sweat production in response to exercise-induced hyperthermia. **Methods:** Thirteen burn survivors (11 males; aged 36 ± 12 years) with well-healed burn injuries spanning $36.4 \pm 17.5\%$ of body surface area (BSA), as well as donor sites covering $18.0 \pm 9.8\%$ BSA, cycled for 60 min at a workload eliciting $\sim 50\%$ of maximal aerobic capacity. Environmental conditions were set at $39.5 \pm 0.2^\circ\text{C}$ and $21.8 \pm 3.8\%$ relative humidity. Immediately prior to and upon completion of exercise, skin blood flow was assessed via laser-Doppler imaging from donor sites and adjacent non-injured skin ($n=12$). Local sweat rate was also assessed at the same skin sites at 45 min of exercise using absorbent material ($n=10$). Gastrointestinal temperature was measured using an ingestible temperature sensor. **Results:** At 60 min of exercise, the elevation in gastrointestinal temperature averaged $0.8 \pm 0.3^\circ\text{C}$ ($P<0.01$). At the end of this exercise bout, the magnitude of the increase in skin blood flow was similar between donor and non-injured sites (donor: 103 ± 45 flux units; non-injured: 123 ± 58 flux units; $P=0.21$). Similarly, local sweat rate did not differ between sites (donor: 0.54 ± 0.29 mg/cm²/min; non-injured: 0.62 ± 0.26 mg/cm²/min; $P=0.27$). **Conclusion:** These data suggest that well-healed donor skin retains the capability to elevate skin blood flow and sweating during exercise in the heat. Therefore, the US Army should exclude donor skin when determining whether the size of a burn injury meets the Standards of Medical Fitness.

Funding: Department of Defense – US Army W81XWH-15-1-0647.

F-09 Free Communication/Slide - Athlete Care: Amateur, Olympic and Professional

Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-200E

2511 **Chair:** Leonardo P. Oliveira. *University of Chicago, Chicago, IL.*

(No relevant relationships reported)

2512 June 1 1:00 PM - 1:15 PM

Lower-Extremity Vibration Threshold, But Not Proprioception Or Mobility, Distinguishes Non-Progressive From Progressive Multiple Sclerosis Sub-Types

Julia D. Miehm¹, Julianna L. Averill¹, Jongil Lim¹, John Buonaccorsi¹, Carolina Ionete², Jane A. Kent, FACSM¹, Richard van Emmerik¹. ¹*University of Massachusetts Amherst, Amherst, MA.* ²*University of Massachusetts Medical School, Worcester, MA.*

(No relevant relationships reported)

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 steady 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 as $p < 0.05$. **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.

	CON (n=19)	NP (n=31)	P (n=29)	ANOVA p value
Big Toe (v) ^{b,c}	12.74±10.97	15.63±13.79	26.11±15.52	0.004
5 th Metatarsal (v) ^{b,c}	9.47±7.97	13.97±13.34	27.19±16.92	0.001
Heel (v) ^{b,c}	12.16±11.85	15.45±12.70	28.07±16.39	0.001
Proprioception (α) ^{a,b}	1.85±1.20	4.53±4.48	5.11±3.76	0.001
25FWT (s) ^{a,b}	5.12±0.50	8.44±4.88	10.07±4.56	0.001
TUG (s) ^{a,b}	6.89±1.17	11.90±7.10	13.95±5.84	0.001

Table 1. Data are mean±SD. Significant differences: ^aCON vs. NP; ^bCON vs. P; ^cNP 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 Research Grant W81XWH-16-1-0351

2513 June 1 1:15 PM - 1:30 PM

The Preventive Effect Of A Bounding Exercise Programme On Hamstring Injuries In Amateur Male Soccer

Sander van de Hoef¹, Michel Brink², Bionka Huisstede¹, Maarten van Smeden³, Niels de Vries⁴, Edwin Goedhart⁴, Vincent Gouttebarger⁵, Frank Backx¹. ¹*University Medical Center Utrecht, Utrecht, Netherlands.* ²*University of Groningen, Groningen, Netherlands.* ³*Leiden University Medical Center, Leiden, Netherlands.* ⁴*Royal Netherlands Football Association, Zeist, Netherlands.* ⁵*Dutch Consumer Safety Institute, Amsterdam, Netherlands.*

(No relevant relationships reported)

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 (meters 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 adult 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).

2514 June 1 1:30 PM - 1:45 PM

Vigorous Physical Activity And Bone Mineral Density In Anorexia Nervosa Female

Gautier ZUNQUIN. *ULCO, Dunkerque, France.*

(No relevant relationships reported)

Restrictive Anorexia Nervosa (ANR) is a clinical mental disorder defined as abnormal eating behavior and is often associated with physical hyperactivity. There is no consistent cut-off use to define what is considered excessive physical activity in term of duration, frequency and intensity in contrast with healthy physical activity (1).

On the other hand, ANR is marked by bone loss and with low Body Mineral Density (BMD)(2). Few data are available in daily patterns of Physical Activity and in the relationship between time spent in moderate to vigorous PA and Bone Mineral Density (BMD) **PURPOSE:** To determine the association between time spent in moderate to vigorous physical activity (MVPA) and BMD in females with anorexia nervosa.

METHODS: 17 females with anorexia nervosa (22±2 yrs) were included in the study. Body composition was assessed by DXA measurements (Hologic QDR-4500W, Waltham, MA). 24h Physical activity levels and sleep time were monitored by using actigraphy (ActiSleep and ActiGraph GT3X, Pensacola, US). **RESULTS:** Females with diurnal higher VPA levels demonstrated an increased in integral Femoral Neck Bone Mineral Density (FNBM) (0.678 g/cm² vs. 0.623 g/cm²) compared to those with lower diurnal VPA levels ($p < 0.05$). Time spent in light physical activity (LPA) is associated with a significantly lower total hip BMD (g/cm²) (0.788 ± 0.11 vs 0.873 ± 0.15 ; $p < 0.001$). **CONCLUSION:** This investigation shows that ANR females accumulating more total Vigorous Physical Activity presented increased BMDs when compared to their less active peers. These data highlight the importance of VPA in females with AN to counteract their low bone mass and to improve their bone health. High time spent in LPA may be considered to be deleterious for BMD.(1) Achamrah N, Coëffier M, Déchelotte P. Physical activity in patients with anorexia nervosa. *Nutr Rev.*

2016 May;74(5):301-11.(2) Howgate DJ, Graham SM, Leonidou A, Korres N, Tsiroidis E, Tsapakis E. Bone metabolism in anorexia nervosa: molecular pathways and current treatment modalities. *Osteoporos Int.* 2013 Feb;24(2):407-21.

2515 June 1 1:45 PM - 2:00 PM

Recovery of Lower Extremity Strength and Function following ACL Reconstruction in Skeletally Immature Patients

Dai Sugimoto, Benton Heyworth, Farren Davis, Mininder Kocher, Lyle Micheli, FACSM. *Boston Children's Hospital / The Micheli Center for Sports Injury Prevention, Boston, MA.*
(No relevant relationships reported)

BACKGROUND: Following anterior cruciate ligament reconstruction (ACLR) surgery, lower extremity recovery of the uninjured limb >90% is commonly recommended for clearance to return-to-play (RTP). 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, posteromedial, and posterolateral 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 quadruple hamstrings (Male-HS), females with transphyseal quadruple hamstrings (Female-HS), and males with extra/intra-compartmental physeal-sparing iliotibial band (Male-ITB) using chi-square (χ^2) 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, 39.1% in hamstrings, 79.6% in hip abductors, and 82.8% in hip extensors. Y-balance test resulted 82.6% in anterior reach, 83.9% in posteromedial 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. χ^2 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.

2516 June 1 2:00 PM - 2:15 PM

Long-term Functional Impact of Viscosupplementation Versus True Placebo in Symptomatic Hip Osteoarthritis; A Randomized Control Trial

Jane Konidis¹, Philippe Corbeil¹, Antoine Cantin-Warren², Sylvie Turmel³, Emile Cardinal-Soucy¹, Remi Lacroix³, Etienne Belzile³. ¹University Laval, Quebec City, QC, Canada. ²Center for Interdisciplinary Research in Rehabilitation and Social Integration (CIRRSI), Quebec City, QC, Canada. ³University Hospital Center of Quebec (CHUQ), Quebec City, QC, Canada.
(No relevant relationships reported)

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 little literature available evaluating the long-term effects and the 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-blinded 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. Patients completed two questionnaires; the Hip Disability and Osteoarthritis Outcome Score (HOOS) and the 36-Item Short Form Survey (SF-36). Gait biomechanics 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 from T0 to T2 by 4.73%. The control group worsened by 1.22% during that same time and continued to deteriorate by 6.09% at T3. There were also improvements in the activities of daily living subscale from T0 to T3, with the treatment group improving

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 7.611 points (- 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:** NCT02086474

2517 June 1 2:15 PM - 2:30 PM

The Prevalence Of Obstructive Sleep Apnea Within A Professional Rugby League Team: An Exploratory Study

Johnpaul Caia¹, Andrew Scott², Shona L. Halson³, Vincent G. Kelly¹. ¹University of Queensland, Brisbane, Australia. ²Wesley Hospital, Brisbane, Australia. ³Australian Institute of Sport, Canberra, Australia.

(No relevant relationships reported)

Obstructive sleep apnea (OSA) is a disorder characterized by recurrent episodes of partial or complete obstruction of the upper airway. This results in non-restorative sleep leading to daytime sleepiness and decreased quality of life. It is estimated that 1-5% of the worldwide population suffer from OSA, however the prevalence within athletes is largely unknown. **PURPOSE:** To characterize the prevalence of OSA 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 OSA. Linear models were used to determine if playing position (back, forward), ethnicity (European-Australian, Polynesian) or body composition influenced the prevalence or severity of OSA. **RESULTS:** 10 cases of OSA 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 susceptible to OSA than European-Australians. Furthermore, our data suggests that athletes with greater BMI and skinfold thickness may be predisposed to the existence of OSA.

2518 June 1 2:30 PM - 2:45 PM

Cardiovascular Risks For Participation In Marathon Among The Adolescent Athletes In Sri Lanka - A Pilot Study

Sanka Thebuwanaarachchi. *Teaching Hospital Karapitiya, Galle, Sri Lanka.*

(No relevant relationships reported)

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, the associated factors 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%. 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.

5219 June 1 2:45 PM - 3:00 PM

Immune and Hormones Levels Responses Before and After Specific Maximal Protocol of Brazilian Olympic AthletesHugo Tadashi Kano, Layene Peixoto Barros, Franz H. Burini, Roberto C. Burini. *UNESP Medical School, Botucatu, Brazil.* (Sponsor: Roberto C Burini, FACSM)*(No relevant relationships reported)*

Athletes are overexposed to stress factors such as training routine, sleep and dietary pattern, which may influence immune function and hormones patterns modulating health and performance. Immune suppression after sport metabolic overload is an issue for elite athletes and should be considered during training log. **Purpose:** The purpose of this study was to evaluate Leukocytes, Testosterone and Cortisol responses to specific maximal protocol of elite Brazilian athletes, and their relations dynamically. **Methods:** We evaluated 55 elite athletes (16 judo, 10 boxing and 29 rowing olympic national athletes; 38 males and 17 females; 24.2±6yrs) for leukocytes (Leuk) and hormones levels such as Testosterone (T) and Cortisol (C) taken blood samples before and after specific maximum effort protocol. **Results:** Leukocytes values before and after test were 7.42±1.3 and 10.02±1.7x10³/mm³ (pre vs post 2.6 x10³/mm³); Cortisol levels were 15.3±2.7 and 16.2±1.9mg/dL (pre vs post 0.9mg/dL) and Testosterone 371.5±57.2 and 362.1±73.1mg/dL. Analysing genders separately, post vs pre difference of Leukocytes, Testosterone and Cortisol levels for males and females were 2.4x10³/mm³, -18.8mg/dL, 0.5mg/dL; 3.1x10³/mm³; 2.2mg/dL and 1.7mg/dL respectively. **Conclusions:** Leukocytes elevation after maximum effort were observed on males and females athletes despite sport modality, and these elevations were not associated with Testosterone or Cortisol variations during this protocol. Leukocytes response may be a primary indicator of immune response integrity compared with Testosterone declines or Cortisol elevations in response to sport induced stress protocol. Health issues, specially upper respiratory tract infections, has been associated with immune suppression after metabolic overload and should be focused besides sports adaptation to training log and competition.

F-10 Free Communication/Slide - Cardiometabolic HealthFriday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-200F5250 **Chair:** Stella L. Volpe, FACSM. *Drexel University, Philadelphia, PA.**(No relevant relationships reported)*

5251 June 1 1:00 PM - 1:15 PM

Oral Consumption of Bisphenol A Increases Glucose Responses in AdultsSean Stanelle, Alyssa Bird, Leana Mosesian, Garrett Grant, Julie Pollard, Eduardo Uribe, Dana Williams, Suzanne Phelan, Todd Hagobian, FACSM. *California Polytechnic State University San Luis Obispo, San Luis Obispo, CA.* (Sponsor: Todd Hagobian, FACSM)*(No relevant relationships reported)*

Previous observational studies have shown a correlation between urinary bisphenol A (BPA) and type 2 diabetes, however the direct effects of BPA on risk markers in the pathogenesis of diabetes are unknown. **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 block randomized, in a double-blinded fashion, to oral consumption of Placebo (PL), BPA at 4 µg/kg BW (BPA-Low), and BPA at 50 µg/kg BW (BPA-High). Blood glucose, insulin, and estrogen concentrations and calculated area under the curve (AUC) were assessed at baseline, minutes 15, 30, 45, 60, and then every 30 minutes for the next 2 hours in response to a 75g oral glucose tolerance test using a repeated measures ANOVA. **Results:** Compared to PL, BPA AUC was significantly higher ($p < 0.05$) in BPA-Low and BPA-High (295 ± 139, 2239 ± 1255, 14030 ± 4350 ng/mL*min). Compared to PL, glucose AUC tended to be higher ($p = 0.08$) in BPA-Low and was significantly ($p = 0.04$) higher in BPA-High (1150 ± 23, 1232 ± 24, 1245 ± 30 mmol/L*min). Insulin AUC (6360 ± 382, 6527 ± 400, 5683 ± 462 µg/mL*min) and estrogen AUC (12154 ± 2752, 12161 ± 2326, 11145 ± 2263 pg/mL*min) were not significantly different between conditions ($p > 0.05$). **Conclusion:** Oral BPA consumption of 50 µg/kg BW significantly increased glucose AUC, but not insulin or estrogen. These data provide the first direct evidence in humans that consumption of BPA alters a risk marker in the pathogenesis of type 2 diabetes.

2522 June 1 1:15 PM - 1:30 PM

The Influence of Metabolic Syndrome on Carotid Intima Media Thickness in ChildrenRobert E. Downing, Rebecca Place, Paul Visich. *University of New England, Biddeford, ME.**(No relevant relationships reported)*

Increased carotid intima-media thickness (CIMT) is accepted as an early indicator for the development of atherosclerotic 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 t3200 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 ($\geq 90^{\text{th}}$, n=31) only and 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±8.0cm, 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 ($p < 0.003$), 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 differences 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

2523 June 1 1:30 PM - 1:45 PM

Combining Short-Term Interval Training With Caloric-Restriction Improves β -Cell Function in Obese AdultsMonique E. Francois, Nicole M. Gilbertson, Natalie Z.M. Eichner, Emily M. Heiston, James H. Mehaffey, Taryn E. Hassinger, Peter T. Hallowell, Steven K. Malin, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: Steve Malin, FACSM)*(No relevant relationships reported)*

Background: Obese adults have an increased risk of type 2 diabetes (T2D). Although insulin resistance is a key etiological 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 fast, a 120-min 75g 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 ([GSIS: Δ insulin/ Δ glucose]), hepatic clearance (HC: $\text{AUC}_{\text{insulin}} / \text{AUC}_{\text{C-peptide}}$), and β -cell function (Disposition Index [DI: $\text{IGI} \times \text{Matsuda Index}$]) for early- (0-30-min) and total-phase (0-120-min) responses. GLP-1_{active} 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 (tAUC) 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-1_{active} tAUC increased similarly after LCD+INT and LCD (Time: $P < 0.05$) by ~28%.

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 matched diet. Additional work is required to elucidate the mechanism(s) by which INT improves insulin secretion during weight loss to optimize diabetes prevention.

2524 June 1 1:45 PM - 2:00 PM

Exercise-induced Energy Deficit Lowers Glycemia At Breakfast The Next Day, But Not Over 24-hours.

Michael Schleh, Lisa Guth, Haojia Jing, Jeffrey F. Horowitz, FACSM. *University of Michigan, Ann Arbor, MI.*

(No relevant relationships reported)

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. **Purpose:** Determine the effect of energy deficit after acute exercise on free-living glycemic control the next day. **Methods:** 12 healthy subjects (male=4, female=8, age=28±6 yrs, BMI=24.6±3.2 kg·m⁻², VO_{2max}=36±10 ml·kg⁻¹·min⁻¹) completed two experimental trials, which were identical other than the energy content of the meals consumed after exercise. Before each trial, continuous glucose monitoring (CGM) probes were inserted in the abdominal region. On day 2, subjects were provided a standardized breakfast and lunch, then they exercised in the afternoon at 65% VO_{2max} until 350 kcal were expended (~50 min). After exercise on one occasion, subjects consumed meals (~55% CHO, ~30% Fat, ~15% PRO) supplemented with calories to replenish the energy expended during exercise, thereby achieving energy balance (EB). On the other occasion, the meals after exercise were not supplemented with extra calories, inducing a 350 kcal energy deficit (ED). Throughout the next day, subjects ate identical meals in both the EB and ED trials, and free-living glycemic control was compared between trials starting at 0800h. **Results:** 3-hour post-prandial area under curve (AUC) was significantly lower after breakfast in ED compared with EB (27.5±3.5 vs. 29.3±4.0 mM·h⁻¹, P=0.03), but not different after lunch (28.8±4.2 vs. 27.9±3.3 mM·hour⁻¹, P=0.38), dinner (28.7±3.3 vs. 27.3±3.3 mM·hour⁻¹, P=0.50), or evening snack (27.8±3.3 vs. 26.8±2.1 mM·hour⁻¹, P=0.45). Similarly, average postprandial glucose (3-hour) was lower after breakfast in ED vs. EB (5.6±0.7 vs. 6.0±0.8 mM, P=0.02), and not different between trials after the other meals. Despite differences in the glycemic response to breakfast, average 24-hour glycemic response did not differ between ED and EB (24-hour AUC: 27.2±2.5 vs. 26.5±2.1 mM·h⁻¹, respectively; P=0.2). **Conclusion:** Compared with eating meals that replenish the energy expended during exercise, an exercise-induced energy deficit lowered the glycemic response to breakfast the next day - but this energy deficit did not impact total 24-hour glycemia the day after exercise. **Supported by NIH GRANT# R01 DK077966**

2525 June 1 2:00 PM - 2:15 PM

Components of Metabolic Flexibility Improved 48 hours After High Intensity Interval Exercise.

Timothy D. Allerton¹, Brian Irving², Guillaume Spielmann², Stefany Primeaux³, Arnold Nelson, FACSM², Dennis Landin⁴, Neil Johannsen². ¹Pennington Biomedical Research Center, Baton Rouge, LA. ²Louisiana State University, Baton Rouge, LA. ³LSU Health Sciences Center, New Orleans, LA. ⁴Louisiana State University, Baton Rouge, LA. (Sponsor: Arnold Nelson, FACSM)

(No relevant relationships reported)

The inability to switching between fuel sources (fat and carbohydrates), termed metabolic inflexibility, plays a prominent role in the development of type 2 diabetes and obesity. Evidence suggests that chronic exercise interventions and weight reduction improve metabolic flexibility (MF). However, little is known about the impact of a single bout of high-intensity interval exercise (HIIE) on MF. **Purpose:** To assess the impact that HIIE has on MF and blood flow in response to a mixed meal tolerance test (MMTT) performed without exercise (BL) or following 1H or 48H post-HIIE. **Methods:** Participants (n=16, aged 21.2 ± 1.2 y, BMI 22.6 ± 2.7 kg/m²) completed 3 mixed meal tolerance tests (MMTT; 412.2 ± 71.5 kcal) (BL, 1H and 48H) lasting 180 minutes. Indirect calorimetry measurements were taken prior to the mixed meal (0 min), 60 min, and 120 min post mixed meal. MF was determined by subtracting RER 60 min - RER 0 min and analyzing the rate of carbohydrate and fat oxidation/suppression (FatOx). HIIE was 10 x 60s intervals at 90% (154.6 ± 35.6 W) of power output achieved at VO_{2peak}, followed by 60s of recovery. Additionally, we measured blood flow in the vastus lateralis (VL) every 30-min utilizing near-infrared spectroscopy (NIRS). **Results:** Fasting FATox was elevated 48H post-exercise compared to BL (1.31 ± 0.39 mg/kg/min vs. 0.96 ± 0.32 mg/kg/min, p=0.04). The ability to suppress FATox at the 60-min time-point of the MMTT was significantly higher 48H post-exercise compared to BL (~20% vs. ~12%, p=0.01). Increased VL blood flow was detected 120-minutes into the MMTT during BL. When compared to BL, 1H post-exercise VL blood flow changes were significantly higher at 60 (1.8 fold, p=0.03) and 120-min (2.0 fold, p=0.04) time points. **Conclusions:** Our results suggest, a single bout of HIIE improves MF up to 48H post-exercise, which is characterized

by higher fasting and meal-induced suppression of FATox. Postprandial VL blood flow was also stimulated to a greater degree 1H post-exercise when compared to the BL postprandial measurement. The impact of acute HIIE demonstrates MF can be improved acutely, prior to chronic adaptations.

Supported By NIH Grant T32 AT 004094

Funded in part by a College of Human Sciences and Education Dean's Circle Grant

2526 June 1 2:15 PM - 2:30 PM

Relationship between Cardiorespiratory Fitness and Relative Gut Microbiota Composition in Healthy Adults

Ryan P. Durk¹, Esperanza Castillo¹, Leticia Márquez-Magaña¹, Gregory J. Grosicki², Nicole Bolter¹, C. Matthew Lee¹, James R. Bagley¹. ¹San Francisco State University, San Francisco, CA.

²Tufts University, Boston, MA.

(No relevant relationships reported)

PURPOSE: Bacteria residing in the human gastrointestinal tract has a symbiotic relationship with its host. Animal models have demonstrated a relationship between exercise and gut microbiota composition. The purpose of this study was to explore the relationship between cardiorespiratory fitness and relative gut microbiota composition, measured by the ratio of Firmicutes to Bacteroidetes (F/B ratio) in healthy adults.

METHODS: Twenty-one males and 19 females (Age=26.1 ± 2.8 y; BMI=24.0 ± 4.2 kg/m²), who did not take antibiotics in the last 6 months, volunteered for this study. Participants completed a 3-month exercise recall, tracked their nutritional intake for 7 days (via MyFitnessPal[®]), and collected their stool sample with an OMNIGENE Gut[®] home stool collection kit. Body composition and maximal cardiorespiratory fitness (VO_{2max}), were measured via air displacement plethysmography using the Bod Pod[®] and a symptom-limited graded treadmill test, respectively. Relative microbiota composition was determined by analyzing DNA extracted from stool samples using a Quantitative Polymerase Chain Reaction (qPCR) approach that specifically measured the amount of a target gene (16s RNA) found in Firmicutes and Bacteroidetes.

Relationships between F/B ratio and potentially related dietary, anthropometric, and fitness variables were assessed using correlation analyses with appropriate Bonferroni adjustment (p<0.004). **RESULTS:** Average F/B ratio in all participants was 0.94 and average VO_{2max} was 45.8 ± 8.8 ml/kg/min. F/B ratio was significantly correlated to VO_{2max} (r=0.45, p<0.004), but no other fitness, nutritional intake, or anthropometric variables (p>0.004). **CONCLUSIONS:** VO_{2max} was responsible for ~20% of the variance of an individual's relative gut bacteria as determined by F/B ratio. These data support animal findings by demonstrating a relationship between relative human gut microbiota composition and cardiorespiratory fitness in healthy adults. Future investigations should confirm this relationship in heterogenous populations and investigate the utility of exercise training as medium to promote beneficial changes in gut microbiota.

2527 June 1 2:30 PM - 2:45 PM

Effects of Maternal Exercise on Hepatic Steatosis in Young Adult Rats

Rory P. Cunningham¹, Grace M. Meers¹, Greg Ruegsegger², Frank Booth, FACSM², R. Scott Rector, FACSM¹. ¹University of Missouri & Truman VA, Columbia, MO. ²University of Missouri, Columbia, MO. (Sponsor: R. Scott Rector, FACSM)

(No relevant relationships reported)

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 older offspring. However, it is unknown whether these protective effects can be seen in younger offspring. Here we sought to determine whether maternal exercise would attenuate maternal HFD-induced 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 normal chow diet (ND) with either exercise (RUN) or sedentary (SED) for each group. All dams returned to ND/SED conditions following parturition. Post-weaning, all offspring were maintained in ND/SED conditions for 18 weeks. **Results:** Male offspring had increased body mass compared with females (p<0.05). Maternal HFD-induced increases in male offspring body mass was attenuated in the HFD/RUN offspring (p<0.05). Maternal HFD feeding significantly increased hepatic steatosis in male (but not female offspring), which was not attenuated by maternal RUN. However, maternal RUN increased (p<0.05) hepatic markers of mitochondrial biogenesis and mitophagy (TFAM, PPARγ, NRF2) in all offspring and the mitophagy marker BNIP3 in HFD-RUN offspring. Interestingly, hepatic markers of de novo lipogenesis (FAS, ACC), mitophagy (ATG12:5, BNIP3, P62, LC3 II/I), and mitochondria biogenesis/content (TFAM, OX PHOS-Complex II) were significantly increased in female vs. male offspring. **Conclusion:** Although maternal exercise did not attenuate maternal HFD-induced hepatic steatosis as has been previously reported in older adult offspring, it did significantly increase hepatic markers of mitochondrial biogenesis and autophagy/mitophagy. Furthermore, female offspring had elevated hepatic markers of mitochondrial health which may possibly explain why female

rats are protected against maternal HFD-induced hepatic steatosis. Future studies are warranted to shed light on the timeline of hepatic steatosis development under the influence of maternal exercise.

2528 June 1 2:45 PM - 3:00 PM

Physical Activity during Pregnancy Alters Gene Expression in Neonatal Tissue

Leryn J. Reynolds¹, Niraj R. Chavan², Brittany B. Rice², Hannah F. Maddox², Joshua D. Preston², Logan B. DeHoff², Kevin J. Pearson². ¹Old Dominion University, Norfolk, VA. ²University of Kentucky, Lexington, KY. (Sponsor: David Swain, FACSM)
(No relevant relationships reported)

Offspring born to mothers who exercise during pregnancy have been shown to have reduced birth weight and body weight during adolescence; however, mechanisms to explain this phenomenon are lacking. **PURPOSE:** This study examined whether male infants born to mothers with low levels of naturally occurring physical activity during pregnancy (<6,000 steps/day; <6K) had altered expression of genes related to glucose metabolism and adipogenesis compared to infants born to mothers with greater than 6,000 steps/day (>6K). **METHODS:** Physical activity levels were assessed via Fitbit Flex during the second and third trimester of pregnancy. The dartos layer of the foreskin was collected following circumcision in full term, singleton, male neonates (n = 6 per group). Tissue was homogenized, RNA isolated, and a NanoString code set run to quantify a panel of genes related to glucose metabolism and adipogenesis, as well as housekeeping genes. **RESULTS:** Peroxisome proliferator-activated receptor alpha (<6K: 86.4±9.2 vs. >6K: 59.4±5.0) and cAMP responsive element binding protein 1 (<6K: 285.7±36.8 vs. >6K: 197.4±12.1), genes encoding proteins that are involved in partially regulating adipogenesis, and DNA methyltransferase 1 (DNMT1) (<6K: 132.2±6.4 vs. >6K: 112.5±3.7), a gene coding an enzyme involved in the regulation of DNA methylation patterns, were significantly decreased in the infants born to mothers with higher levels of physical activity during pregnancy (p<0.05). Adiponectin receptor 1 (<6K: 490.1±38.1 vs. >6K: 743.3±99.7), a receptor that is downregulated in obese, insulin resistant populations, and glucose transporter 1 (<6K: 88.0±15.7 vs. >6K: 153.3±13.0), a glucose transporter responsible for basal levels of glucose uptake in most cells, were significantly increased in the tissue of neonates born to mothers with higher levels of physical activity (p<0.05). **CONCLUSION:** These preliminary data suggest that low levels of physical activity during pregnancy are associated with increased gene expression of markers of adipogenesis and decreased markers involved in insulin sensitivity and glucose uptake. Further, these adaptations or other gene expression changes may be epigenetically regulated as DNMT1 levels were significantly lower in the lower physical activity group.

F-11 Free Communication/Slide - Exercise and Neuroscience

Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Mezzanine M100D

2529 **Chair:** J. Carson Smith, FACSM. *University of Maryland, College Park, MD.*
(No relevant relationships reported)

2530 June 1 1:00 PM - 1:15 PM

Exercise Training Alters Expression of Acid Sensing Ion Channels (ASICs) in Sensory Pathways

Tahsin Khataei¹, Anne Marie S. Harding², Mahyar Janahmadi³, Hamid Agha alinejad¹, Christopher J. Benson². ¹Tarbiat Modares University, Tehran, Iran, Islamic Republic of. ²University of Iowa, Iowa city, IA. ³Shahid Beheshti University of Medical Sciences, Tehran, Iran, Islamic Republic of.
(No relevant relationships reported)

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) and 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: Female C57BL/6 mice were divided into sedentary (SED), low intensity training (LIT) and high intensity interval training (HIIT) groups. HIIT was trained on treadmill 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 LIT trained at 40-50% of V_{max} for the same distance. 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 determined by RT-qPCR.

Results: HIIT had higher exercise performance (V_{max} , time to exhaustion and workload) compared to LIT and SED ($p \leq 0.05$), while there was no significant difference between LIT and SED groups. Body composition, as measured by NMR, did not change significantly between groups after 4 weeks of training. HIIT showed reductions ($p \leq 0.05$) of ASIC1b, ASIC2, ASIC3, TRPV1 mRNA levels in DRG, as well as reductions ($p \leq 0.05$) in ASIC1b, ASIC2 in CB compared to SED. Paradoxically, LIT showed an upregulation ($p \leq 0.05$) 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 Department of Veteran Affairs.

2531 June 1 1:15 PM - 1:30 PM

Functional Brain Plasticity Following Physical Training in Amnesic Mild Cognitive Impairment: A Neuroimaging Study

Tamir Eisenstein, Galit Yogev-Seligmann, Nir Giladi, Elissa Ash, Talma Hendler, Yulia Lerner. *Tel Aviv Sourasky Medical Center, Tel Aviv, Israel.*
(No relevant relationships reported)

Amnesic mild cognitive impairment (aMCI) is the typical prodromal stage of Alzheimer's disease (AD). To date, pharmacological treatments in aMCI are of modest efficacy. Evidence suggest that physical exercise may promote structural and functional brain changes in healthy adults and clinical settings. However, the extent to which comparable effects can be observed in aMCI remains unclear. **PURPOSE:** Identify brain mechanisms underlying neurocognitive effects of aerobic training in aMCI. **METHODS:** 23 subjects with aMCI (age 70.9±5.6) were assigned to aerobic (AT, n=11) or balance and coordination (BAC, n=12) groups. Intervention lasted 16 weeks, 3 sessions/week. AT intensity gradually increased to 70-80% of heart rate reserve (HRR), while BAC was kept below 30%. HRR and peak oxygen consumption ($Vo2peak$) were determined using cardiopulmonary exercise test. Subjects underwent fMRI sessions, evaluating neural pattern during tasks, known to be sensitive in aMCI (i.e. face-name associative memory and processing of complex auditory information). Neuropsychological assessments were performed to evaluate changes in cognitive domains including verbal and spatial memory, and executive functions. **RESULTS:** Increased activity in bilateral hippocampi was found in the AT group post intervention ($p < 0.007$), while increased activity in left fusiform gyrus was shown in the BAC group ($p < 0.008$), during memory encoding. During information processing, both groups demonstrated increased responses in high-order cognitive and language areas (e.g. temporo-parietal junction and inferior frontal gyrus), representing greater resemblance to normal aging patterns, compared to pre-training [$q(FDR) < 0.05$]. Changes in $Vo2peak$ were correlated with changes in executive functions in the AT group, including semantic verbal fluency ($r = 0.819$, $p < 0.002$) and phonemic verbal fluency ($r = 0.611$, $p < 0.03$). Improvements in immediate recall (normalized Z-score change 0.74 ± 0.89 , $p < 0.015$) and delayed recall (0.71 ± 0.71 , $p < 0.005$) of verbal information (1st & 8th repetitions of the Rey auditory verbal learning test) were demonstrated in the BAC group. **CONCLUSION:** Both aerobic and non-aerobic (low-intensity balance and coordination) training modalities may promote neuroplastic changes in older individuals with aMCI and high risk of AD.

2532 June 1 1:30 PM - 1:45 PM

The Impact of Imperceptible Vibratory Noise on the Spinal Motor Reflex

Matthew S. Tenan, Maxwell Alander, Courtney A. Haynes, Antony D. Passaro. *U.S. Army Research Laboratory, Research Triangle Park, NC.*
(No relevant relationships reported)

Imperceptible noise stimulation has been shown to increase agility, stability and decrease muscle tremor. Previous research has shown that this effect is mediated via decreases in motor unit discharge variability and decreased motor unit synchronization. However, whether these motor unit effects arise from a spinal or cortical mechanisms is unknown and may change how these technologies are implemented to enhance human performance.

PURPOSE: Determine the effect of imperceptible vibratory noise on the spinal motor reflex (Hoffman Reflex).

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.

2533 June 1 1:45 PM - 2:00 PM
Aerobic Exercise and Cerebral White Matter Integrity in MCI Patients: A 1-Year Randomized Controlled Trial
 Takashi Tarumi¹, Binu P. Thomas¹, Ciwen Wang², Tsubasa Tomoto², Evan Pasha², Rong Zhang¹. ¹The University of Texas Southwestern Medical Center, Dallas, TX. ²Texas Health Presbyterian Hospital Dallas, Dallas, TX.
 (No relevant relationships reported)

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 amnesic 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_{2max}) 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_{2max} while those in stretching group showed slight declines ($time \times treatment: P=0.008$). The volumes of WM and WM hypointensities did not show treatment effects over time ($time \times treatment: P>0.05$). However, TBSS analysis demonstrated that improvements of VO_{2max} with AET are correlated with the reductions of MD among the major WM fiber tracts (Figure). **CONCLUSIONS:** In patients with amnesic MCI, AET did not improve cerebral WM volume and integrity between the intervention and control groups. However, individual improvements of VO_{2max} 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 (R01AG033106 and K99HL133449).*

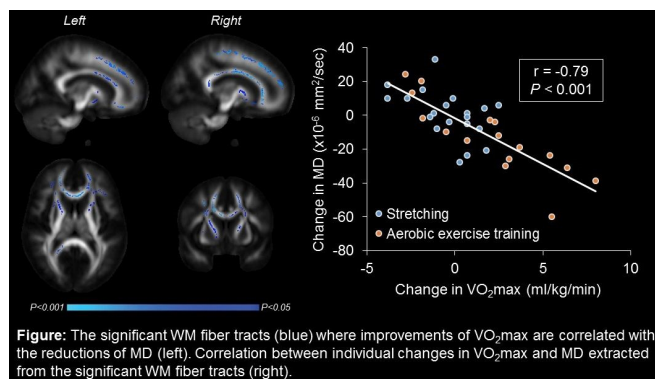


Figure: The significant WM fiber tracts (blue) where improvements of VO_{2max} are correlated with the reductions of MD (left). Correlation between individual changes in VO_{2max} and MD extracted from the significant WM fiber tracts (right).

2534 June 1 2:00 PM - 2:15 PM
Aerobic Exercise Regulates Synaptic Transmission by Attenuating Oxidative Stress in the Paraventricular Nucleus of Spontaneously Hypertensive Rats
 Li ZHAO, Yan LI, Boya GU, Yuanyuan LV. *Beijing Sport University, Beijing, China.*
 (No relevant relationships reported)

PURPOSE: Synaptic transmission in the hypothalamic paraventricular nucleus (PVN) plays a key role in the control of sympathetic outflow. Whether exercise training associated with reduced sympathetic activity and oxidative stress in hypertension is implicated in changes in sympathetic drive in the PVN remain unclear. **METHODS:** In the present study, spontaneously hypertensive rats (SHRs) were subjected to exercise training for 8 weeks, five times per week, and Westar Kyoto (WKY) rats as cohort control. Miniature excitatory and inhibitory postsynaptic currents (mEPSCs and mIPSCs) were recorded from PVN *ex vivo* hypothalamic slice preparations obtained after the last training, and biomarkers of oxidative stress and physical indexes were observed. **RESULTS:** The mean frequency and amplitude, as well as the rise time and the decay time constant of mIPSCs, were significantly decreased in 20-wk-old SHRs compared with WKY 20-wk-old controls. In contrast to mIPSCs, only the mean mEPSCs frequency was higher, and there were no other changes in mEPSCs in comparison to the control group. SHRs exhibited higher ROS, 8-OHdG, and MDA, and lower SOD1, SOD2, CAT, Ogg1, and SOD activity, CAT activity in the PVN. These SHRs also had a significant increase in heart rate, blood pressure and sympathetic nerve activity, and higher levels of norepinephrine (NE). Exercise training ameliorated all these changes, resulting in an increase in the mean frequency, amplitude and the kinetics of mIPSCs, accompanied by a decrease in the mean frequency of mEPSCs in the PVN. **CONCLUSIONS:** This study demonstrates that moderate intensity, high frequency exercise training induces antioxidant-related adaptations in the PVNs of SHRs, which in studies resulted in a selective enhancement of inhibitory synaptic transmission partly to recue autonomic nerves and reduce blood pressure in hypertension.

2535 June 1 2:15 PM - 2:30 PM
Effect of Acute Exercise on Salience Network Functional Connectivity and Affect in Healthy Older Adults
 Alfonso J. Alfini¹, Lauren R. Weiss², Junyeon Won², Corey Michelson², Daniel Callow², Caroline Simon², Adam P. Spira¹, J. Carson Smith, FACSM². ¹Johns Hopkins University, Baltimore, MD. ²University of Maryland, College Park, MD. (Sponsor: Dr. J. Carson Smith, FACSM)
 (No relevant relationships reported)

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 \pm SD = 65.6 \pm 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.

2536 June 1 2:30 PM - 2:45 PM

Probing the Therapeutic Potential of Brain Stimulation for Functional and Corticospinal Deficits Following Traumatic Musculoskeletal InjuryShawn Flanagan, *University of Pittsburgh, Pittsburgh, PA.*
(Sponsor: William Kraemer, FACSM)*(No relevant relationships reported)*

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 musculature or joint translation. Recently, others have demonstrated reduced cortical sensorimotor excitability and hemodynamic activity in conjunction with increased cortical inhibition and normalized spinal inhibition. The consequences of traumatic musculoskeletal injury (MSI) appear to extend to the brain, with maladaptive neuroplasticity contributing to disability. Non-invasive brain stimulation (NIBS) represents a promising strategy to modulate corticospinal activity after traumatic MSI, but therapeutic efficacy is untested. **Objective:** To examine the influence of NIBS on behavioral and neurophysiological activity after ACL rupture. **Methods:** Twenty women participated in a randomized, sham-controlled, double-blind, cross-over study. Nine experienced traumatic ACL rupture and reconstruction within five years of the study (ACL: N=9, age 20.6±2.3yr, height 166.1±8.0cm, weight 68.1±9.1kg). Eleven matched participants with no history of lower body injury served as controls (CON: N=11, 20.3±1.4yr, 165.0±5.3cm, 65.7±8.4cm). Participants completed a familiarization visit followed by two treatment visits with active or sham intermittent theta-burst stimulation (iTBS) applied to the injured (or non-dominant) motor cortex (M1) leg representation. Voluntary activation, force production, and corticospinal dynamics were examined. **Results:** The protocol was well tolerated. Active stimulation increased voluntary activation (4.2±1.4%, $p = 0.01$), relative force (44.22±14.21N, $p = 0.01$), and MEP amplitude (10.9±3.1%, $p = 0.00$) in the injured leg. Stimulation normalized superimposed twitch force (0.28±3.02N, $p = 0.93$) and contralateral silent period duration (-10.91±5.13ms, $p = 0.05$). **Conclusions:** One bout of NIBS was sufficient to normalize behavioral and corticospinal dysfunction 3.2±1.1yr after MSI, with distinct effects on the interhemispheric motor system network. Future work on the effects of repeated treatments, injury characteristics, and timing is needed. Nevertheless, traumatic MSI may be added to the list of conditions with neurological aspects responsive to NIBS.

2537 June 1 2:45 PM - 3:00 PM

Are Exercise Effects on Valence-Modulation of the Acoustic Startle Eyeblink Response Trait Dependent?Kathryn Elizabeth Wilson¹, Jianchun Yin², Rodney King Dishman, FACSM³. ¹*University of Nebraska Medical Center, Omaha, NE.* ²*Shanghai Normal University, Shanghai, China.* ³*University of Georgia, Athens, GA.* (Sponsor: Rodney K. Dishman, FACSM)*(No relevant relationships reported)*

Studies using objective probes for emotional state conclude no effect of exercise on affective processing. However, these studies fail to control for trait differences in sensitivity to affective cues and have been primarily restricted to prescribed (rather than self-selected) exercise intensities. It is possible that effects of exercise on affective processing of appetitive and aversive stimuli are moderated by motivational dispositions (approach/avoidance) reflective of individual differences in functioning of neural systems responsible for behavioral inhibition and behavioral activation (BIS/BAS traits). It is also possible that effects are influenced by perceived control of the exercise intensity.

PURPOSE: This laboratory experiment tested the hypotheses that 1) changes in sensitivity to emotional stimuli would manifest for those stimuli to which one is naturally predisposed to attend (i.e., aversive stimuli for BIS-dominant, and appetitive stimuli for BAS-dominant individuals), and 2) effects would be enhanced following exercise at a self-adjusted intensity.

METHODS: We examined valence-modulation of the acoustic startle eyeblink response during affective picture viewing before and after moderate intensity exercise with and without the opportunity to adjust intensity, or quiet rest among 58 undergraduates scoring high or low for BIS/BAS traits.

RESULTS: A 4 way mixed-model ANOVA indicated a main effect for valence [$F(2, 108) = 16.21, p < .01, \eta^2 = .23, \epsilon = .97$], consistent with expected effects of picture content. There were no effects of personality group ($p \geq .18, \eta^2 \leq .08$). Helmert contrasts revealed a 3-way quadratic interaction between valence, condition and time [$F(1, 54) = 6.2, p = .02, \eta^2 = .10$]. Follow-up RM-ANOVAs revealed a quadratic valence X time interaction during the prescribed exercise condition [$F(1, 57) = 7.38, p = .01, \eta^2 = .12$]; the reduction in ASER magnitude in response to neutral stimuli was greater than that in response to unpleasant or pleasant stimuli. These effects were not observed in the adjustable exercise or control conditions.

CONCLUSIONS: Results confirm that cycling exercise does not alter emotional response to affective pictures, regardless of motivational disposition, and extend the evidence to conditions in which participants can alter the exercise intensity.

F-12 Free Communication/Slide - Gait and BiomechanicsFriday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Mezzanine M100F2538 **Chair:** Julia Freedman Silvernail, *University of Nevada, Las Vegas, Las Vegas, NV.**(No relevant relationships reported)*

2539 June 1 1:00 PM - 1:15 PM

Effect Of Forefoot Type On Self-reported Pain In Minimalist and Traditionally Shod RunnersJean L. McCrory, FACSM¹, Lauren K. Cline¹, Erica Casto², Kyla M. Galbreath¹. ¹*West Virginia University, Morgantown, WV.* ²*University of Massachusetts, Amherst, MA.**(No relevant relationships reported)*

Distance running is a popular recreational activity despite high rates of overuse injury. The efficacy of wearing minimalist shoes to prevent injury has been debated. We previously reported that minimalist runners are more likely to experience site-specific lower extremity pain; however, no clear relationship has been established between shoe type, forefoot (FF) shape (Egyptian, Morton's, or square), and pain. Therefore, the **purpose** of this study is to examine self-reported pain in the lower limbs in minimalist and traditionally shod runners with various forefoot types. **Methods:** Following consent, 48 experienced runners (age: 27.5 ± 9.3 yrs, hgt: 172.2 ± 10.2 cm, mass: 70.6 ± 15.6 kg, gender: 18M/30F) who reported running at least 10 miles a week for the past three months, completed a visual analog scale (VAS) about pain they experience in five common sites of injury: knee, ankle, calf, shin, and foot. A score of ≥3 on the VAS was considered pain. Shoes were categorized as either minimalist (n=40 feet, midsole drop <4mm) or traditional (n=56 feet, midsole drop >4mm). Superior view photographs were taken of the FF and were categorized as Egyptian (EF) (n=73 feet, typical foot with Hallux the most distal toe), Morton's (MF) (n=10 feet, 2nd toe longer than Hallux), or square (SQ) (n=13 feet, Hallux and 2nd toe equal length). Separate three-factor chi-square analyses determined if shoe type (minimalist, traditional) and forefoot type (EF, MF, SQ) were related to pain (yes, no). ($\alpha = 0.05$). **Results:** More minimalist runners with EF reported pain (61.8%; $p = 0.004$) when compared to MF (50%) or SQ (20%). More minimalist runners with EF reported calf pain (77.8%; $p = 0.028$) than those with MF (0%) or SQ (20%). FF type did not relate to pain at any other site. **Conclusion:** Runners with EF are more likely to report pain in at least one location, and specifically in the calf, than runners with other FF shapes when wearing minimalist vs traditional shoes. Minimalist shoes encourage the runner to strike the ground with the forefoot; however, this requires more eccentric loading of the calf musculature and Achilles tendon. Our minimalist runners with EF reported more calf pain than those with other FF types. Other FF types may be better able to absorb the foot contact and muscle forces better than a more typical foot when wearing minimalist shoes.

2540 June 1 1:15 PM - 1:30 PM

Sagittal Plane Gait Mechanics are Associated with Femoral Cartilage Thickness After ACL ReconstructionDerek N. Pamukoff¹, Tyler J. Moffitt¹, Michael N. Vakula², Skylar C. Holmes¹, Steven A. Garcia¹, Melissa M. Montgomery¹. ¹*California State University, Fullerton, Fullerton, CA.* ²*Utah State University, Logan, UT.* (Sponsor: Daniela Rubin, FACSM)*(No relevant relationships reported)*

Individuals with ACL reconstruction (ACLR) are at greater risk for knee osteoarthritis (OA) due to aberrant walking biomechanics. Cartilage morphology is typically imaged using magnetic resonance imaging, but ultrasonography may provide a cost-effective alternative method. **PURPOSE:** To evaluate the association between sagittal plane knee mechanics and femoral cartilage thickness in individuals with ACLR. **METHODS:** 33 individuals with primary unilateral ACLR (age=22.2±2.9 years; body mass index=24.2±4.5 kg/m²; time since ACLR=55.8±31.6 months; 73% Female; IKDC=85.7±9.5; 16 patellar tendon; 8 hamstring tendon; 9 allograft) participated in this study. Femoral cartilage thickness was assessed at the medial (MC) and lateral (LC) femoral condyle, and intercondylar (IC) notch using ultrasonography in 140° of knee flexion. Participants completed 5 walking trials at a self-selected speed while striking consecutive force plates, and data were extracted from the first 50% of stance phase. Kinematic variables included the peak knee flexion angle (KFA), knee flexion angle at heel contact (KFHC), and knee flexion excursion (KFE). Kinetic variables included the peak external knee flexion moment (KFM) and angular impulse (KFI). Partial correlation adjusted for gait speed and time since ACLR was used to analyze the relationship between ultrasound and gait variables ($\alpha = 0.05$). **RESULTS:** After adjusting for gait speed and time since ACLR, greater KFI was associated with thicker MC cartilage ($r = 0.46, p = 0.006$). Trends were observed between greater KFI and

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 Shod Treadmill Running

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

(No relevant relationships reported)

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 (\pm 1 S.E.) amplitude normalized RMS value during the barefoot condition for the TA, PL, and AH was 50 (\pm 4.7), 109 (\pm 17.9), and 123 (\pm 18.4) percent, respectively. During the shod condition the mean (\pm 1 S.E.) amplitude normalized RMS value for the TA, PL, and AH was 52 (\pm 6.1), 103 (\pm 17.3), and 130 (\pm 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 Hoffman². ¹Fort Lewis College, Durango, CO. ²Denver 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 (Hozhoni Balance Rail®) was designed to adhere to the plantar surface rather than being secured 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 shod runners (7 men and 5 women, age: 25 \pm 3.8 yr; height: 1.58 \pm 0.15 m; mass: 68.1 \pm 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 with an embedded force plate. Kinematic and kinetic differences between the SHOD, BF and BF ORTHO conditions for both walking and running 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 \pm 0.20 m, BF ORTHO: 1.43 \pm 0.19 m, SHOD: 1.54 \pm 0.17 m, $p < 0.05$ compared to SHOD) and running (BF: 1.98 \pm 0.27 m, BF ORTHO: 2.06 \pm 0.30 m, SHOD: 2.16 \pm 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 \pm 0.10 m, BF ORTHO: 1.19 \pm 0.12 m, SHOD: 1.29 \pm 0.11 m, $p < 0.05$ compared to SHOD) and running (BF: 2.29 \pm 0.26 m, BF ORTHO: 2.27 \pm 0.21 m, SHOD: 2.48 \pm 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

Christine D. Pollard, Justin Ter Har, JJ Hannigan, Marc F. Norcross. *Oregon State University-Cascades, Bend, OR.*

(No relevant relationships reported)

Lower extremity injuries are a common occurrence among runners. Recent footwear trends have included minimal and maximal running shoe types. Maximal running shoes are unique because they provide the runner with a highly cushioned midsole in both the rearfoot and forefoot. Little is known about how maximal shoes influence running biomechanics. **PURPOSE:** To examine the influence of maximal running shoes on biomechanics prior to and following a 5K run as compared to neutral running shoes. **METHODS:** Fifteen female runners participated in two testing sessions (neutral shoe session and maximal shoe session) with 7-10 days between sessions. Three-dimensional kinematics and kinetics were collected while subjects ran along a 10 meter runway. After five running trials, they completed a 5K treadmill run, and then completed five additional running trials. Variables of interest included impact peak of the vertical ground reaction force, loading rate, and peak eversion. Differences were determined by using a series of two-way repeated measures ANOVA models (shoe x time). **RESULTS:** There was a significant main effect for shoe type for impact peak and loading rate. Comparing the neutral shoe to the maximal shoe prior to and following running a 5K, subjects exhibited an increased loading rate [(pre-neutral: 60.83 BWs/sec; pre-maximal: 81.15 BWs/sec) $p=0.000$, (post-neutral: 61.22 BWs/sec; post-maximal: 79.10 BWs/sec) $p=0.008$], and increased impact peak [(pre-neutral: 1.58 BWs; pre-maximal: 1.76 BWs) $p=0.004$, (post-neutral: 1.55 BWs; post-maximal: 1.79 BWs) $p=0.003$] in the maximal shoe condition. There were no shoe-time interactions and no significant findings for peak eversion. **CONCLUSIONS:** Runners exhibited increased impact forces and loading rate when running in a maximal versus neutral shoe. Since increases in these variables have been associated with an increased risk of running related injuries, runners who are new to running in a maximal shoe may be at an increased risk of injury. Therefore, runners should be cautious when switching from a neutral shoe to a maximal shoe; however, further work is necessary to better understand the longer-term impact.

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

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

James Becker¹, Brianne Borgia². ¹Montana State University, Bozeman, MT. ²University of Nevada, Las Vegas, Las Vegas, NV.

(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 minimalist (Min), traditional (Trad), and ultra-cushioning (Ultra) shoes. **METHODS:** Participants included 13 runners (sex: 5 M; 8 F; age: 22 \pm 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 Trad ($p=.033$) or Min ($p=.047$) shoes. Ankle dorsiflexion ROM was lower in the Ultra shoes than in either the Trad ($p=.007$) or Min ($p=.038$) shoes. Mean gluteus medius RMS was higher in the Ultra shoes than in either the Trad ($p=.013$) or Min ($p=.017$). Mean RMS for the tibialis anterior was also higher in the Ultra shoes than in either the Trad ($p=.033$) or Min ($p=.029$). Finally, mean RMS for the peroneus longus was higher in the Ultra shoes than the Trad shoes ($p=.046$). **CONCLUSION:** The minor 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.

Table 1. Mean (\pm standard deviation) for variables which were significantly different between shoe conditions. *F* and *p* values refer to omnibus tests. For post hoc values see text.

	Min	Trad	Ultra	<i>F</i> _{2,24} , <i>p</i>
Hip int. rotation ROM(°)	7.0 \pm 5.6	6.4 \pm 4.4	8.4 \pm 5.9	4.82, .017
Ankle dorsiflexion ROM(°)	20.8 \pm 3.6	20.7 \pm 4.2	18.3 \pm 3.7	6.69, .005
Mean GMRMS (mV)	3.6 \pm 1.2	2.6 \pm 0.7	6.5 \pm 2.4	5.15, .014
Mean TARMS (mV)	6.4 \pm 3.1	5.0 \pm 4.6	7.1 \pm 4.5	4.50, .036

2545 June 1 2:30 PM - 2:45 PM

Sex and Speed Influence Frontal Plane Kinematics During Running

Mikel R. Stiffler-Joachim, Herman J. Feller, Christa M. Wille, Bryan C. Heiderscheit. *University of Wisconsin - Madison, Madison, WI.*

(No relevant relationships reported)

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_{IC}, deg), peak hip adduction (ADD_{PK}, deg), and peak contralateral pelvic drop (PEL_{PK}, 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 ($p \geq .40$) were observed for ADD_{IC}, ADD_{PK}, or PEL_{PK}. There was a significant speed main effect for ADD_{IC}, ADD_{PK}, and PEL_{PK}. ADD_{IC} and ADD_{PK} increased significantly with speed ($p < 0.01$). PEL_{PK} at 2.68 m/s was significantly less than 3.35 and 4.47 m/s ($p < 0.01$, mean difference = 0.5 deg). Females demonstrated greater ADD_{IC} and ADD_{PK} than males ($p < 0.01$, mean difference = 2.0 deg for both ADD_{IC} and ADD_{PK}). **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.

2546 June 1 2:45 PM - 3:00 PM

Lower Extremity Strength & Kinematic Variability in Healthy Runners During a Prolonged Run: Preliminary Analysis

Amanda Estep¹, Steven Morrison², Shane Caswell¹, Nelson Cortes¹. ¹George Mason University, Manassas, VA. ²Old Dominion University, Norfolk, VA.

(No relevant relationships reported)

BACKGROUND: To date limited studies incorporating prolonged runs in healthy runners have produced conflicting results. Furthermore, kinematic variability of the ankle, knee and hip have not been assessed, nor has hip strength been measured simultaneously. Rather previous studies have focused on foot contact angle variability and stride time variability.

PURPOSE: To compare changes in lower limb strength & kinematic variability after a prolonged run in healthy runners.

METHODS: 7 healthy subjects (25 \pm 2.5 years, 1.77 \pm 0.12 m, 65.2 \pm 19.9 kg) volunteered for this study. Subjects ran on a motorized treadmill for an average of 44.3 \pm 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 plane angles. Standard deviation (SD) and coefficient of variation (CV), were calculated for each dependent variable (DV) at the beginning and end of run. Approximate entropy (ApEn) was also calculated for each DV at both time intervals. Hip strength was assessed in the sagittal, frontal and transverse planes of motion before and after the run using a handheld dynamometer. Each subject performed 3 maximum voluntary isometric contractions (MVICs) for each motion. The highest number for each motion was recorded.

Additionally, heart rate (HR) and rate of perceived exertion (RPE) was recorded at the beginning and end of run. A paired samples T-test was conducted to compare all DVs. Alpha level was set at 0.05.

RESULTS: Average running speed: 2.63 \pm .26 m/s. Only hip front plane SD was significantly different from the beginning to the end of the run ($t=-2.93$, $p=.03$). Specifically, SD increased from 7.42 \pm 1.63 to 8.21 \pm 1.44. All other DVs, including all strength measures, remained unchanged from the beginning to end of run ($p>0.05$). **CONCLUSIONS:** Based on our preliminary results, a prolonged run had minimal impact on kinematic variability and hip strength. Despite subjects reaching a fatigued state (RPE 17; 85% HR max), each subject was able to maintain their preferred running pattern. Perhaps it is not the running time that affects kinematic variability, but the combination of both time and intensity of the run.

F-13 Free Communication/Slide - Physical Activity, Sedentary Behavior and Health: New Epidemiologic Findings

Friday, June 1, 2018, 1:00 PM - 3:00 PM

Room: CC-101CD

2547 **Chair:** Charles E. Matthews, FACSM. *National Cancer Institute, Rockville, MD.*

(No relevant relationships reported)

2548 June 1 1:00 PM - 1:15 PM

Mortality Attributable to Sedentary Behavior and Physical Inactivity in the United States

Peter T. Katzmarzyk, FACSM, Emily F. Mire. *Pennington Biomedical Research Center, Baton Rouge, LA.*

(No relevant relationships reported)

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 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 , 2.51-16, 16.01-34.5, and ≥ 34.51 . 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% [$((P[HR-1])/(P[HR-1]+1)) \times 100$] 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 attributable to excessive sitting and physical inactivity.

2549 June 1 1:15 PM - 1:30 PM

Physical Activity Throughout Adulthood And Medicare Expenditures In Us Adults

Diarmuid Coughlan¹, Pedro Saint-Maurice, FACSM¹, Susan Carlson², Janet Fulton, FACSM², Charles E. Matthews, FACSM¹. ¹National Cancer Institute, Bethesda, MD. ²Centers for Disease and Prevention, Atlanta, GA.

(No relevant relationships reported)

PURPOSE: To examine the relationship between moderate-to vigorous physical activity (MVPA) participation throughout adulthood and Medicare health care expenditures later in life.

METHODS: NIH-AARP Diet and Health Study respondents' data were linked to Medicare claims data (N=21,750 US adults) to estimate health care utilization and costs prospectively after age 65 yrs. The analytical cohort, retrospectively reported their MVPA participation (never/rarely, <1, 1-3, 4-7, and >7 hrs/week) for ages 15-18, 19-29, 35-39 and 43-64 years, from a single time-point prior to Medicare eligibility. 10 distinct MVPA trajectories were identified, and a two-part multivariable model was used to estimate the association between trajectories and average annual Medicare expenditures.

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) (See Table). 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

Trajectory (N)	Average marginal decrease (per person/year) (95% CI)	
	Age-adjusted	Multivariable
Consistently inactive (743)	Referent	Referent
Moderate improver (1,988)	-\$1,116 (-\$1,185, -\$1,047)	-\$818 (-\$2061, \$425)
Consistent 1hr (3,273)	-\$152 (-\$221, -\$83)	-\$48 (-\$1249, \$1,154)
Aggressive improver (1,168)	-\$2,310 (-\$2,382, -\$2,237)	-\$1,896 (-\$3,178, -\$616)
Early improver & late decliner (1,128)	-\$1,044 (-\$1,122, -\$965)	-\$819 (-\$2,106, \$467)
Moderate decliner (2,028)	\$255 (\$176, \$335)	-\$101 (-\$1,357, \$1,155)
Fast decliner (1,676)	-\$319 (-\$393, -\$247)	-\$250 (-\$1,518, \$1,018)
Consistently active (5,220)	-\$1,421 (-\$1,488, -\$1,354)	-\$1,165 (-\$2,299, -\$31)
Steady decliner (1,802)	-\$37 (-\$144, +\$39)	-\$115 (-\$1,389, \$1,160)
Lull in 20-30s (2,724)	-\$1,607 (-\$1,675, -\$1,540)	-\$1,423 (-\$2,602, -\$244)

2550 June 1 1:30 PM - 1:45 PM

Sitting Time And Quality Of Life In Office Workers Undergoing A Sedentary Behavior Intervention

Nirjhar Dutta¹, Nathan R. Mitchell¹, Sarah A. Rydell¹, Meynard L. Toledo², Sarah L. Mullane², Miranda L. Larouche², Matthew P. Buman, FACSM², Mark A. Pereira¹. ¹University of Minnesota, Minneapolis, MN. ²Arizona State University, Phoenix, AZ. (Sponsor: Matthew P. Buman, FACSM)
(No relevant relationships reported)

PURPOSE: The purpose of this study was to investigate the association of changes in occupational sitting time and self-rated quality of life (QOL) in adult sedentary office workers undergoing a sedentary behavior intervention. **METHODS:** Data were derived from the ongoing study ‘Stand & Move at Work’, a group randomized trial aimed at reducing employee sedentary time through individual, environmental, and policy level changes. Physical functioning and mental health QOL scores were assessed with the SF-12 questionnaire. Sitting time (min/day) throughout the work day was assessed by the activPal accelerometer/inclinometer with seven days of continuous wear. Work logs were used to isolate sitting minutes at work. These measures were assessed at baseline and at the three month time-point during the intervention. Change over time was computed for all variables by subtracting the individual 3-month value from the baseline value. The correlations between change in sitting time and changes in physical functioning and mental health were estimated by Pearson’s correlation coefficient. **RESULTS:** A total of 344 men and women were available for these analyses, of whom 24% were male and the average age was 45 +/- 11 yr. The mean baseline sitting time was 70 +/- 16% of the workday. Change in sitting time was inversely correlated with the physical functioning score (r=-0.13, p<0.05), whereas sitting time was not associated with the mental health score (r=-.042, p = 0.44). **CONCLUSIONS:** Decreases in sitting time were associated with improvement in self-reported physical functioning quality of life but not in mental health quality of life. Longer term results over 12 months of intervention and comparisons between the two different intervention arms may shed more light on the robustness and interpretation of the possible link between sitting time and quality of life domains.

2551 June 1 1:45 PM - 2:00 PM

10-year Changes In Accelerometer-determined Physical Activity And Sedentary Time During Midlife: CARDIA

Kelley Pettee Gabriel, FACSM¹, Steve Sidney², David R. Jacobs, Jr.³, Mercedes Carnethon⁴, Cora E. Lewis⁵, Pamela Schreiner³, Raja Malkani¹, James M. Shikany⁵, Kara M. Whitaker⁶, Jared P. Reiss⁷, Barbara Sternfeld, FACSM². ¹University of Texas Health Science Center at Houston School of Public Health, Austin, TX. ²Kaiser Permanente Northern California, Oakland, CA. ³University of Minnesota, Minneapolis, MN. ⁴Northwestern University, Chicago, IL. ⁵University of Alabama at Birmingham, Birmingham, AL. ⁶University of Iowa, Iowa City, IA. ⁷National Heart, Lung, and Blood Institute, Bethesda, MD.
(No relevant relationships reported)

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 hours 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 ct·min⁻¹·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.

2552 June 1 2:00 PM - 2:15 PM

Effects of Replacing Prolonged Sedentary Bouts with Short Sedentary Bouts or Physical Activity On Mortality

Keith M. Diaz¹, Andrea T. Duran¹, Natalie Colabianchi², Suzanne E. Judd³, Virginia J. Howard³, Steven P. Hooker, FACSM⁴. ¹Columbia University Medical Center, New York, NY. ²University of Michigan, Ann Arbor, MI. ³University of Alabama at Birmingham, Birmingham, AL. ⁴Arizona State University, Phoenix, AZ.
(No relevant relationships reported)

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 shorter 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-to-vigorous intensity physical activity (MVPA) is associated with reductions in all-cause mortality risk. **METHODS:** Participants (n=7,999) from the REasons for Geographic and Racial Differences in Stroke (REGARDS) Study, a national cohort study 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 ≥

30 min) with an equal amount of time in a given type of activity (short sedentary bouts, LIPA, or MVPA) on all-cause mortality risk. **RESULTS:** Over a median follow-up of 5.5 years, there were 647 deaths. There was a beneficial association for replacing prolonged, uninterrupted sedentary bout time with both LIPA (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 LIPA or MVPA.

2553 June 1 2:15 PM - 2:30 PM

Mortality Risk Reductions for Replacing Sedentary Time with Physical Activities

Erika Rees-Punia¹, Charles E. Matthews, FACSM², Susan Gapstur¹, Alpa V. Patel¹. ¹American Cancer Society, Atlanta, GA. ²National Cancer Institute, Bethesda, MD. (Sponsor: Charles Matthews, FACSM)

(No relevant relationships reported)

BACKGROUND: Insufficient physical activity is a well-established risk factor for chronic disease and early mortality. More recent evidence suggests that excess sitting time may be an additional risk factor, independent of physical inactivity. This may be due, at least in part, to the displacement of physical activities with sedentary behaviors.

PURPOSE: To examine the mortality risk reductions associated with replacing thirty minutes of daily sitting time for an equivalent duration of physical activity.

METHODS: Participants included 40,866 men and 60,891 women in the Cancer Prevention Study-II Nutrition Cohort. An isothermal substitution approach to Cox proportional hazards regression models were used to estimate adjusted hazard ratios (HR) and 95% confidence intervals (HR, 95% CI) for all-cause mortality associated with the substitution of thirty minutes of daily sitting time with an equal duration of light or moderate-to-vigorous intensity physical activity (LPA, MVPA).

RESULTS: During 14 years (1999-2013) of follow-up, 16,163 men and 15,638 women died. Overall, reallocation of 30 min-day⁻¹ of sitting to LPA (HR=0.94, 0.92-0.97) or MVPA (HR=0.91, 0.88-0.93) was associated with significant reductions in mortality risk. Among the least active participants, the replacement of 30 min-day⁻¹ of sitting time with 30 min-day⁻¹ LPA was associated with a 14% mortality risk reduction (HR=0.86, 0.83-0.89) and replacement with MVPA was associated with a 50% mortality risk reduction (HR=0.50, 0.44-0.58). Similar associations were seen among the moderately active group (HR=0.91, 0.89-0.96 for LPA replacement, HR=0.65, 0.56-0.79 for MVPA replacement). However, among the most active participants, substitution of sitting time with LPA or MVPA was not associated with a significant reduction in mortality risk (HR=1.00, 0.97-1.02, HR=0.97, 0.95-1.01, respectively).

CONCLUSIONS: Among the least active and moderately active, the replacement of modest amounts of sitting time with either LPA or MVPA was associated with longevity, although the associations were strongest when sitting time was replaced with MVPA.

2554 June 1 2:30 PM - 2:45 PM

Changes in Energy Reserves Contribute to Cognitive Decline with Aging

Jennifer A. Schrack¹, Amal A. Wanigatunga¹, Adam P. Spira¹, Vadim Zipunnikov¹, Eleanor M. Simonsick², Susan M. Resnick². ¹Johns Hopkins University, Baltimore, MD. ²National Institute on Aging, Baltimore, MD.

(No relevant relationships reported)

PURPOSE: Identification of physiological changes that predict functional decline and reflect the onset of cognitive change may identify mechanisms common to mobility and cognition; potentially leading to earlier diagnoses and intervention efforts. Although greater peak VO₂ and walking efficiency have been linked to better preservation of physical functioning with aging, it is unclear how changes in energy reserve affect cognitive performance. The objective of this study was to assess the association between longitudinal changes in energy reserve and cognitive performance in a cohort of well-functioning adults.

METHODS: Peak VO₂ (ml/kg/min), the energetic cost of a 5-min 1.5 mph treadmill walk (ml/kg/min), and cognitive performance were assessed in over 1000 participants (mean baseline age 67.5, range 24-96, 49% male) of the Baltimore Longitudinal Study of Aging. The primary outcomes were changes in the domains of attention, memory, and executive function over an average of 4-years (range 1-7 yrs), measured through a neuropsychological battery at each visit. The primary predictor was energy reserves (mean walking VO₂/peak VO₂). The association between change in energy reserves and change in cognitive performance was modeled using linear regression models with generalized estimating equations for repeated measures, adjusted for age, sex, body mass index (kg/m²), race, education, number of chronic conditions, and an interaction between energy reserves and age.

RESULTS: In fully adjusted population average models, a significant interaction between energy reserves and age was observed for memory ($\beta = -0.42$, $p < 0.001$), executive function ($\beta = 1.63$, $p < 0.001$), and attention ($\beta = -0.19$, $p = 0.04$), indicating that declining energy reserves contributed to poorer cognitive performance in all domains over time. Z-scores indicate these effects were greatest for memory, followed by executive function and attention.

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.

2555 June 1 2:45 PM - 3:00 PM

Strong Evidence from the 2018 Physical Activity Guidelines Advisory Committee

Alison Vaux-Bjerke¹, Eric Hyde², Katrina L. Piercy¹, Richard D. Olson¹, Richard P. Troiano³, Janet E. Fulton, FACSM². ¹Office of Disease Prevention & Health Promotion, U.S. Dept. of Health & Human Services, Rockville, MD. ²Centers for Disease Control and Prevention, U.S. Dept. of Health & Human Services, Atlanta, GA. ³National Cancer Institute, National Institutes of Health, U.S. Dept. of Health & Human Services, Bethesda, MD. (Sponsor: Janet Fulton, FACSM)

(No relevant relationships reported)

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 during five public 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.

Table 1. Selected conclusion statements for 'strong' evidence.

Subcommittee / Work Group	Topic	Conclusion Statement
Brain Health	Dementia	Strong evidence demonstrates that greater amounts of physical activity are associated with a reduced risk of developing dementia.
	Anxiety	For the general population, strong evidence demonstrates reduced state anxiety following acute bouts of exercise and reduced trait anxiety following weeks/months of regular exercise.
	Depression	Strong evidence demonstrates that greater amounts of physical activity reduce the risk for depression.
Cardiometabolic Health and Weight Management	Weight Gain	Strong evidence demonstrates a relationship between greater amounts of physical activity and attenuated weight gain in adults, with some evidence to support that this relationship is most pronounced when physical activity exposure is above 150 minutes per week.
Sedentary Behavior	All-cause mortality	Strong evidence demonstrates a significant relationship between greater time spent in sedentary behavior and higher all-cause mortality rates.
Youth	Fitness in youth ages 6-17	Strong evidence demonstrates that increased moderate-to-vigorous physical activity increases cardiorespiratory fitness and increased resistance exercise increases muscular fitness in children and adolescents.
Pregnancy Work Group	Prevention of gestational weight gain	Strong evidence demonstrates a significant, but modest, inverse relationship between physical activity and gestational weight gain.
	Incidence of gestational diabetes mellitus	Strong evidence demonstrates a significant inverse relationship between leisure-time physical activity and risk of gestational diabetes mellitus.

F-31 Thematic Poster - Cardiac Physiology

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100C

2610 **Chair:** Tracy Baynard, FACSM. *University of Illinois at Chicago, Chicago, IL.*
(No relevant relationships reported)

2611 Board #1 June 1 3:15 PM - 5:15 PM
Effects of Increased Preload on Cardiac Function in Younger vs Older Women

David N. Proctor, FACSM¹, Samuel J. Ridout², Zhaohui Gao³, Joaquin U. Gonzales⁴, Danielle Jin-Kwang Kim³, Matthew D. Muller, FACSM⁵, Urs A. Leuenberger³. ¹*Penn State University, University Park, PA.* ²*Kaiser Permanente, San Jose, CA.* ³*Milton S. Hershey Medical Center, Hershey, PA.* ⁴*Texas Tech University, Lubbock, TX.* ⁵*Case Western Reserve University School of Medicine, Cleveland, OH.*
(No relevant relationships reported)

PURPOSE: Limitations in cardiac preload and/or compliance could underlie diminished stroke volume and ventricular remodeling adaptations to endurance exercise in older women. The present study tested the hypothesis that attenuated cardiac function in older women persists during acute increases in preload, both at rest and during exercise. **METHODS:** Nine younger (Y, 21-28 y) and ten older (O, 61-73 y) healthy, non-endurance trained women were studied 1) at rest in the supine and seated positions, and 2) during graded upright cycle ergometer exercise (20, 40, 60 and 80% of VO₂peak), both before and after acute plasma volume (PV) expansion (via IV infusion of 5% albumin; 10ml/kg). Cardiac responses to postural change, exercise, and PV expansion were measured using echocardiography (rest and low intensity exercise) and open circuit C₂H₂ (exercise). **RESULTS:** Under resting normovolemic conditions, stroke volume (SV) was augmented in the supine (vs. upright) posture in both Y (61±9 vs. 52±8 ml/beat, P<0.05) and O (55±10 vs. 49±7 ml/beat, P<0.05) women. Hypervolemia augmented supine SV further in Y (68±4 ml/beat, P<0.05 vs. normovolemia), but not in O (55±10 ml/beat, P>0.05 vs. normovolemia) women. These resting postural and hypervolemic effects were mediated by changes in end diastolic volume, and not secondary to age group differences in the extent of PV expansion (averaged +16% and +13% in Y and O, respectively) or estimated

filling pressures (E/E'). E/A ratio during peak resting preload conditions (i.e., supine hypervolemia), moreover, was positively associated with VO₂peak in Y, but not in O women. During upright exercise, hypervolemia increased SV an average of 15 ml/beat across all 4 work intensities in Y women (p<0.05 vs. normovolemia). This was in contrast to O women, who exhibited very small increases in SV during hypervolemic exercise (i.e., <5 ml/beat). **CONCLUSIONS:** Healthy older women appear to have a reduced ability (relative to younger women) to utilize acute increases in preload to raise left ventricular stroke volume, including during large muscle exercise. These findings likely reflect the combined effects of exceptional lusitropic function in younger women, and a less compliant ventricle in the aged female heart.

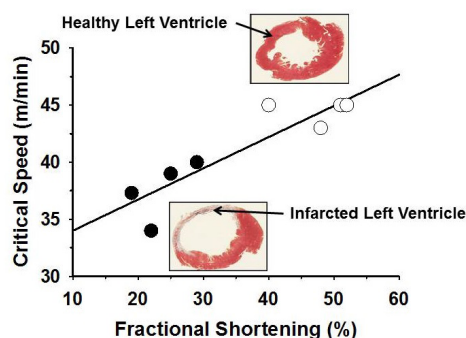
2612 Board #2 June 1 3:15 PM - 5:15 PM
Critical Speed in Heart Failure Rats: The Central Determinant of Performance

Jesse C. Craig, Joseph H. Merino, Daniel M. Hirai, Trenton D. Colburn, Ayaka Tabuchi, Jacob T. Caldwell, Carl J. Ade, Timothy I. Musch, FACSM, David C. Poole, FACSM. *Kansas State University, Manhattan, KS.* (Sponsor: David C. Poole, FACSM)

(No relevant relationships reported)

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.

Structural and Functional Determinants of Critical Speed in Heart Failure



2613 Board #3 June 1 3:15 PM - 5:15 PM
Non-invasive Assessment Of Right And Left Ventricular Cardiac Output After Changes In Gravity And Posture

Uwe Hoffmann¹, Jessica Koschate¹, Uwe Drescher¹, Lutz Thieschäfer¹, Daniel Koeln Dunitescu², Andreas Werner³. ¹German Sport University, Koeln, Germany. ²University of Cologne, Koeln, Germany. ³German Air Force - Centre of Aerospace Medicine, Koelnbrueck, Germany.
 (No relevant relationships reported)

Gravity changes along the z-axis (posG_z) influence right and left ventricular cardiac output (CO_{RV}, CO_{LV}). This is of importance 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·m⁻²) 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 (I₁, I₂, I₃) 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 V_{O₂}, heart rate and cBP were measured. Left ventricular stroke volume was determined from cBP allowing to estimate CO_{LV}. Arterio-venous O₂ concentration difference was calculated as average for 30 s before the first posGz change (I₁). This allows calculating CO_{RV} 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 V_{O₂} and cBP measurements allows to assess differences in CO_{RV} and CO_{LV}. The differences in I₂, after a reduction in posGz indicate a blood volume shift into the pulmonary veins which has an impact on CO_{LV}, which increases during the following posGz increase (I₃). Further influences from breathing must be studied.

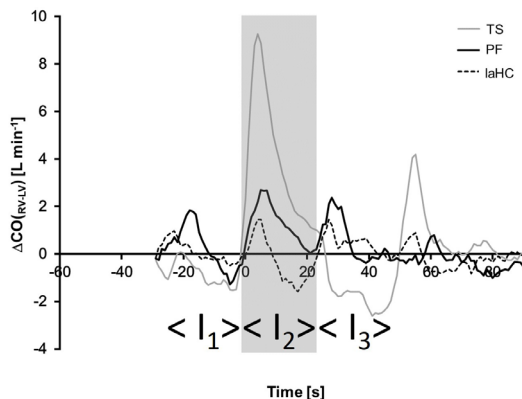


Fig. 1: Difference of CO_{RV} and CO_{LV}

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

2614 Board #4 June 1 3:15 PM - 5:15 PM
Right Ventricular Remodeling In Olympic Athletes During 8 Years Of High-intensity Training

Vincent L. Aengevaeren¹, Stefano Caselli², Maria T.E. Hopman, FACSM¹, Thijs M.H. Eijvogels¹, Antonio Pelliccia². ¹Radboud University Medical Center, Nijmegen, Netherlands. ²Institute of Sports Medicine and Science, Rome, Italy. (Sponsor: Maria Hopman, FACSM)
 (No relevant relationships reported)

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 cardiovascular evaluation before every Olympic event including a clinical and echocardiographic examination. Athletes were categorized as either endurance or non-endurance athletes. **RESULTS:** 50 Olympic athletes (64% male; 24±4 y) from different sporting disciplines (n=20 endurance and n=30 non-endurance athletes) met the criteria for inclusion. Mild increases in RV outflow tract diameter (long axis 6±12%; short axis 5±13%), RV basal (7±12%) and mid diameter (18±21%), RV end-diastolic area (7±15%), right atrium area (6±15%), and RV/Left Ventricle (LV) diameter ratio (5±11%) were observed during follow-up. Furthermore, significant increases in aortic root size (8±7%), left atrium area (9±21%) and left ventricle

diameter were found (1±4%). Systolic functional parameters of both ventricles did not change over time, whereas a mild decrease in indices of LV diastolic function (E/A ratio: -12±21%; E': -5±17%) was observed. Most changes occurred between the first and second evaluation, and parameters plateaued between the second and third evaluation. Endurance athletes demonstrated greater increases in RV end-diastolic area compared to non-endurance athletes. **CONCLUSION:** Olympic athletes showed mild but continued cardiac remodeling, including RV and LV cavity, RV and LV atrium, and 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.

2615 Board #5 June 1 3:15 PM - 5:15 PM
Heart Rate Responses in the Diving Reflex among Aerobically Trained and Untrained Men

Kathryn Lewis, Samuel Headley, Jessica Peacock, Christa Winter, Vincent Paolone, FACSM. Springfield College, Springfield, MA.
 (No relevant relationships reported)

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 investigated in 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 lowest 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. **CONCLUSION:** 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.

2616 Board #6 June 1 3:15 PM - 5:15 PM
Exercise Training May Attenuate the Cardiac Changes Associated with the Menopause

Amanda Q.X. Nio, Eric J. Stöhr, Samantha Rogers, Rachel Mynors-Wallis, Victoria L. Meah, Jane M. Black, Mike Stemberidge, Rob Shave. Cardiff Metropolitan University, Cardiff, United Kingdom.
 (No relevant relationships reported)

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 are 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 4 × 4 min intervals at 90-95% maximum heart rate; attendance ≥70%). Data on LV mechanics are reported for 11 pre- and 12 post-menopausal women. The Bayes factor [BF₁₀ = p(H₀)/p(H₁)] from the Bayesian independent samples t-test was used to assess the evidence for differences in cardiovascular function between untrained pre-menopausal women and post-menopausal women before and after exercise training (H₁). A BF₁₀ of 1 indicates equal evidence for both the null (H₀) and alternative hypotheses, while smaller values indicate increasing strength of evidence for the null hypothesis and larger values favour H₁. **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 (BF₁₀ 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; BF₁₀=3.56). After exercise training, peak aerobic capacity was higher in post-menopausal women (34±5 vs. 29±5 mL/min/kg; BF₁₀=2.58), while strength of evidence for menopause-related differences in E' decreased (BF₁₀=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.

2617 Board #7 June 1 3:15 PM - 5:15 PM
Differential Effects of Three Distinct Training Approaches in a Rat Model of Severe Pulmonary Hypertension

Mary Beth Brown¹, Andrea Frump², Gary Long¹, Ashley Troutman¹, Amanda Fisher¹, Robert Presson², Tim Lahm².
¹Indiana University School of Health and Rehabilitation Sciences, Indianapolis, IN. ²Indiana University School of Medicine, Indianapolis, IN.

(No relevant relationships reported)

PURPOSE: Optimizing exercise as therapy for pulmonary arterial hypertension (PAH) requires an understanding of which approaches maximize benefit and minimize detriment, 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 (~200g, male) with Sugen+Hypoxia-induced PAH (SuHx) underwent 6 wks of training as either HIIT (2 min at ~85% VO₂reserve [VO₂R] + 3 min at 30%VO₂R, for 4-5 cycles, n=12) or CET (45-60 min at 50%VO₂R, n=11) performed 5 days/wk on a treadmill, or were housed with computer-monitored wheels (n=14). Additional SuHx rats were untrained (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 (2), 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) and stroke volume (SV, 466±39uL/min) at pre-training compared to surviving SuHx (n=39, 216±19uL, 593±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) as indicated by CO (mL/min) = 258±51, 222±44, 191±17, and 126±16; and by SV (uL/min) = 564±60, 529±51, 554±48, and 364±32, for HIIT, CET, VWR, and SED SuHx, respectively.

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)

F-32 Thematic Poster - Military Physiology: Energy Expenditure

Friday, June 1, 2018, 3:15 PM - 5:15 PM
 Room: CC-Lower level L100F

2618 Chair: David DeGroot, FACSM. *Tripler Army Medical Center, Tripler AMC, HI.*

(No relevant relationships reported)

2619 Board #1 June 1 3:15 PM - 5:15 PM
Prediction Equation For Estimating Total Daily Energy Requirements Of Special Operations Personnel

Lee M. Margolis¹, Nicholas D. Barringer¹, Holly L. McClung¹, Aaron P. Crombie², Stefan M. Pasiakos, FACSM¹. ¹United States Army Research Institute of Environmental Medicine, Natick, MA. ²US Military-Baylor University Graduate Program in Nutrition, US Army Medical Department Center & School US Army Health Readiness Center of Excellence, San Antonio, TX. (Sponsor: Stefan M Pasiakos, FACSM)

(No relevant relationships reported)

Abstract

Special Operations Forces (SOF) engage in a variety of military tasks with many producing high energy expenditures, resulting in undesired energy deficits and loss

of body mass. Therefore, the ability to accurately estimate daily energy requirements would be useful to generate adequate feeding regimens to support maintenance of energy balance during military operations. **Purpose:** Generate a predictive equation estimating energy requirements of SOF. **Methods:** Retrospective analysis of data collected from SOF personnel engaged in 12 different SOF training scenarios. Energy expenditure and total body water were determined using the doubly-labeled water (DLW) technique. Physical activity level was determined as daily energy expenditure divided by resting metabolic rate. Physical activity level was broken into quartiles (0 = mission prep, 1 = common warrior tasks, 2 = battle drills, 3 = specialized intense activity) to generate a physical activity factor (PAF). Regression analysis was used to construct two predictive equations (Model A; body mass and PAF, Model B; fat-free mass and PAF) estimating daily energy expenditures. **Results:** Average measured energy expenditure during SOF training was 4468 (range: 3700 to 6300) Kcal·d⁻¹. Regression analysis revealed that physical activity level (r = 0.91; P < 0.05) and body mass (r = 0.28; P < 0.05; Model A), or fat-free mass (FFM; r = 0.32; P < 0.05; Model B) were the factors that most highly predicted energy expenditures. Predictive equations coupling PAF with body mass (Model A) and FFM (Model B), were correlated (r = 0.74 and r = 0.76, respectively) and did not differ (mean ± SEM: Model A; 4463 ± 65 Kcal·d⁻¹, Model B; 4462 ± 61 Kcal·d⁻¹) from DLW measured energy expenditures. **Conclusion:** By quantifying and grouping SOF training exercises into activity factors, SOF energy requirements can be predicted with reasonable accuracy and these equations can be used by dietetic/logistical personnel to plan appropriate feeding regimens to meet SOF nutritional requirements across their various mission profile.

Disclaimer: The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

2620 Board #2 June 1 3:15 PM - 5:15 PM
Comparison of Pandolf Equation and Measured Metabolic Cost of Load Carriage in UK Military Personnel

Christopher A J Vine¹, Sarah L. Coakley¹, Stephen D. Myers¹, Ella F. Walker¹, Carla A. Rue¹, Ben J. Lee¹, Tessa R. Flood¹, Julianne Doherty¹, Beverley Hale¹, Mark Rayson², Joeseeph J. Knapik, FACSM³, Deborah Gebhardt, FACSM⁴, Bradley C. Nindl, FACSM⁵, Pieter E H Brown⁶, Sarah Jackson⁷, Julie P. Greeves⁷, Sam D. Blacker¹. ¹University of Chichester, Chichester, United Kingdom. ²Mark Rayson Consulting Limited, Bristol, United Kingdom. ³Fitness, Injury, and Performance Analysis, Abingdon, MD. ⁴Human Resources Research Organization, Alexandria, VA. ⁵University of Pittsburgh, Pittsburgh, PA. ⁶Institute of Naval Medicine, Royal Navy, Gosport, United Kingdom. ⁷Army Personnel Research Capability, Army HQ, Andover, United Kingdom.

(No relevant relationships reported)

PURPOSE: The metabolic cost of load carriage (LC) is frequently predicted using the Pandolf et al. (1977) equation. Recent laboratory investigations have identified that the Pandolf equation under-predicts the metabolic cost of LC in untrained personnel during treadmill walking (Drain et al., 2017). However, the relationship between the actual and Pandolf predicted metabolic cost of outdoor LC in UK Armed Forces personnel has not been established.

METHODS: Twenty-two UK Armed Forces personnel (Royal Marine Commandos and Parachute Regiment, mean ± SD: age 23 ± 3 years; stature 180.9 ± 4.9 cm; body mass 83.1 ± 6.6 kg; predicted VO_{2max} 54.0 ± 3.1 ml·kg⁻¹·min⁻¹) completed 15, 20 minute stages of outdoor LC, with external load masses ranging from 25 to 70 kg. The stages were completed at a patrol, forced, and insertion marching speed (2.5, 4.8, and 5.5 km·h⁻¹, respectively). During the final 2-4 minutes of each LC stage, oxygen uptake (VO₂) was measured using the Douglas bag technique. Predicted VO₂ for each speed-load mass combination was calculated using the Pandolf equation and compared to the measured VO₂ using paired t-tests and 95 % Limits of Agreement (LoA).

RESULTS: The Pandolf equation systematically under-predicted the metabolic cost of LC for all speeds and load masses combined [mean difference 3.2 ± 2.9 ml·kg⁻¹·min⁻¹ (p<0.001), 95% LoA -2.5-8.9 ml·kg⁻¹·min⁻¹] resulting in a VO₂ predictive error of 17.5 %. Mean difference and 95% LoA at the different speeds were: (a) 2.5 km·h⁻¹ [4.8 ± 1.9 ml·kg⁻¹·min⁻¹, (p<0.001), 95% LoA 1.0-8.6 ml·kg⁻¹·min⁻¹], (b) 4.8 km·h⁻¹ [1.5 ± 2.7 ml·kg⁻¹·min⁻¹ (p<0.001), 95% LoA -3.9-6.9 ml·kg⁻¹·min⁻¹], and (c) 5.5 km·h⁻¹ [4.2 ± 3.3 ml·kg⁻¹·min⁻¹ (p<0.001), 95% LoA -2.1-10.7 ml·kg⁻¹·min⁻¹], with prediction errors of 30 %, 6 % and 14 %, respectively.

CONCLUSIONS: The current study demonstrates a systematic under-prediction of VO₂ for British Army personnel during outdoor LC when applying the Pandolf equation, supporting the findings of previous laboratory studies. Furthermore, the error appears to be of greater magnitude when LC speeds are lower, i.e. at a representative patrolling pace. This in part could be attributed to the load mass distribution of the modern soldier, which differs from the back mounted load carried data used to develop and refine the Pandolf equation.

2621 Board #3 June 1 3:15 PM - 5:15 PM

Pandolf Equation Efficacy In Predicting Gender-Specific Energy Expenditure Differences While Carrying Light To Heavy Loads

Victoria A. Gregory, Charles S. Fulco, Peter N. Frykman, Rebecca E. Fellin, Nathaniel I. Smith, Joseph F. Seay. *U.S. Army Institute of Environmental Medicine, Natick, MA.*
(No relevant relationships reported)

With the recent decision permitting women to enter Combat Arms roles in the military, knowledge of gender-based differences in energy expenditure (EE) during load carriage has become more operationally relevant. However, one of the most common equations for predicting the energy cost of load carriage has not been systematically compared between male and female Soldiers.

PURPOSE: To examine the efficacy of the Pandolf equation [1] to predict EE of male and female Soldiers while carrying light to heavy loads.

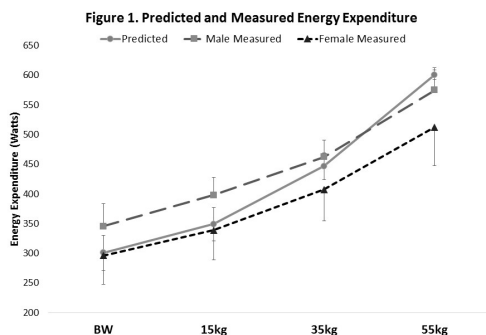
METHODS: Seven women were individually matched with 7 men by height and body weight (differences < 2.54 cm and 4.54 kg for each pair). All participants walked at 1.34 m·s⁻¹ for 10-min bouts on a level treadmill while unloaded (BW) and then carrying vest-borne loads of 15, 35 and 55 kg. VO₂ data were collected during the last 3 min of each bout. 2-way RM ANOVA compared VO₂ at each load between the men and women. Measured results were then compared to equation predictions.

RESULTS: Measured EE increased significantly with load and was significantly greater for men (443 ± 92 W) than women (388 ± 97 W). The equation predicted EE more accurately for women at lighter loads and more accurately for men at heavier loads (Figure 1).

CONCLUSION: Using height and weight matched men and women, the Pandolf equation was more accurate for predicting EE at the heavier loads for men and at the lighter loads for women. These results support modification of the Pandolf equation to account for differences in gender and carried load.

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

[1] Pandolf *et al.*, 1977. *J Appl Physiol.* Oct; 43(4): 577-81.



2622 Board #4 June 1 3:15 PM - 5:15 PM

Comparison of Training Intensity, Energy Balance, and Sleep Duration in British Army Officer Cadets between Base and Field Exercise

Sarah C. Needham-Beck¹, Andrew G. Siddall¹, Jane E.S. Thompson¹, Steven D. Powell¹, Victoria C. Edwards¹, Sam D. Blacker¹, Sarah Jackson², Julie P. Greeves², Steve D. Myers¹.
¹University of Chichester, Chichester, United Kingdom. ²Army Personnel Research Capability, Army HQ, United Kingdom.
(No relevant relationships reported)

PURPOSE: Initial military training typically prepares personnel for service through a combination of structured activities such as physical training, foot drill, and classroom and practical lessons conducted on base and during field exercises. This study compared the training intensity, energy balance, and sleep duration between 5 days 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 mass 79.4 ± 11.0 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. On base and field exercise data were compared using paired and independent

sample t-tests, with statistical significance set at p<0.05. **RESULTS:** Time spent in the sedentary, light, and moderate exercise intensity zones was similar while training on base and on field-exercise (p>0.05). However, more time was spent in the vigorous exercise intensity zone on base compared to the field exercise (mean difference ± SD: 28 ± 22 min, p<0.001). Daily sleep time was higher on base compared to the field exercise (333 ± 91 vs. 126 ± 79 min, p<0.001) and the OCs were in negative energy balance both on base (-3.17 ± 2.00 MJ), and during the field exercise (-7.18 ± 5.35 MJ), with a greater energy deficit experienced on exercise (p<0.05). **CONCLUSIONS:** 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.

2623 Board #5 June 1 3:15 PM - 5:15 PM

Timing of Energy and Macronutrient Intake of British Army Officer Cadets during Military Training

Victoria C. Edwards¹, Steve D. Myers¹, Andrew G. Siddall¹, Jane E.S. Thompson¹, Steven D. Powell¹, Sarah Jackson², Julie P. Greeves², Sophie L. Wardle², Sam D. Blacker¹. ¹University of Chichester, Chichester, United Kingdom. ²Army HQ, Andover, United Kingdom.
(No relevant relationships reported)

Purpose: In athletic populations, the amount and timing of macronutrient intake can influence the restoration of muscle glycogen, attenuation of muscle damage and affect training recovery and adaptations. Despite similarities in the physically demanding, long-term nature of training for both athletes and military personnel, the composition and timing of dietary intake by military personnel is often more limited than athletes, particularly in initial military training establishments. This study quantified the total energy intake and timing of energy and macronutrient intake for Officer Cadets (OC) during training. **Methods:** Twenty (10 male and 10 female) OC's (mean ± SD: age 22 ± 1 years, 1.73 ± 0.08 m, body mass 77.0 ± 9.3 kg) undertaking the British Army Officer Commissioning Course at the Royal Military Academy Sandhurst completed food diaries for 10 days, alongside researcher-led dietary weighing of main meals. Daily energy intake and carbohydrate (CHO), protein (PRO) and fat proportions were analysed using nutritional analysis software (Nutritics). Paired and independent samples t-tests were used to compare dietary intake between meals and sex, respectively. **Results:** Total average energy (M; 16 ± 5, F; 13 ± 3 MJ·day⁻¹) and PRO (M; 144 ± 42, F; 114 ± 25 g·day⁻¹) intake over 10 days was greater for men than women (p<0.05). However, 33w2, no difference (p>0.05) was found between sexes for CHO (M; 453 ± 148, F; 377 ± 80 g·day⁻¹) and fat (M; 149 ± 46, F; 122 ± 34 g·day⁻¹) intake. Energy, PRO and fat intake, but not CHO intake, was in line with UK Military Dietary Reference Values for both sexes. Average PRO and CHO intake was greater (p<0.05) at mealtimes (M) than snacks (S) irrespective of sex (PRO 112 ± 48 (M) vs 28 ± 28 (S); CHO 306 ± 137 (M) vs 167 ± 134 (S) g). However, unlike PRO (breakfast (B) 32 ± 14; mid-morning (S1) 10 ± 10; lunch (L) 38 ± 15; mid-afternoon (S2) 11 ± 11; dinner (D) 42 ± 18; evening (S3) 8 ± 7 g), CHO intake was more evenly spread throughout the day (B 91 ± 43; S1 52 ± 43; L 101 ± 42; S2 66 ± 53; D 114 ± 52; S3 43 ± 38 g). **Conclusion:** The present study indicates that OC energy, PRO and fat intake is in line with current UK military guidelines, however CHO intake was suboptimal. Future research should consider whether a more even distribution of macronutrient intakes throughout the day can aid training adaptations and recovery.

2624 Board #6 June 1 3:15 PM - 5:15 PM

Comparison of Research- and Consumer-grade Energy Expenditure Estimation Methods during 10 Days of Military Training

Andrew G. Siddall¹, Jane E. S. Thompson¹, Steven D. Powell¹, Victoria C. Edwards¹, Sarah S. Kefyalew², Priya A. Singh², Elise R. Orford², Michelle C. Venables², Sarah Jackson¹, Julie P. Greeves³, Sam D. Blacker¹, Steve D. Myers¹. ¹University of Chichester, Chichester, United Kingdom. ²Medical Research Council, Cambridge, United Kingdom. ³Army HQ, Andover, United Kingdom.
(No relevant relationships reported)

PURPOSE: Wearable physical activity monitoring devices have improved the ability to estimate free-living total energy expenditure (TEE) but their application during arduous military training alongside more well-established techniques has not been widely documented. This study aimed to assess the validity of two wrist-worn activity monitors to estimate TEE by evaluating performance against doubly labelled water (DLW) during British Army Officer Cadet (OC) training. **METHODS:** Twenty (10 male and 10 female) OCs (mean ± SD: age 22 ± 1 years, height 1.73 ± 0.08 m, body mass 77.0 ± 9.3 kg) wore one research-grade accelerometer (GENEActiv, Cambridge, UK; "RES") on the dominant wrist and one commercially

available (FITBIT SURGE, USA; "COM") monitor on the non-dominant wrist for 10 days of training. Immediately prior to this 10-day period, participants consumed a bolus of DLW and provided daily urine samples, which were analysed by mass spectrometry to determine TEE. Bivariate correlations and limits of agreement were calculated to compare the 10-day mean TEE from DLW with both activity monitors to evaluate device performance.

RESULTS: TEE (mean \pm SD) from DLW, RES and COM were 17.2 ± 2.7 MJ day⁻¹ (4112 ± 652 kcal day⁻¹), 17.3 ± 2.8 MJ day⁻¹ (4129 ± 677 kcal day⁻¹) and 15.1 ± 3.7 MJ day⁻¹ (3607 ± 888 kcal day⁻¹), respectively. TEE from DLW was linearly correlated with both RES ($r=0.786$, $p<0.001$) and COM ($r=0.888$, $p<0.001$). Despite a stronger association with DLW however, COM tended to underestimate TEE (mean bias [95% CI] by -2.1 [-5.6-1.4] MJ day⁻¹ (-505 [-1348-339] kcal day⁻¹; $p<0.05$). In contrast, mean TEE from RES was similar to DLW (-0.05 [-3.6-3.5] MJ day⁻¹; -11 [-867-845] kcal day⁻¹; $p>0.05$).

CONCLUSION: Wearable physical activity monitors provides 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 training in comparison to a research-grade device.

2625 Board #7 June 1 3:15 PM - 5:15 PM
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 Thompson¹, Victoria C. Edwards¹, Sarah Jackson², Julie P. Greeves², Sophie Wardle², Sam D. Blacker¹, Steve D. Myers¹. ¹University of Chichester, Chichester, United Kingdom. ²Army HQ, Andover, United Kingdom.

(No relevant relationships reported)

PURPOSE: Wearable physical activity monitors provide the capability to estimate the physical demands of military training and to potentially inform training practices. This study aimed to compare both the daily energy expenditure (EE) and weekly physical activity (PA) measured from two wrist-worn activity monitoring devices in Officer Cadets (OC) during initial military training.

METHODS: Forty (26 male, 14 female) OC's (mean \pm SD: age 24 ± 2 , height 1.76 ± 0.08 m, body mass 79.21 ± 9.97 kg) wore a consumer ("CN"; Fitbit Surge, San Francisco, USA) and a research-grade ("RG"; GENEActiv Original, Activinsights, Cambridge, UK) activity monitor during the second 14-week term of British Army OC training. A filtering process was implemented to exclude training days that did not fulfil wear-time criteria. Bivariate Pearson's correlations and limits of agreement (LoA) were used to compare EE measurement and duration of sedentary, light, moderate and vigorous PA between devices.

RESULTS: Mean daily estimated EE from the CN and RG were 13.9 ± 2.5 and 15.7 ± 1.8 MJ day⁻¹, respectively. Estimated daily EE ranged from 8.6 ± 2.8 (day 35) to 22.4 ± 6.7 MJ day⁻¹ (day 49) in CN and from 10.7 ± 4.5 (day 55) to 21.3 ± 8.1 MJ day⁻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 [-1.6 - 3.2] MJ day⁻¹, $p<0.001$) compared to the RG.

Mean daily estimates from CN were 1069 ± 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), 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.

2626 Board #8 June 1 3:15 PM - 5:15 PM
The Use of Modern Technology to Evaluate Shipboard Metabolic Rate Aboard a U.S. Navy Ship While Deployed in the Persian Gulf

Jay H. Heaney¹, Douglas M. Jones², Katherine M. Wilson², Eric S. Duckworth², Melissa D. Laird¹, Magnus Perkins³. ¹Naval Health Research Center, San Diego, CA. ²Leidos Inc, San Diego, CA. ³USS NIMITZ, Bremerton, WA.

(No relevant relationships reported)

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 VO_2 , HR, and T_{core} 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 VO_2 , 12,120 min (95%) for HR, and 10,711 min (84%) for T_{core} . Mean results were consistent across all personnel for both trials (mean trial duration = 194 ± 33 min). VO_2 was 0.67 ± 0.14 L/min and 0.67 ± 0.11 L/min, $p=.22$; HR was 102 ± 11 bpm and 96 ± 11 bpm, $p=.06$; and T_{core} was $37.6 \pm 0.2^\circ\text{C}$ and $37.4 \pm 0.2^\circ\text{C}$, $p=.04$ for T1 and T2, respectively. **CONCLUSION:** Findings from this pilot study indicate that physiological data, including actual work setting VO_2 , HR, and T_{core} 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 place environments. Results from this pilot evaluation will lead to an effort to revise the U.S. Navy's shipboard PHEL curve guidance.

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

2627 Chair: Clare E. Milner, FACSM. Drexel University, Philadelphia, PA.

(No relevant relationships reported)

2628 Board #1 June 1 3:15 PM - 5:15 PM
Differences in Jump Landing Mechanics, Strength, and Vertical Jump Height Between Obese and Non-Obese Children

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

(No relevant relationships reported)

It has been reported that overweight and obese children display increased joint loading, higher impact loading and decreased joint ROM during walking and running. There is limited research examining the movement mechanics of other high impact activities in children. **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, ages 10.9 ± 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, participants jumped off a 20 cm platform onto 2 force plates and immediately jumped up to a target set at 60% of their max jump height. Ground reaction forces (1000Hz) and joint kinematics (200Hz) were captured for each trial. One way ANOVAs ($\alpha=0.05$) were used to determine group differences for each of the variables of interest listed in Table 1. **RESULTS:** Results can be found in Table 1. **CONCLUSION:** 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.

Variable	HW Mean(SD)	OW/OB Mean(SD)	ANOVA
Leg Strength (Nm/BW)	223.8(41.0)	221.3(57.7)	0.87(0.05)
Max vertical jump (cm)	33.6(7.34)	30.8(7.44)	0.22(0.38)
Max landing force (BW)	2.02(0.38)	1.96(0.47)	0.64(0.14)
Average load rate (BW/s)	34.1(12.6)	26.5(10.0)	0.041(0.67)*
Instantaneous Load rate (BW/s)	110.4(24.1)	82.9(20.3)	0.0003(1.23)*
Dorsiflexion excursion (degrees)	48.6(5.07)	42.6(7.92)	0.008(0.90)*
Knee flexion excursion (degrees)	43.4(9.32)	35.3(8.20)	0.007(0.92)*
Hip flexion excursion (degrees)	21.3(9.83)	14.8(6.10)	0.026(0.79)*
*indicates $p \leq 0.05$			

2629 Board #2 June 1 3:15 PM - 5:15 PM
Gait Characteristics in Persons With COPD Who Have Obesity

Micah J. Munoz, Ann Marie N. Wilson, Christian P. Manhard, Stephen Bailey, FACSM, Gytis Balilionis, Srikanth Vallabhajosula. *Elon University, Elon, NC.* (Sponsor: Dr. Stephen Bailey, FACSM)

(No relevant relationships reported)

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 (HBMI) participated. Participants completed 5 trials of walking forward at a comfortable pace on pressure-sensor walkway. Velocity, cadence, step width, stride length, and stance % 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; HBMI: 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 fear of falling. Research with greater sample size must be done to further investigate the how obesity affects gait patterns in persons with COPD.

2630 Board #3 June 1 3:15 PM - 5:15 PM
Kinetic Features and Recent History of Lower Extremity Injury in Overweight and Obese Runners

Heather K. Vincent, FACSM, Cong Chen, Michelle L. Bruner, Daniel C. Herman, FACSM, Joseph G. Wasser, Kevin R. Vincent, FACSM. *University of Florida, Gainesville, FL.*

(No relevant relationships reported)

Kinetics of running mechanics have been implicated in the development of bony and soft tissue injuries. Progressively heavier runners may be at increased risk for lower extremity injuries due to kinetic factors, but this has yet to be examined. The relationships between running kinetics and recent lower extremity injury among runners of different body sizes are not clear. **PURPOSE:** To determine the key kinetic characteristics of running gait among runners across the spectrum of body mass index (BMI in kg/m^2) values with and without recent history of lower extremity injuries. **METHODS:** Recreational competitive runners ($N=278$; 46.6% women; 34.8 ± 14.9 yr) were stratified into three BMI groups in kg/m^2 : healthy weight BMI < 24.9, overweight BMI 25-30, obese BMI ≥ 30. A 3D motion tracking system and instrumented treadmill captured ground reaction forces (GRF) and loading rates at preferred running speed. BMI group comparisons were made using univariate analyses of variance covaried for running speed. Recent history of lower extremity bony and soft tissue injuries related to running was self-reported. Key variables included peak GRF and vertical instantaneous loading rate (VILR). Linear regressions were used to determine the relationship between BMI and VILR after accounting for running speed; models included age, sex, running speed, GRF and VILR. **RESULTS:** Injury prevalence (stress fractures, tendonitis, plantar fasciitis, patellofemoral pain) was not different among the three BMI strata (28%-38%). Peak GRFs were highest in the overweight group compared to the healthy weight and obese runners, respectively (1919 ± 282 N vs 1566 ± 318 and 1794 ± 419 N; $p < 0.0001$). VILR was also highest in

the overweight group compared to the healthy weight and obese runners, respectively (47.9 ± 11.9 kN/s vs 40.7 ± 14.1 kN/s and 39.9 ± 13.3 kN/s; $p < 0.001$). Regression results indicated that after accounting for running speed ($R^2 = .123$), BMI accounted for an additional 6% of the variance to the model for VILR (B coefficient 0.251). **CONCLUSIONS:** The effect of BMI on loading rates during running at a preferred speed is relatively small. Our findings indicate that progressively heavier runners were not at a higher risk for lower extremity injury, and this may be due to internal motion adjustments that are made to control VILR and peak GRF at preferred speeds.

2631 Board #4 June 1 3:15 PM - 5:15 PM
Relative Muscle Strength Is Associated With Obesity-induced Biomechanical Adaptations Of The Trunk During Sit-to-stand

Lance M. Bollinger, Amanda L. Ransom, Rebekah F. Seay. *University of Kentucky, Lexington, KY.*

(No relevant relationships reported)

Obesity decreases relative skeletal muscle strength and alters biomechanics during daily activities such as rising from a chair. To date, the role of this decreased muscle strength in obesity-induced biomechanical alterations is unknown. **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/m^2) 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 retroreflective coordinate data through 3D motion analysis at a rate of 200Hz. Specific 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 ($y = 4.458x - 57.208$, $r^2 = 0.506$, $p = 0.032$), 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 ($r^2 = 0.541 - 0.780$, $p < 0.05$). The ratio of relative knee extensor to knee flexor strength was inversely related to task duration ($y = -0.773x + 4.784$, $r^2 = 0.553$, $p = 0.022$). **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.

2632 Board #5 June 1 3:15 PM - 5:15 PM
Fatigability of the Dorsiflexor Muscles in People with Type 2 Diabetes and Controls

Kevin Ryan, Jonathon Senefeld, Sarah D'Astice, Bonnie Schlinder-Delap, Sandra Hunter, FACSM. *Marquette 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/m^2 ; 8,378±2,712 daily steps; 2 women) with no signs of diabetic polyneuropathy were matched based on age, BMI, and physical activity with 5 healthy controls (64±6 yrs; 26±2 kg/m^2 ; 9,400±828 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. 11.40±6.58 min, respectively; $P=0.065$). Voluntary activation was similar between T2D and control group at baseline (96.8±3.7 vs. 98.2±1.4%, $P=0.43$) and declined similarly during the fatiguing task (task end; 94.9±6.4 vs. 92.6±4.0%, $P=0.39$). The electrically-evoked twitch amplitude was similar for people with T2D and controls before the fatiguing task (5.3±3.8 vs. 5.4±2.3 Nm, $P=0.96$) 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 mechanisms in the muscle played a greater role than the reduction in neural drive. These findings that suggest people with T2D whom have no signs of diabetic polyneuropathy are more

fatigable than controls independent of physical activity levels, although, statistical power analysis indicates 11 people in each group are needed to clarify the findings of this preliminary data set.

2633 Board #6 June 1 3:15 PM - 5:15 PM

Quadriceps Impairment Is Associated With Knee Mechanics During Gait In Obese Young Adults

Michael N. Vakula¹, Koren L. Fisher², Pablo B. Costa², Derek N. Pamukoff². ¹Utah State University, Logan, UT. ²California State University, Fullerton, Fullerton, CA. (Sponsor: Daniela Rubin, PhD, FACSM)

(No relevant relationships reported)

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 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 knee flexion angle (PKF), knee flexion excursion (PKE), peak internal knee extension moment (KEM), peak vertical ground reaction force (vGRF), vertical loading 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, $p=.03$), and late RTD (7.6 [95%CI: 6.1, 9.1] vs. 10.0 [95%CI: 8.8, 11.2] Nm/FFM/sec, $p=.02$) compared to NW. NW had a faster SS gait speed compared to the OB (1.30 [95%CI: 1.29, 1.31] vs. 1.19 [95%CI: 1.11, 1.21] m.s⁻¹, $p=.02$). *Post hoc* analyses reveal that at SS gait speed, NW had greater vGRF ($p=.002$), vLR ($p=.009$), and KEM ($p=.01$). 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 ($r=0.42$, $p<.01$).

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.

F-34 Thematic Poster - Muscle Physiology in Muscular Dystrophy and Cancer

Friday, June 1, 2018, 3:15 PM - 5:15 PM

Room: CC-Lower level L100H

2634 Chair: Dawn Lowe, FACSM. University of Minnesota, Minneapolis, MN.

(No relevant relationships reported)

2635 Board #1 June 1 3:15 PM - 5:15 PM

Structural Mechanism For Small-molecule Activation Of The Serca Calcium Pump In Muscular Dystrophy

Samuel F. Carlson, J. Michael Autry, Ji Li, Hideki Aihara, Razvan L. Cornea, David D. Thomas. University of Minnesota - Twin Cities, Minneapolis, MN. (Sponsor: Dawn Lowe, FACSM)

(No relevant relationships reported)

Purpose: We have characterized a small-molecule activator of SERCA, the sarcoplasmic reticulum calcium transporting ATPase in muscle. A hallmark of muscular dystrophy (MD) is decreased sarcolemma stability 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, dose-dependent fluorescence quenching by SMA1163, with an EC₅₀ = 2 ± 1 μM, indicating a transmembrane binding site of SMA1163. Fluorescence of a site-directed fluorescein probe (FITC) identifies kinetic transitions resulting from SMA activation, including enhancement of calcium binding and phosphate release. Conformation-specific proteolytic cleavage and intramolecular glutaraldehyde cross-linking were used to determine the effect on SERCA headpiece structure, indicating that SMA1163 retains 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.

2636 Board #2 June 1 3:15 PM - 5:15 PM

Isometric Training Increases Strength and Improves Pathophysiology of Dystrophic Skeletal Muscle

Angus Lindsay, James M. Ervasti, Dawn A. Lowe, FACSM. University of Minnesota, Minneapolis, MN. (Sponsor: Dawn A. Lowe, FACSM)

(No relevant relationships reported)

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:** Anterior crural muscles of male wildtype and *mdx* mice were subjected to either no training or training sessions composed of 5 isometric tetanic contractions and a torque-frequency protocol *in vivo*. In Study 1, mice (n = 8) completed 3 training sessions over 7 days followed by an *in vivo* eccentric contraction injury protocol. In Study 2, mice (*mdx* only, n = 8) completed 6 training sessions over 28 days. Centrally-nucleated fibers, myosin/actin content, fiber cross-sectional area and embryonic MHC (eMHC) positive fibers from *tibialis anterior* (TA) muscles were quantified. **RESULTS:** In Study 1, peak isometric torque increased in both wildtype (2.6 to 2.9 N·mm, $p = 0.03$) and *mdx* (3.0 to 3.6 N·mm, $p < 0.01$) mice after 7 days; however this did not affect *in vivo* susceptibility to eccentric contraction-induced injury of *mdx* mice ($p = 0.69$). In Study 2, peak isometric torque of *mdx* mice increased after 28 days (2.6 to 3.4 N·mm, $p = 0.04$). Training resulted in lower TA mass of the trained compared to the contralateral leg (67 ± 4 vs 81 ± 3 mg, $p = 0.02$) without altering the content of myosin-actin ($p = 0.82$). Trained TAs also had reduced fibrosis (5.1 ± 0.5 vs 2.9 ± 0.4%, $p = 0.02$), fewer eMHC positive fibers (3.6 ± 0.8 vs 0.9 ± 0.2%, $p = 0.03$) and more uniformly-sized fibers compared to untrained TAs. **CONCLUSION:** These results show that exercise training in the form of isometric tetanic contractions can improve dystrophic muscle strength and morphology indicating a potential alternative therapy for enhancing muscle strength and ambulation in patients with DMD.

Supported by NIH Grant RO1 AR042423 and RO1 AR04899.

2637 Board #3 June 1 3:15 PM - 5:15 PM

Recovery of Membrane Excitability in Dystrophic Skeletal Muscle Following Eccentric Contractions

Cory W. Baumann¹, Gordon L. Warren, FACSM², Dawn A. Lowe, FACSM¹. ¹University of Minnesota, Minneapolis, MN. ²Georgia State University, Atlanta, GA.

(No relevant relationships reported)

PURPOSE: Dystrophin, a subsarcolemmal protein, plays a role in maintaining membrane integrity of muscle fibers. A key feature of skeletal muscle that lacks dystrophin, as in the *mdx* mouse model for Duchenne muscular dystrophy (DMD), is a heightened sensitivity to contraction-induced strength loss. We have previously reported that this exaggerated loss of strength is attributed to impaired membrane excitability, which is evident during and immediately following eccentric (ECC) contractions. However, a detailed electromyographic (EMG) analysis of the time course of recovery from this type of injury is currently lacking. The purpose of this study was to assess recovery of strength and membrane excitability of injured, dystrophic muscle. **METHODS:** Male *mdx* mice were chronically implanted with stimulating electrodes on the left common peroneal nerve and EMG electrodes on the left *tibialis anterior* muscle. The left anterior crural muscles of anesthetized mice performed 50 maximal ECC contractions. Peak isometric torque and M-wave root mean square (RMS) were measured up to 14 days post-injury. **RESULTS:** Torque and M-wave RMS were reduced 66% ($p < 0.001$) from the first to last ECC contraction, with 99% ($p < 0.001$) of the variance in torque being explained by the variance in M-wave RMS. Immediately after the ECC protocol, isometric torque and M-wave RMS were reduced 61% (2.87 to 1.10 mNm) and 52% (1.37 to 0.65 mV), respectively,

compared to pre-injury ($p < 0.001$). By day 2, the low M-wave RMS recovered to pre-injury (1.37 vs. 1.18 mV, $p = 0.34$) and coincided with a large improvement in isometric torque (1.10 to 1.85 mNm, $p < 0.001$), which fully recovered by day 9 (2.87 vs. 2.90 mNm, $p = 0.82$). **CONCLUSIONS:** These data substantiate that a main contributor to ECC contraction-induced strength loss in dystrophic muscle is impaired 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.

2638 Board #4 June 1 3:15 PM - 5:15 PM
The Effect of Exercise Interventions on Muscle Fiber Type in mdx Mice

Matthew C. Kostek, 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 gastrocnemius muscle demonstrated an increase in the percentage of type I fibers ($5.2 \pm 3.6\%$, $p = 0.04$). 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 ($p = 0.03$). Exercise was able to modify muscle fiber type in mdx mice. **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.

2639 Board #5 June 1 3:15 PM - 5:15 PM
The Effect of Creatine and Creatinine on Myocellular Injury in Doxorubicin-Treated Skeletal Muscle Myoblasts

Eric Bredahl¹, Wisam Najdawi¹, Sarah Hook¹, Joan Eckerson, FACSM¹, Jake Siedlik¹, Kristen Drescher². ¹Creighton University, Omaha, NE. ²Creighton University School of Medicine, Omaha, NE. (Sponsor: Dr. Joan M. Eckerson, FACSM)
(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 CrN 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 using rat skeletal muscle growth media (GM). Cells were subcultured and treated with one of the following for 12 hours: normal GM (control); Cr (10mM Cr+GM); CrN (10mM CrN+GM); DOX (25µM DOX+GM); DOX+Cr+GM; and DOX+CrN+GM. After incubation, protein analysis was performed using western blotting and rates of apoptosis and necrosis were assessed using an Annexin V apoptosis detection kit and high contrast staining. A one-way ANOVA with Tukey's *post-hoc* testing was used to detect significance. **Results:** There was a significant change relative to GAPDH in creatine kinase (CK) expression between the control and DOX-treated cells ($15 \pm 18.2\%$ vs. $90 \pm 8.7\%$, $p = 0.03$). In addition, $13.2 \pm 7.5\%$ of DOX-treated cells were undergoing apoptosis, which was significantly higher than the $3.26 \pm 5.5\%$ in the control cells ($p = 0.04$). No significant differences in rates of apoptosis were found between control samples and cells treated with DOX+Cr or DOX+CrN. **Conclusion:** These findings suggest that CK expression is significantly altered in skeletal muscle myoblasts treated

with DOX relative to control cells and that DOX treatment results in higher rates of necrosis and apoptosis. Treatment with Cr or CrN minimized the DOX-induced change in CK expression, as well as the rate of apoptosis and necrosis. These findings suggest that Cr and CrN may attenuate the degree of skeletal muscle dysfunction and atrophy during chemotherapy with DOX.

2640 Board #6 June 1 3:15 PM - 5:15 PM
Effect of Resistance Training on Contractile Force Production during Doxorubicin-Treatment

Mikayla Kaufenberg¹, Allison Tigner¹, Sarah Hook¹, MacKenzie Twaddell¹, Meghan Wagner¹, Eric Bredahl¹, Jake Siedlik¹, Joan Eckerson, FACSM¹, Kristen Drescher². ¹Creighton University, Omaha, NE. ²Creighton University School of Medicine, Omaha, NE. (Sponsor: Dr. Joan Eckerson, FACSM)
(No relevant relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent associated with several harmful side effects including cardiovascular and skeletal muscle dysfunction. The observed muscle dysfunction can have a significant impact on the capacity of the DOX-treated patient to perform activities of daily living. Although it has been shown that aerobic and anaerobic exercise before treatment can minimize the degree of DOX-induced muscle dysfunction, few studies have examined the effect of resistance training (RT) on muscle dysfunction during chemotherapy treatment with DOX. **Purpose:** To examine the ability of RT on skeletal muscle dysfunction during DOX treatment using a rat model. **Methods:** Male Sprague-Dawley rats ($N = 39$) were randomly assigned to one of four groups: Sedentary + Saline (SS, $n = 8$), Sedentary + DOX (SDOX, $n = 10$), RT + Saline (RTS, $n = 12$), and RT + DOX (RTDOX, $n = 9$). Animals in the RT groups were housed in specialized cages where the food and water height was progressively elevated so that they achieved an erect bipedal stance to access their food and water for a total of 15 wk. Animals in the sedentary groups remained in standard animal housing for the duration of the study. Starting week 10, animals received weekly intraperitoneal injections of DOX (3 mg/kg) for 4 wk. One week after their last injection, animals underwent *ex vivo* muscle analysis of the soleus (SOL) and extensor digitorum longus (EDL) muscles. A one-way ANOVA with Tukey's *post-hoc* testing was used to detect significance. **Results:** Maximal twitch forces for the EDL were significantly lower in the SDOX (6.01 ± 1.85 g/s vs. 11.39 ± 3.48 g/s, $p \leq 0.05$) group compared to SS. Rats in the RTDOX had a significantly higher maximal twitch force compared to SDOX (9.37 ± 3.01 vs. 6.01 ± 1.85 g/s, $p \leq 0.05$) and a significantly lower twitch force compared to RTS (9.37 ± 3.01 vs. 15.42 ± 4.83 , $p \leq 0.05$) for the EDL. No significant differences were found among the groups for maximal twitch forces in the SOL. **Conclusion:** These findings suggest that DOX-induced muscle dysfunction is more pronounced in the EDL than the SOL. However, it appears that RT during treatment is effective in mitigating some of the effects of DOX-induced muscle dysfunction in the EDL.

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.* (Sponsor: Dr. James Carson, FACSM)
(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 $Apc^{Min/+}$ (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 (SEDINTARY [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. Statistical significance was set at $p \leq 0.05$. **Results:** B6 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 2.3 ($p < 0.001$) 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

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 Health; ST-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 caliper measures. **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 muscle mass and function. However aerobic training does not prevented these effects. **CONCLUSIONS:** MiR-486 expression was decreased in skeletal muscle and circulation due to cancer and can be regulating cachexia by decreasing protein syntheses pathway. 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 of 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, FACS. *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, FACS. *Drexel University, Philadelphia, PA.* (Sponsor: Stella L. Volpe, FACS)
(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 explore whether a relationship exists between average protein intake and LBM in Masters athletes. **METHODS:** This was a cross-sectional study, where 132 Masters athletes (70 women; 62 men) (39±10 years of age) were measured for LBM with dual-energy X-ray absorptiometry (DXA). Athletes also completed a food frequency questionnaire (FFQ) to determine average daily protein intake. Bivariate and multivariate regression models were used to correlate and predict LBM with protein intake, after controlling for percent body fat (PBF), sex, age, and body mass index (BMI) as potential confounders. Alpha levels were set *a priori* at $p < 0.05$. **RESULTS:** Significant correlations were reported between LBM and protein intake ($r = 0.297$, $p < 0.001$), PBF and protein intake ($r = -0.343$, $p < 0.001$), and sex and protein intake ($r = 0.272$, $p < 0.01$), and were included in our multivariate regression. LBM predicted

protein intake bivariate ($R^2 = 0.088$, $p < 0.001$), but was lost in the multivariate model when PBF and sex were controlled ($p > 0.05$). PBF alone predicted protein intake in this model ($sr = 0.112$, $sr = -0.215$, $p < 0.01$). **CONCLUSION:** Our results support a significant relationship between protein intake and LBM in Masters athletes using a bivariate model; however, it is unclear whether a definitive relationship exists due to lack of significant results in the multivariate model. An additional finding revealed that PBF demonstrated a significant negative relationship with protein intake. Longitudinal research should be conducted to better elucidate these relationships. This study was not funded

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, Annemie P. Gijzen, Joy P.B. Goessens, 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 (LLRE-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-¹³C₆]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 (0.0445±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 (LLRE-BFR) increased post-exercise myofibrillar protein synthesis by 10±5% 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

2646 Board #3 June 1 3:15 PM - 5:15 PM
Myofibrillar Protein Synthesis to Traditional and Cluster Sets in Trained Young Men and Women

Amadeo F. Salvador¹, Sarah K. Skinner¹, Joseph W. Beals¹, Justin Parel¹, Alexander Ulanov¹, Lucas Li¹, Scott A. Paluska, FACS, Jonathan M. Oliver², Nicholas A. Burd¹. ¹University of Illinois at Urbana-Champaign, Urbana, IL. ²Texas Christian University, Fort Worth, TX. (Sponsor: Scott A. Paluska, FACS)
(No relevant relationships reported)

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±2 y; LBM: 60±5 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-¹³C₆]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 and 30 seconds intra-set rest at ~70% of 1RM. Mean and peak velocity were measured for all repetitions. **RESULTS:** Volume load (repetitions × load) was matched between the TRD (8400±39 kg) and CLU conditions (8400±39 kg; $P = XX$). 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 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 in trained 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-Diabetics and Type 2 Diabetics

Chris Irvine¹, Todd Castleberry¹, Michael Oldham¹, Matthew Brisebois¹, Sarah Deemer², Ryan Gordon¹, Aubrien Henderson¹, Vic Ben-Ezra¹. ¹Texas Woman's University, Denton, TX. ²The University 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 response.

METHODS: Nine diabetic and pre-diabetic participants ($n=9$, mean \pm SD; age: 64.3 ± 8.1 yrs; BMI: 29.4 ± 6.0 kg/m²; HbA1c: $6.4 \pm 0.6\%$) 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 decreased ghrelin 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: 30 g 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 insulinotropic and satiety effects stemming from GIP, PP, and ghrelin responses in type 2 and pre-diabetics.

2648 Board #5 June 1 3:15 PM - 5:15 PM

Aerobic Exercise Training Improves Myofibrillar Protein Synthesis, Capillarization, and Quadriceps Strength in Older Adults

Camille R. Brightwell¹, Tatiana Moro¹, Christopher S. Fry¹, Melissa M. Markofski², Elena Volpi¹, Blake B. Rasmussen¹. ¹University of Texas Medical Branch, Galveston, TX. ²University of Houston, Houston, TX.

(No relevant relationships reported)

Skeletal muscle atrophy and subsequent strength loss occur in aging via a myriad of biological mechanisms. This involuntary loss of muscle and strength, termed sarcopenia, can progress to a clinically relevant decline in physical function. Resistance exercise training (RET) effectively attenuates sarcopenia, but RET may not be feasible for many older adults. Aerobic exercise training (AET) is well-established to improve cardiopulmonary health; however, its effects on protein turnover, skeletal muscle mass and strength are less clear. **PURPOSE:** The aim of this study was to determine if AET improves basal myofibrillar protein synthesis (MPS) and capillarization, thereby promoting skeletal muscle hypertrophy and increased strength. We hypothesized that basal MPS would increase in response to AET and that this would be accompanied by enhanced capillarization, skeletal muscle mass, and strength. **METHODS:** Subjects included healthy older adults who were randomized to non-exercise (NON; $n=11$, 71.4 ± 1.3 y) or exercise (EX; $n=12$, 73.7 ± 1.2 y). EX group completed 24 weeks of walking 3x/week for 1 hr at 70% heart rate reserve, while the NON group did not participate in structured exercise. For both groups, a stable isotope tracer was infused after an overnight fast before and after 24 weeks.

Muscle biopsies were taken from the *vastus lateralis* to assess MPS and capillarization. Subjects performed maximal strength testing via isokinetic dynamometry, and lean mass was determined with dual-energy X-ray absorptiometry (DXA). **RESULTS:** Basal MPS increased in the EX group ($+50.7\%$, $p=0.0094$) along with capillary density ($+66.4\%$, $p=0.0333$), peak oxygen consumption ($+15.8\%$, $p=0.0104$), and isokinetic quadriceps strength ($+15.1\%$, $p=0.0149$). Lean mass did not change in either group ($p>0.05$). **CONCLUSION:** These results indicate the effectiveness of AET to increase muscle protein turnover and capillarization in healthy older adults, possibly ridding muscle of damaged proteins and improving overall muscle quality. We conclude that AET improves muscular strength which may mitigate the functional decline associated with sarcopenia.

Supported by: NIH/NIA R01 AG030070 (EV), R56 AG051267 (BR), NIH/NCATS UL1 TR001439, and NIH/NIA T32AG000270 (CRB)

2649 Board #6 June 1 3:15 PM - 5:15 PM

Blunted Muscle Protein Synthetic Response To Feeding And Resistance Exercise In Obese Young Adults

Joseph W. Beals, Sarah K. Skinner, Stephan van Vliet, Isabel G. Martinez, Elizabeth G. Poozhikunnel, Alexander V. Ulanov, Li Lucas, Scott A. Paluska, Nicholas A. Burd. University of Illinois, Urbana, IL. (Sponsor: Scott A Paluska, FACSM)

(No relevant relationships reported)

Abstract

Obesity induces anabolic resistance of myofibrillar protein synthesis rates (MPS) to the ingestion of a protein-dense food in young adults. However, the effectiveness of acute resistance exercise before food ingestion to enhance the amino acid sensitivity of MPS with obesity has not been examined. **PURPOSE:** To compare the impact of resistance exercise on MPS responses to protein-dense food ingestion in normal-weight (NW) and obese (OB) young adults. **METHODS:** 7 NW (21 ± 1 y, BMI 21.9 ± 0.5 kg/m²) and 7 OB (22 ± 1 y, BMI 35.7 ± 2.3 kg/m²) men and women underwent primed continuous L-[ring-¹³C₆]phenylalanine infusions coupled with blood and muscle biopsy collections to measure MPS at basal and fed-state of the exercise (EX) and non-exercise (CON) legs. Participants performed unilateral resistance exercise (4 sets \times 10-12 repetitions) followed by the ingestion of 6 oz of lean pork loin (36 g protein; 4 g fat; 180 kcal). **RESULTS:** Total work performed during exercise was similar among groups (NW: 1610 ± 164 kg; OB: 1888 ± 154 kg, $P=0.24$). Plasma essential amino acid concentrations increased similarly after pork ingestion in both groups (time effect: $P<0.05$) with peak values at 2 h of the postprandial period. Basal MPS was similar between NW and OB groups ($P>0.05$). MPS was stimulated in the EX and CON legs after pork ingestion in both the NW (absolute change from basal: CON 0.027 ± 0.008 %/h; EX 0.058 ± 0.011 %/h) and OB groups (CON 0.027 ± 0.006 %/h; EX 0.033 ± 0.011 %/h; $P<0.05$). MPS was stimulated to a greater extent in the EX vs. CON legs in NW ($P=0.02$) but not OB group ($P=0.26$). **CONCLUSION:** Our results suggest that increased adiposity may attenuate the effectiveness of resistance exercise to augment the postprandial MPS response.

Funding provided by the ACSM Foundation Doctoral Student Research Grant

2650 Board #7 June 1 3:15 PM - 5:15 PM

The Effect of Pre Sleep Casein Protein Consumption on Next Morning Resting Metabolic Rate in Resistance Trained Women

Brittany R. Allman, Margaret C. Morrissey, Michael J. Ormsbee, FACSM. Florida State University, Tallahassee, FL.

(No relevant relationships reported)

The Effect of Pre-Sleep Casein Protein Consumption on Next-Morning Resting Metabolic Rate in Resistance-Trained Women

Brittany R. Allman, Margaret C. Morrissey, Michael J. Ormsbee FACSM Institute of Sports Sciences & Medicine, Florida State University Nighttime eating has been discouraged by the media due to its purported negative implications on metabolism. However, recent studies have shown that nighttime casein protein (PRO) either increases or has no effect on next morning resting metabolic rate (RMR). However, the effects of eating PRO at night on RMR in resistance-trained women is unclear. **PURPOSE:** To examine the effect of consuming nighttime PRO on next-morning RMR in resistance-trained women. **METHODS:** Thirteen healthy, resistance-trained (squat 100% body weight, bench press 70% body weight), normal weight and fatness (BMI, 19.9 ± 2.3 kg/m²; body fat $28.7 \pm 4.9\%$), eumenorrhic females (age, 22 ± 3 years) volunteered for this study. Participants reported to the lab on four different occasions: pre-testing and maximal testing familiarization (1a), maximal testing (1b), and two experimental trials (2 and 3). Thirty minutes before bed participants consumed micellar casein protein (PRO; 30g protein, 120kcal) or a non-caloric, sensory-matched placebo (PLA; 0g protein, 0kcal) in random order. RMR and respiratory exchange ratio (RER) were measured using open-circuit indirect calorimetry at baseline (BL) and immediately upon waking (AM) the following morning. **RESULTS:** There was no significant change in next-morning RMR when

consuming PLA (BL: 1554±193; NM: 1537±204 kcal/d; Δ = -17kcal/day; $p=0.41$), or PRO before bed (BL: 1551±156; NM: 1525±171 kcal/d; Δ = -26 kcal/day; $p=0.36$). There was no significant change in next-morning RER when consuming PLA (BL: 0.74 ± 0.05 CO₂/O₂; NM: 0.76 ± 0.04 CO₂/O₂; $\Delta=0.02$ CO₂/O₂; $p=0.13$) or PRO before bed (BL: 0.77 ± 0.05 ; NM: 0.77 ± 0.02 ; $\Delta=0.0$; $p=0.29$). **CONCLUSIONS:** In resistance-trained women, 30g of casein PRO pre-sleep does not significantly change next morning RMR or RER. Therefore, it is metabolically feasible for women to consume protein at night without negative metabolic implications. This study was supported by Dymatize® Nutrition and FrieslandCampina®.

2651 Board #8 June 1 3:15 PM - 5:15 PM
Higher Protein Intakes Enhance Whole Body Protein Metabolism and Exercise Performance in Endurance-Trained Males
 Eric Williamson, Hiroyuki Kato, Kimberly A. Volterman, Daniel R. Moore. *University of Toronto, Toronto, ON, Canada.*
(No relevant relationships reported)

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 (~32y; ~65 ml O₂/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 protein/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/d 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 (5kmTT) 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, $p<0.05$). Inferential 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 5kmTT, HIGH likely (probability 79%) had a moderate benefit over LOW (ES=0.57) and a possible (probability 69%) 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 at the higher end of current ACSM recommendations (i.e. 1.2-2g/kg).

F-36 Free Communication/Slide - Physical Activity Promotion and Intervention Strategies

Friday, June 1, 2018, 3:15 PM - 5:15 PM
 Room: CC-Mezzanine M100D

2652 **Chair:** Catrine Tudor-Locke, FACSM. *University of Massachusetts Amherst, Amherst, MA.*
(No relevant relationships reported)

2653 June 1 3:15 PM - 3:30 PM
Physical Activity Maintenance Among African American Women: Factors Associated with Lapses and Recovery
 Amber W. Kinsey¹, Melicia C. Whitt-Glover, FACSM², Michelle Segar³, Olivia Affuso, FACSM¹. ¹University of Alabama at Birmingham, Birmingham, AL. ²Gramercy Research Group, Winston-Salem, NC. ³University of Michigan, Ann Arbor, MI. (Sponsor: Olivia Affuso, FACSM)
(No relevant relationships reported)

PURPOSE: Studies have demonstrated that lapse-recovery cycles, or the brief periods of little to no physical activity (PA) that may persist for days or weeks (lapses) followed by a return to normal PA levels (recovery), are integral to long-term PA maintenance in African American (AA) women. Given the low PA levels and high

rates of chronic disease among AA women, understanding factors associated with lapse-recovery cycles in AA women who successfully maintain PA may improve interventions for promoting and sustaining PA in high-risk populations. **METHODS:** AA women (≥ 18 years) who self-reported PA maintenance (≥ 6 months) were recruited via email, word-of-mouth, and social media to complete an online survey. Questions included whether respondents experienced a lapse in the previous year, and if so, the number and causes of lapses, the longest lapse experienced, and factors that helped to resume PA. Trained reviewers coded open-ended responses separately, using a priori codes; discrepancies were discussed to reach consensus. **RESULTS:** Of the 206 respondents, 139 (67.5%; age 38.4 ± 11.6 years) experienced a lapse in PA in the past year. Most women (58.3%, $n=81$) experienced 1-2 lapses, with most lasting <1 month (43.9%). The top five predictors of lapses included work demands (33.1%), an injury or surgery (24.5%), travel/vacations (22.3%), lack of time (19.4%; e.g. scheduling conflicts) and family factors (16.5%; e.g. caretaking, relationship issues). The factors associated with resuming PA included becoming motivated again (18.0%; e.g. goal-setting, self-talk), social support (15.1%; e.g. encouragement from friends/family, joining PA groups), weight (14.4%; e.g. gaining weight as motivation), feeling better (14.4%; e.g. physically and mentally, body craving PA), and recovering from an injury or surgery (14.4%). **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.

2654 June 1 3:30 PM - 3:45 PM
African American Women and Outdoor Physical Activity: Understanding Patterns and Group Engagement
 Olivia Affuso, FACSM¹, Amber W. Kinsey¹, Melicia C. Whitt-Glover, FACSM², Michelle Segar³. ¹University of Alabama at Birmingham, BIRMINGHAM, AL. ²Gramercy Research Group, Winston-Salem, NC. ³University of Michigan, Ann Arbor, MI.
(No relevant relationships reported)

PURPOSE: New strategies are needed to improve leisure-time physical activity (PA) levels among African American (AA) women. Outdoor PA provides immediate benefits such as stress reduction and social cohesion and shows promise for PA promotion. However, little is known about the prevalence of outdoor PA among AA women as well as if engaging in PA with others is associated with outdoor PA participation. The purpose of this study was to: 1) describe outdoor PA among AA women and 2) examine differences in outdoor PA participation between those who engage in PA in a group compared to those who engage in PA alone. **METHODS:** Using an assets-based approach, we conducted an online survey of 206 AA women who had maintained PA for at least 6 months. Those who completed both of the following questions were included in this preliminary analysis (N=195): 1) In the last 6 months, what type(s) of outdoor physical activities did you engage in most often? and 2) In the past 6 months, have you engaged in PA with others? Chi-square tests were used to examine differences in outdoor physical activities by group engagement. Significance was set at $\alpha < .05$ and SAS 9.3 was used to perform these analyses. **RESULTS:** Of the 195 respondents completing both questions (age in years: 40.3 ± 11.8), 107 (54.9%) reported participating in at least 1 outdoor PA. Hiking (35.5%) was the most frequently reported outdoor PA followed by walking (19.6%) and running (14.0%). The majority of respondents (50.8%) participated in PA with others as a part of an organized group (30.8%), with family (6.2%) or with friends (13.9%). However, there was no significant difference in frequency of outdoor PA by category of group PA engagement (chisq: 8.93, $p=0.0630$). **CONCLUSIONS:** Our findings suggest that a significant proportion of AA women participate in outdoor PA. However, more research is needed to explore the potential of outdoor PA to motivate AA women.

2655 June 1 3:45 PM - 4:00 PM
Incentivizing Physical Activity in American Indian Adolescents At Risk For Metabolic Disorders
 Kevin R. Short¹, Jennifer Q. Chadwick¹, Mary A. Tullier², Lisa Wolbert³, Charlotte Coleman², David F. Wharton⁴, Dannielle E. Branam⁴, Tamela K. Cannadt², Kenneth C. Copeland¹. ¹University of Oklahoma Health Sciences Center, Oklahoma City, OK. ²Choctaw Nation of Oklahoma, Talihina, OK. ³Choctaw Nation of Oklahoma, Hugo, OK. ⁴Choctaw Nation of Oklahoma, Durant, OK.
(No relevant relationships reported)

PURPOSE: American Indians (AI) have high prevalence of diabetes in youth and may benefit from programs designed to promote increased exercise behavior as a strategy to improve metabolic health. In this study, we tested whether financial incentives would elicit greater frequency and/or duration of exercise in AI youth at high risk to

develop diabetes. **METHODS:** We enrolled overweight or obese, non-diabetic AI boys and girls, 11-20 years old with low physical activity. Participants were instructed to exercise 3 days/week for 48 weeks at a Choctaw Wellness Center, earning payments for 20-60 minute sessions of moderate-to-vigorous physical activity. The program was subdivided into three, 16-week-long phases to test different incentive strategies. **RESULTS:** Mean \pm sem age of the 43 girls and 34 boys who completed baseline tests and started exercise was 14.0 ± 2.2 y. Several risk factors for future diabetes were present, including high body fat ($43 \pm 8\%$), low physical activity ($6,400 \pm 2,899$ steps per day) and low aerobic fitness (VO_{2max} : 19.4 ± 5.7 ml/kg/min). In Phase 1, the financial incentive to exercise more frequently was not effective; the incentivized subgroup had a similar number of exercise sessions (28 ± 2) as the control payment group (26 ± 3 , $p > 0.05$). However, in Phase 2, the financial incentive to increase exercise duration was successful; exercise duration for the incentivized and control subgroups were 38 ± 2 versus 29 ± 1 minutes per session ($p = 0.002$, Effect size = 0.9), respectively. In Phase 3, the effect of reducing the incentives was inconclusive due to high participant withdrawal. **CONCLUSIONS:** Our goal to get habitually sedentary, obese adolescents to increase their exercise behavior was at least partly successful, since the participants collectively completed 3,229 exercise sessions. The use of incentives was also helpful to promote the program and to extend the duration of exercise sessions in Phase 2. However, a remaining challenge is to help adolescents overcome barriers that prevent them from exercising more frequently and sustaining a daily exercise program. Funding: NIH/ NIMHD P20 MD000528, Choctaw Nation of Oklahoma

2656 June 1 4:00 PM - 4:15 PM

Effect Of An Exercise Counselling Clinic On Exercise Behaviour In Men With Prostate Cancer.

Sarah Weller¹, Phil Pollock², Maria Spillane², Eugenia Wu², Monita Sundar², Larry Goldenberg¹, Celestia Higano³, Kristin L. Campbell¹. ¹University of British Columbia, Vancouver, BC, Canada. ²Vancouver Prostate Centre, Vancouver, BC, Canada. ³University of Washington, Seattle, WA.
(No relevant relationships reported)

Prostate cancer (PC) treatments can result in long-term side effects that impact physical function and quality of life. Exercise has been shown to be a safe and effective strategy to reduce and manage treatment side effects; however, very few PC survivors are sufficiently active and providing supervised exercise programming is not feasible in many clinical settings. To address this need, the Prostate Cancer Supportive Care (PCSC) Program implemented an exercise counselling clinic led by a certified exercise physiologist that focused on facilitating exercise behaviour change. **Purpose:** To evaluate if an exercise counselling clinic can improve the aerobic and resistance exercise levels in men with PC, to align with the exercise oncology guidelines. **Methods:** Participants of the PCSC Program were invited to attend an exercise counselling clinic as part of their regular PC clinical care, namely 4 x 45-minute one-on-one sessions over 12-months (baseline, 3-, 6- and 12-months). At each session, the total amount of aerobic and resistance exercise, current PC treatments, physical symptoms and readiness for change were recorded using self-report questionnaires and a guided interview. A retrospective chart review was performed from data collected between July 2015 (clinic inception) and September 2017. **Results:** 128 men (age = 67.6 ± 7.0) attended the clinic at baseline. 93 of these men attended 2 or more visits and were analyzed further. 55% were currently receiving treatment or had received it in the past 6-months. Attendance was 73% at the 6-month follow-up and dropped to 36% at 12-months. Compared to baseline, there was an 18% increase in men meeting aerobic exercise guidelines (62%, $p < 0.01$), 26% increase for resistance training guidelines (47%, $p < 0.01$) and 22% increase for both aerobic and resistance training guidelines (39%, $p < 0.01$). At baseline, the vast majority of men were in the preparation, action or maintenance stage of change (41%, 13% and 40% respectively). **Conclusion:** An exercise counselling clinic can significantly improve aerobic and resistance exercise levels in men with PC and improve adoption of the exercise oncology guidelines. Future 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.

2657 June 1 4:15 PM - 4:30 PM

Exercise Prescription in Cancer Survivors: What Explains Poor Retention?

Nicole J. Richards¹, Cynthia Villalobos¹, Justin C. Brown², Paul D. Vosti³, Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²Harvard University, Cambridge, MA. ³St. Joseph's Medical Center, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)
(No relevant relationships reported)

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 hyperlipidemia (50.0% retained) compared to patients without hyperlipidemia (32.4%; $p = 0.040$). Patients with poor sit-and-reach scores were also more likely to drop out: 53.3% 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.

2658 June 1 4:30 PM - 4:45 PM

Effects Of Three-stage Training Program On Functional Fitness And Physical Activity For Community-dwelling Old-old Japanese

Hiroshi Kohno¹, Hidenori Asai². ¹TOYO University Faculty of Human Life Design, Asaka-shi, Saitama, Japan. ²Ehime University, Matsuyama-shi, Ehime, Japan.
(No relevant relationships reported)

PURPOSE: To examine the effectiveness of a three-stages physical training program on ADL-related functional fitness and daily physical activity for community-dwelling old-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 1 time/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 $82 \pm 4\%$ and $81 \pm 8\%$ respectively. Sitting & standing time (HFG: 18.4 ± 5.6 to 16.3 ± 5.1 sec., LFG: 17.4 ± 3.9 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 ± 2.9 sec, $F = 11.88$, $P = 0.002$), 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: 3864 ± 747 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.

2659 June 1 4:45 PM - 5:00 PM

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. Lott³, Rachel Hess¹, Cindy Bryce², Gary S. Fischer², Dana Tudorascu², Diane Comer², Laurey Simkin-Silverman², Kimberly Huber², Kathleen M. McTigue². ¹University of Utah, Salt Lake City, UT. ²University of Pittsburgh, Pittsburgh, PA. ³University of Miami, Miami, FL.

(No relevant relationships reported)

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 $\geq 5\%$ 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-720ITC 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 53.4 (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. Recording 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 higher PA levels at baseline (6473 vs. 4730 steps; $p=0.045$) and 24 months (6103 vs. 5251 steps; $p=0.02$) than those who did not. Within self-monitoring strategies, participants recording steps had greater PA levels than those who did not at 24 months (6103 vs. 5251; $p=0.04$, 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.

CONCLUSIONS: 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.

2660 June 1 5:00 PM - 5:15 PM

Perceived Physical Fatigability Improves after a Weight Management Intervention in Obese Older Adults

Nancy W. Glynn, Theresa A. Gmelin, Adam J. Santanasto, John M. Jakicic, FACSM, Robert M. Boudreau, Steven M. Albert, Anne B. Newman, Elizabeth M. Venditti. University of Pittsburgh, Pittsburgh, PA. (Sponsor: John Jakicic, FACSM)

(No relevant relationships reported)

Obesity and lower physical activity (PA) are related to higher perceived global fatigue in older adults. Fatigue is also associated with disability and higher mortality. However, the effects of weight loss and PA interventions on improving physical fatigability are unknown. **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 68.8±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 ≥ 15). 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 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 disablement pathway. Supported by CDC Cooperative Agreement #5U48DP0050001.

F-37 Free Communication/Slide - Strength Testing/ Training

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-Mezzanine M100F

2661 **Chair:** Kyle Sunderland. High Point University, High Point, NC.

(No relevant relationships reported)

2662 June 1 3:15 PM - 3:30 PM

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

Charity Lane, Dustin Hardwick, Thomas Janus, O'Dane Brady, John Mayer, FACSM. University of South Florida, Tampa, FL. (Sponsor: John Mayer, FACSM)

(No relevant relationships reported)

Firefighting is an extremely demanding occupation requiring high levels of muscular strength and endurance to attend to a multitude of emergency situations. Matching resistance exercise programs to firefighter job demands has not been well-studied. **PURPOSE:** The purpose of this study was to compare the EMG activity of relevant muscles during the Candidate Physical Ability Test (CPAT) and weightlifting exercises in firefighters.

METHODS: A repeated measures study was conducted in 13 full-duty career firefighters (1 F, 12 M; aged 18-44 years) from 3 Florida fire departments. Participants reported to a university laboratory to complete 7 low load weightlifting exercises: Romanian deadlift, back squat, overhead press, bent-over row, banded Romanian deadlift, kneeling rotational throw, and glute hyperextension. On a separate day, participants reported to firefighter training grounds to complete the CPAT. The CPAT is a pre-employment functional capacity evaluation that reflects usual tasks performed during emergency responses, which consists of 8 events - stair climb, hose drag, equipment carry, ladder raise and extension, forcible entry, search, rescue, and ceiling breach and pull. During exercises and CPAT events, surface EMG activity was recorded from the oblique abdominal, deltoid, trapezius, latissimus dorsi, lumbar multifidus, gluteus maximus and medius, and hamstring muscles. For each muscle group, surface EMG activity (% maximum voluntary isometric contraction - MVC) was compared between the exercises and CPAT.

RESULTS: No difference ($p > 0.05$) in EMG activity was observed between weightlifting exercises and CPAT for the deltoid, trapezius, lumbar multifidus, gluteus maximus and medius, and hamstring muscles. EMG activity was significantly greater ($p = 0.002$) during the CPAT compared to the exercises for the abdominal obliques (39.9% +/- 27.8% vs. 12.0% +/- 6.4%, respectively). EMG activity was significantly greater ($p = 0.049$) during the exercises compared to CPAT for the latissimus dorsi (21.8% +/- 16.7% vs. 11.4% +/- 4.6%, respectively).

CONCLUSION: Standardized weightlifting exercises, along with additional exercises to activate and strengthen the abdominal obliques, should be considered when designing resistance exercise programs to match firefighter job demands.

2663 June 1 3:30 PM - 3:45 PM

High Intensity Functional Training Improves Multiple Domains of Fitness in Females and Males

Katie M. Heinrich, Sarah J. Cosgrove, Jacob Frye. Kansas State University, Manhattan, KS. (Sponsor: Yuri Feito, FACSM)

(No relevant relationships reported)

It is unclear if high intensity functional training (HIFT), that temporally combines aerobic, gymnastics, and weightlifting exercises for general physical preparedness (GPP), improves multiple fitness domains. **PURPOSE:** To examine effects of 6-months of HIFT on nine fitness domains.

METHODS: Program evaluation participants (N = 48, 50% female, age = 31.8 ± 13.3 years, range = 18-66 years, 87.5% white) were new/existing members of a university HIFT gym at enrollment (HIFT experience = 9.8 ± 8.4 months, range = 0-27 months), and reported usually doing HIFT workouts 4.0 ± 1.1 days/week. At baseline and 6-months, field fitness tests measured coordination and balance (agility hop), agility (pro-agility), flexibility (sit-and-reach), power (standing long jump and seated medicine ball put), and muscular endurance/stamina (60-seconds of push-ups/ knee push-ups, sit-ups, air squats, and max repetitions of strict/banded pull-ups) on day 1; strength (1RM back squat, press, and deadlift) on day 2; and speed (400m run), and

cardiorespiratory endurance (1.5 mile run) on day 3. Participants completed the same standardized warm-up before each measurement day. Paired/independent samples t-tests were conducted using SPSS 24.

RESULTS: Females significantly improved flexibility (31.1 ± 9.2 cm to 34.1 ± 8.1 cm, $t = 3.8$, $p = .001$), power (long jump = 1.75 ± 0.33 m to 1.81 ± 0.31 m, $t = 3.0$, $p = .006$), muscular endurance (push-ups [$n=13$] = 25.2 ± 7.0 to 29.8 ± 7.8 reps, $t = 2.4$, $p = .035$), and strength (back squat = 58.2 ± 12.4 kg to 64.3 ± 13.9 kg, $t = 4.6$, $p < .001$; press = 32.3 ± 5.9 kg to 34.7 ± 7.4 kg, $t = 3.7$, $p = .002$; and deadlift = 80.0 ± 18.9 kg to 87.7 ± 22.0 kg, $t = 3.2$, $p = .005$). Males significantly improved flexibility (29.5 ± 8.6 cm to 31.6 ± 7.4 cm, $t = 2.1$, $p = .043$), muscular endurance (pull-ups [$n=16$] = 3.6 ± 0.9 to 4.2 ± 1.0 reps, $t = 2.7$, $p = .018$) and strength (back squat = 101.8 ± 27.0 kg to 110.6 ± 30.0 kg, $t = 5.0$, $p < .001$; deadlift = 130.4 ± 31.6 kg to 139.5 ± 31.2 kg, $t = 4.2$, $p < .001$). Females improved significantly more than males only for power (long jump, $t = 3.1$, $p = .004$).

CONCLUSIONS: The GPP-focused HIFT training significantly improved multiple fitness domains for females and males after 6 months of training, with no significant fitness decreases. Improvements were found even among experienced HIFT participants, which may help facilitate continued participation.

2664 June 1 3:45 PM - 4:00 PM

Effect of Heavy Resistance and Plyometric Training on Running Economy and 5km Performance in Well-trained Male Athletes

Li Fei, Ding Haiyong, Zhang Xiaohui, Han Guangqiang, Chen LinShan, Huang Chunyan. *SHANGHAI UNIVERSITY OF SPORT, SHANGHAI, China.*

(No relevant relationships reported)

Purpose The present study was to investigate the effect of 8-week heavy strength training plus plyometric training on well-trained male athletes' running economy and 5km performance.

Methods Twenty-three male long-distance runners (25.2 ± 3.8 years; BMI: 21.0 ± 1.1 kg·m⁻²; VO_{2max}: 66.4 ± 7.0 mlO₂·kg⁻¹·min⁻¹) were allocated into experimental group (EG, N=12) or control group (CG=11). EG performed 8-weeks heavy resistance plus plyometric training, include 5sets of 5RM squats, RDL, Bulgaria squats plus 3sets of 10-15reps on low hurdle jumping and single leg jumping. CG performed endurance-strength, include 5sets of 20RM squats, RDL, Bulgaria squats plus 3sets of 20reps on trunk stability exercises. EG and CG did the similar endurance training program, which include 60-80km LSD per week, the intensity was a little bit below the anaerobic threshold. Before and after 8 weeks intervention, performed the following tests: (a) incremental test, (b) 12km·h⁻¹, 14km·h⁻¹, 16km·h⁻¹ running economy test (c) 5-km running time trial, (e) counter movement jump test, (f) maximum dynamic strength test (1RM), (g) ground contact time at 16km/h.

Results: The EG showed significant improvement ($p \leq 0.05$) on 1RM strength ($27.8\% \pm 5.4$), RFD ($18.1\% \pm 3.3$), CMJ ($13\% \pm 7.8$) 12km·h⁻¹ RE ($3.3\% \pm 2.1$), 14km·h⁻¹ RE ($4.6\% \pm 3.7$), 16km·h⁻¹ RE ($6.2\% \pm 5.4$), 5km ($4.7\% \pm 3.2$). CG did not show any change in 1RM, RFD, CMJ and 5km trial, but a improvement on 12km·h⁻¹ RE ($2.3\% \pm 2.7$). Both EG and CG did not have any change in 16km·h⁻¹ ground contact time.

Conclusions: The 8-week heavy strength training plus plyometric training have a good effect on running economy and 5km performance, and was more effective in improving neuromuscular performance and running economy compare with endurance-strength training.

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

Exercise Time and Intensity: The Ideal Ratio to Prevent Overtraining and Maximize Fitness

Heather J. Porter¹, Joshua J. Davis², Jinger S. Gottschall¹. ¹The Pennsylvania State University, University Park, PA. ²Penn State Hershey Medical Center, Hershey, PA. (Sponsor: W. Larry Kenney, FACSM)

(No relevant relationships reported)

The American College of Sports Medicine recommends that adults achieve at least 30-50 minutes of moderate-intensity cardiorespiratory exercise 5 days per week or 20-60 minutes of vigorous-intensity exercise 3 days per week. While these minimum guidelines are clearly described, there are currently no maximum guidelines, particularly with respect to high-intensity time and frequency, for the prevention of overtraining. **PURPOSE:** To evaluate the correlation between salivary hormones, time in varying heart rate zones, and psychosocial stress variables in order to prevent overtraining and improve fitness. Our hypothesis is that chronic exercise durations greater than 1 hour per week in the high intensity (greater than 90% maximum heart rate) zone will lead to decreased variation in the production of stress hormones, decreased ability to reach heart rate max and increased self-reporting of tension as well as fatigue. **METHODS:** Twelve healthy adults between 25-50 years who regularly exercised more than 8 hours per week recorded their heart rate during every training session and answered daily surveys regarding their mood for 3 weeks. Next, they

completed an experimental day composed of 2, 30-minute high-intensity interval sessions separated by 4-hours of non-active recovery. We collected saliva samples prior to each exercise session, immediately following, and 30-minutes post to assess changes in cortisol and testosterone concentrations. Heart rate was monitored throughout the experimental day to determine exercise and recovery values. **RESULTS:** There was a correlation between weekly time training at an intensity greater than 90% maximum heart rate and the variables associated with overtraining. Cortisol and testosterone saliva concentration fluctuated less in the participants who exercised in this extreme zone for more than 50 minutes per week. To add, these participants were not able to reach the same intensity during the second-high intensity session on the experimental day and reported greater tension as well as fatigue on the surveys in the weeks prior to testing. **CONCLUSIONS:** Our data demonstrate that 50 minutes of high-intensity training per week is a suggested maximum, cumulative time in order to prevent symptoms related to overtraining.

2666 June 1 4:15 PM - 4:30 PM

The Effect of Pre-Workout on Resistance Training Repetitions to Failure

Jacob Prete, Elaina Biechler, Adam Brogley, Matthew Greene, Emma Corkill, Hunter Dunlap. *Loras College, Dubuque, IA.*

(Sponsor: Vincent Paolone, FACSM)

(No relevant relationships reported)

The usage of pre-workout supplementation has increased substantially in recent years, as research has shown pre-workout supplements can significantly enhance resistance performance in all populations.

PURPOSE: To compare and determine the effectiveness of a caffeine-free pre-workout and a caffeinated 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 standard warmup, then completed four sets of back squat for five repetitions at 70% of 1RM, and on the fifth set the subject would complete repetitions until fatigue. Bench press was done for four sets for five repetitions at 70% of 1RM, on the fifth set the subject would complete repetitions until fatigue. The number of repetitions completed on the last set of both squat and bench press were recorded.

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 ($F(1.304, 7.823) = 5.543$, $p = .041$) and bench press ($F(1.857, 11.141) = 5.484$, $p = .024$) repetitions to failure. Post hoc analysis revealed that squat repetitions to failure were significantly greater in CA and NC when compared to C ($p = .028$; $p = .044$). There was no significant difference between repetitions to failure when comparing CA and NC ($p = .99$). Post hoc analysis also revealed that bench press repetitions to failure were significantly greater in CA when compared to C and NC ($p = .05$; $p = .234$).

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.

2667 June 1 4:30 PM - 4:45 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 Mintsu Ossene. *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 \pm 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 0.0.916-0.966 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 performance 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

Courtenay Dunn-Lewis, Shawn D. Flanagan. *University of Pittsburgh, Pittsburgh, PA.*
(No relevant relationships reported)

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 = $22.14 \pm 10.23\%$) 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 (lbs)

	Bilateral	Unilateral
Pre	0 ± 0	0 ± 0
Mid	19.3 ± 32.1	7.0 ± 11.3
Post	32.6 ± 42.0	15.2 ± 16.4

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.*
(No relevant relationships reported)

High-intensity interval training (HIIT), which consists of repeated sessions of brief, intense bouts of exercise, has been shown to be an effective and time-efficient approach to improve aerobic training. Early pubertal children rely more heavily on aerobic metabolism and recover faster from exercise bouts. Borg's Rating of Perceived Exertion (RPE), a subjective measure of exercise intensity used to evaluate responses to specific training loads, has yet to be systematically explored in relation to HIIT among children of different maturation stages and sex groups. **PURPOSE:** To evaluate RPE during HIIT in children, adolescence, and young adults and to investigate the relationship between RPE, sex, and puberty. **METHODS:** One hundred healthy children and young adults (7-34 y/o, 47 males) participated in two exercise sessions on a cycle ergometer: 1) ramp-type progressive cycle ergometry to determine peak $\dot{V}O_2$; 2) HIIT - ten times, 2-min bout at 80% peak work rate interspersed with 1-min rest. Borg's RPE (scale of 6-20) was recorded at the end of each 2-min exercise bout. **RESULTS:** Fifty two participants completed HIIT at 80% peak work rate. Completion rates were higher in early pubertal children (70%, 26/37) and young adults (68%, 13/19) compared to adolescents (30%, 13/44) with no sex difference. Among completers, mean RPE was significantly lower in the early pubertal children ($14.9 \pm 1.7\%$, "hard") compared to adults ($16.8 \pm 1.7\%$, "very hard") with no sex-effect. In all 3 groups RPE was increased with the progression of the test. Heart rate recovery was fastest in early pubertal children with no group difference in oxygen uptake. **CONCLUSION:** Early pubertal children perceive high-intensity exercise as less strenuous than young adults. Differences in RPE reported by the 3 groups may be partially explained through faster HR recovery and relying more on aerobic metabolism in early pubertal children compared to older children and young adults. Researchers and coaches should take into consideration the age of the participant

when using RPE in research or as a training tool. Underlying mechanisms involved in RPE-maturational related differences should be further explored (including cognitive responses).

Supported by NIH P01HD-048721, PERC Systems Biology Fund, SURP grant & NCATS grant #UL1TR001414

F-38 Clinical Case Slide - Hip and Pelvis III

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-200E

2670 **Chair:** Benjamin Hasan. *Northwestern Community Hospital Medical Group, Arlington Heights, IL.*
(No relevant relationships reported)

2671 **Discussant:** Bryan Wiley. *Kaiser Permanente, Ontario, CA.*
(No relevant relationships reported)

2672 **Discussant:** Pierre d'Hemecourt, FACS. *Boston Children's Hospital, Boston, MA.*
(No relevant relationships reported)

2673 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, FACS)
(No relevant relationships reported)

Hip injuries in dance can be commonplace and distressing in terms of human and financial impact. Approximately 11% of all time-loss injuries to dancers are because of hip pain and up to 50% of dancer visits to physicians are because of hip pain. **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 ± 7.5 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 talocrural 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.

2674 June 1 3:35 PM - 3:55 PM
Hip Pain - Equestrian

Amanda M. Honsvall Hoefler. *University of Minnesota Methodist Family Medicine Residency, Saint Louis Park, MN.*
(Sponsor: William O. Roberts, MD, FACS)
(No relevant relationships reported)

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.

She returned 2 weeks later unable to bear weight.

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

3. Hemarthrosis

4. Reactive or crystalline synovitis

TESTS AND RESULTS

XR pelvis w/L lateral hip: Collapse of superior joint space with subchondral cystic change.

L Hip Aspiration: 4 mL bloody effusion (4.9 million RBCs, 2668 WBC, 69% PMNs). Synovasure positive.

Open I&D w/resection of the femoral head and placement of antibiotic spacer

- Synovitis with small amount of clear joint effusion. No gross purulence. Subchondral collapse and area of necrotic bone in the femoral head.

- 1/5 periarticular tissue cultures and 1/1 bone culture positive for Strep mitis/oralis.

- Bone path revealed acute osteomyelitis and osteonecrosis.

FINAL WORKING DIAGNOSIS

Septic arthritis and osteomyelitis of the left native hip

TREATMENT AND OUTCOMES

1. Six week course of IV ceftriaxone

2. Re-admitted 3 weeks post-op for fever, chills, headache and severe L hip pain following return to riding. Two extra-articular hematomas were identified on MRI and aspirated.

3. Re-admitted 6 weeks post-op for iliofemoral DVT. Underwent catheter-directed thrombolysis and stent placement for May Thurner's defect. Started on 6 months of Xarelto.

4. Left THA completed 6 weeks post-DVT.

2675 June 1 3:55 PM - 4:15 PM

Groin Injury- Swimming

Jennifer Soo Hoo, MD¹, Kristen Abbott, MD², Monica Rho, MD¹. ¹Shirley Ryan AbilityLab, Chicago, IL. ²Northwestern University Health Service, Chicago, IL. (Sponsor: Joseph Ihm, FACSM)

(No relevant relationships reported)

History:

A 20 year old Division 1 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

Test 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 Outcomes:

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

2676 June 1 4:15 PM - 4:35 PM

Hip Injury - Soccer

James Alex, Heather Gillespie, FACSM. *Maine Medical Center, Portland, ME.* (Sponsor: Heather Gillespie, MD, FACSM)

(No relevant relationships reported)

ACSM 2018 National Conference

Clinical Case Abstract Submission

Title: Hip Injury - Soccer

Author: James Alex, Heather Gillespie, Maine Medical Center, Portland, ME. Email: jalex@mmc.org.

(Sponsor: Heather Gillespie, FACSM)

History: A 13 year old male soccer player without significant past medical history sustained an acute onset of anterior right hip pain while sprinting during a soccer game. He was immediately unable to walk and was carried off the field by teammates. He developed occasional transient episodes of pain radiating down his right leg without numbness or tingling noted. He was evaluated in the emergency department that evening, given oxycodone for analgesia, crutches to maintain non-weight-bearing status, and was referred to sports medicine for follow-up.

Physical Exam: Examination in the office 2 days after injury revealed no hip, leg, or abdominal abnormalities on inspection. He was able to bear about 50% of his weight on the right leg without crutches. Mild tenderness to palpation was noted anterior to the right lesser trochanter. Right hip active range of motion was limited to 10 degrees of flexion in the supine position with normal passive range of motion throughout and intolerance of resisted hip flexion. Normal resisted adduction strength was noted. Neurovascular testing of the right lower extremity was normal.

Differential Diagnosis:

1. Iliopsoas strain
2. Apophyseal avulsion fracture: AIIS, ASIS, or lesser trochanter.
3. Adductor strain
4. Femoral neck stress fracture
5. Slipped capital femoral epiphysis

Tests and Results: 2-view xray of the right hip reveals apophyseal avulsion fracture of the lesser trochanter of the right femur with 20mm of proximal displacement.

Final Diagnosis: Closed, proximally-displaced apophyseal avulsion fracture of the lesser trochanter of the right femur.

Treatment and Outcome:

1. Case reviewed with multiple surgeons (sports, trauma, pediatric orthopedics) regarding potential screw fixation.
2. Non-operative management pursued.
3. Stable proximal displacement visualized on repeat xray post-injury day 6.
4. Non-weight-bearing on crutches for 3 weeks.
5. OTC analgesia after post-injury day 3.
6. Gradual weight bearing by week 4.
7. Final return to sport pending at the time of submission.

2677 June 1 4:35 PM - 4:55 PM

Pelvic Pain In A Soccer Player- Soccer

John T. Nelson¹, Delmas Bolin². ¹Carilion Clinic VTC Family Medicine Residency, Roanoke, VA. ²Edward Via College of Osteopathic Medicine, Virginia Campus, Roanoke, VA. (Sponsor: Delmas Bolin, FACSM)

(No relevant relationships reported)

HISTORY: A 23 year old men's soccer player presented with left sided pubic bone pain for seventeen months. The injury occurred after collision with another player and falling onto his left side during a soccer game. He developed left sided pubic symphysis pain later that evening. He finished the season followed by complete inactivity for 2 months. At the start of the next season, the same left sided pain returned that was worse with initial steps, change of direction, and lateral movements. He was seen in a sports medicine clinic and had an MRI which showed edema in the rectus abdominis, left abductor, and pubic symphysis. He completed physical therapy with no improvement. He then developed intermittent sharp pain radiating to the left testicle with running, preventing return to play. Steroid and Platelet Rich Plasma injections did not alter symptoms. He was referred to General Surgery, Orthopedics, given NSAIDs, repeated PT, repeat MRI, and finally referred for a biomechanical evaluation and treatment.

PHYSICAL EXAMINATION: Pelvic compression test is + left. Palpation: left superior pubic rami pain; mild pain in left ischial tuberosity. ASIS to umbilicus measures 12 cm left, 13 cm right. ASIS is inferior on right. PSIS is superior on left. Left leg 1.5 cm shorter. Palpation of left lower abdominal quadrant lateral to the border of pubic symphysis reproduces left sided scrotal pain. Genitourinary/Hip exam: Unremarkable. Sensation intact bilateral L4-S1 distribution. Reflexes: 2+/4 bilateral knee and ankle. Pulses: 2+/4 bilateral post tibial

DIFFERENTIAL DIAGNOSIS: Stress Fracture of Pubic Ramus, Athletic pubalgia, Inguinal Hernia, Abdominal muscles strain/tear, Nerve Entrapment

TEST AND RESULTS: MRI (2nd): small area of edema in the left side of the pubic symphysis and inferior pubic ramus, consistent with stress reaction/athletic pubalgia.

FINAL WORKING DIAGNOSIS: Stress Fracture of the Pubic Ramus (resolving), left hemipelvis in-flare, causing pubic symphysis and genital branch of Genitofemoral Nerve entrapment

TREATMENT AND OUTCOMES: Osteopathic manipulation- one course resolved pubic symphysis pain. US-guided hydrodissection of the left genitofemoral nerve- immediate alleviation of symptoms with return to play without pain or discomfort.

2678 June 1 4:55 PM - 5:15 PM

Hip Tumor Discovered in High School Basketball Player Referred to Physical Therapy with Knee Pain

Nicholas B. Washmuth. *Samford University, Homewood, AL.*
(Sponsor: C Scott Bickel, FACSM)
(No relevant relationships reported)

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 squatting 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:

Radiographs and MRI of left hip revealed hip tumor, leading to surgery on left hip
FINAL/WORKING DIAGNOSIS:

1. Knee pain compensatory in nature, related to decreased hip joint ROM and LE muscle extensibility
2. Surgery, status post tumor excision, left hip

TREATMENT AND OUTCOMES:

Patient followed hip surgical dislocation post-operative rehabilitation protocol and returned to basketball without restrictions at 6 months post-operatively. This clinical case exemplifies the concept of regional interdependence and importance of inter-professional collaboration when patients are not progressing as expected with rehabilitation.

F-39 Clinical Case Slide - Knee IV

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-200F

2679 **Chair:** Mark E. Lavallee, FACSM. *Wellspan York Hospital, South Bend, IN.*

(No relevant relationships reported)

2680 **Discussant:** Ashley Zapf. *Andrews Institute, Woodbridge, VA.*

(No relevant relationships reported)

2681 **Discussant:** Jessie R. Fudge, FACSM. *Kaiser Permanente Washington, Everett, WA.*

(No relevant relationships reported)

2682 June 1 3:15 PM - 3:35 PM

A Rare Cause of Knee Pain in a Healthy Male Ultra-marathon Runner

Pierre L. Viviers, FACSM, Riaan Dreyer, Jeandré Viljoen, Wayne Derman. *Stellenbosch University, Stellenbosch, South Africa.*

(No relevant relationships reported)

HISTORY: A 58-year-old healthy male ultra-marathon runner presented with a 3-month history of atraumatic, gradually worsening right-sided anterior knee pain, aggravated by activity and associated with prominent morning stiffness and pain. Night pain was absent. Oral and parenteral NSAIDs provided no relief, nor did massaging. No history of smoking, alcohol or prior corticosteroid use was reported.

PHYSICAL EXAMINATION: The R-knee was slightly swollen with no obvious deformities. No clinical intra-articular effusion was noted. Palpation revealed tenderness over the quadriceps tendon insertion and superomedial knee. In addition, 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-lucent 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)/ Ahlback’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.

2683 June 1 3:35 PM - 3:55 PM

Unusual Knee Pain in a Volleyball Player

Adam Lewno, Daniel R. Lueders. *University of Michigan, Ann Arbor, MI.* (Sponsor: Robert Kinningham, FACSM)

(No relevant relationships reported)

HISTORY:

A 20 year old collegiate volleyball libera presents mid-season with 2 year history of self-resolving right inferolateral burning dysethesitic knee pain with a lasting dull ache that is primarily aggravated with hard contact to her lateral knee as when diving for balls. Over the last 3 weeks her pain has progressed despite multiple forms of knee padding, guards, braces, as well as dive form adjustments causing her to be more hesitant when diving for balls; ultimately negatively affecting her ability to be a defensive specialist on the court. She was previously evaluated for similar complaints in the 2016 season with planned sonographic guided infrapatellar branch of the saphenous nerve (IBSN) corticosteroid injection with hydrodissection but ultimately

did not proceed with treatment due improvement during the off season. She denies any catching, locking, instability, or swelling with no history of prior injury to her right lower extremity.

PHYSICAL EXAM:

SKIN: No rash or lesion

NEUROMUSCULAR: Tenderness at Gerdy's tubercle and distal lateral insertion of the patellar tendon. Normal strength, deep tendon reflexes, and sensation in lower extremities. No ligamentous laxity on special testing.

GAIT: No abnormality

DIFFERENTIAL DIAGNOSIS:

1. Tibial Contusion
2. Fibular Contusion
3. Avulsion fracture
4. Common fibular nerve neuropraxia or neuroma
5. IBSN neuropraxia or neuroma
6. Lateral Meniscus extrusion
7. LCL Strain
8. Distal Iliotibial Band (ITB) Syndrome
9. Distal ITB tendinosis
10. Symptomatic lateral plica

TESTS and RESULTS:

Right knee radiographs indicated bipartite patella with a small joint effusion but no fractures or degenerative changes

Diagnostic ultrasound of the right knee identified asymmetric thickening of the right ITB in its distal-most 5cm to its Gerdy's Tubercle insertion and correlating tenderness with sonopalpation. The adjacent joint line, bursae, nerves, and ligamentous anatomy were normal.

FINAL DIAGNOSIS:

Distal Iliotibial Band Tendinosis

TREATMENT AND OUTCOMES:

1. Focused exercises on dynamic balance and quadriceps strengthening
2. Progressive ITB stretching
3. Graston instrument assisted soft tissue mobilization
4. Class IV laser treatment

Two weeks of in season treatment achieved complete resolution of her complaints with no disruption of her competitive play.

2684 June 1 3:55 PM - 4:15 PM

Knee Pain in a High School Soccer Player

Brian J. Schutzbach¹, Robert Gillis². ¹*Wellspan Health, York, PA.* ²*Wellspan Health, Gettysburg, PA.* (Sponsor: Mark Lavallee M.D., FACSM)

(No relevant relationships reported)

HISTORY: A 17 year old male soccer player presented with left knee pain after feeling an acute "snap" while running across field. He described pain as being sharp, stabbing, worse with movement and associated swelling immediately after the injury. He was unable to continue the game or bear weight. He was sent to Emergency Department for further evaluation.

PHYSICAL EXAMINATION: Examination in emergency department revealed athlete in no acute distress with a left knee appearing to have significant swelling, patella was superiorly displaced, and inability to flex or extend knee. Dorsal Pedis pulse was 2+. Skin was warm, dry, pink, with normal capillary refill. No neurological deficits. Vitals stable.

DIFFERENTIAL DIAGNOSIS: 1. Patella tendon rupture 2. Tibial tuberosity avulsion fracture 3. Osgood Schlatter Disease 4. Patellar dislocation 5. Patella sleeve fracture

TEST AND RESULTS: Left Knee anterior-posterior, lateral, and oblique radiographs: Distracted and anteriorly displaced large avulsion fracture involving anterior proximal tibia and anterior tibial tuberosity. Maximum distraction of 18.7 mm. Growth plates not completely fused consistent with continued growth.

FINAL WORKING DIAGNOSIS: Type III tibial tuberosity avulsion fracture

TREATMENT AND OUTCOMES: 1. Initial immobilization, non-weight bearing, pain control.

2. Evaluation by Orthopedic Surgeon in office following day. 3. Open reduction and internal fixation with 2 screws perpendicular to fracture line performed on day 4 after injury. 4. Discharged home the same day with weight bearing as tolerated with knee immobilizer locked in extension with crutches. 5. 10 days post-operation: Transition to hinge brace and leg remained locked straight to prevent hyperextension. 6. 3 weeks: Physical therapy with unlocking brace for range of motion exercises 7. 7 weeks: Full range of motion. Cleared to play limited minutes in senior night game. 8. 10 weeks: Return to all activities without restriction.

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 +5 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 hematoma 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

Charonn D. Woods, Jonathan T. Finnoff, FACSM, Brennan J. Boettcher. *Mayo Clinic, Rochester, MN.* (Sponsor: Jonathan T. Finnoff, FACSM)

(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 nonantalgic. Heel and toe walking were normal. Squatting reproduced lateral right knee pain.

Knee exam: Active terminal knee extension reproduced superolateral 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
- Osteoarthritis with crepitus
- 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.

2687 June 1 4:55 PM - 5:15 PM

Snapping Knee After Knee Arthroplasty In Recreational Athlete

Angela N. Cortez, Tracy Hoeg, Brian A. Davis, FACSM.
University of California at Davis, Sacramento, CA. (Sponsor:
Brian Adam Davis, FACSM)

(No relevant relationships reported)

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 experiences 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 periprosthetic lucency to suggest loosening or fracture.
- Right Knee MRI Maverick protocol without contrast showed the imaged portions of the biceps, semimembranosus, and semitenosus 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

Friday, June 1, 2018, 3:15 PM - 4:55 PM
Room: CC-101CD

2688 **Chair:** Shawn F. Kane, FACSM. *US Army, Carthage, NC.*
(No relevant relationships reported)

2689 **Discussant:** Poonam P. Thaker, FACSM. *Presence Resurrection Sports Medicine Fellowship, Chicago, IL.*
(No relevant relationships reported)

2690 **Discussant:** George Guntur Pujalte, FACSM. *Mayo Clinic, Jacksonville, FL.*
(No relevant relationships reported)

2691 June 1 3:15 PM - 3:35 PM

Recurrent Chest Pain in an 18 Year Old Male with a History of Viral Perimyocarditis

Paul C. Goleb, Jr, Kyle Yost, Andrew Tucker. *University of Maryland Medical Center; Baltimore, MD.*
(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 pulsus paradoxus.

Respiratory: Clear to auscultation bilaterally.

Extremities: No clubbing, no cyanosis, no edema.

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.

Cardiac MRI: Heterogeneous focal enhancement consistent with myocarditis. Normal LV size with low normal LV function (LVEF 51%).

Follow-Up:

TSH 0.6, ANA negative, P-ANCA negative, C-ANCA negative, CRP <0.1, ESR 1, CK 183, BNP 32, Troponin <0.04.

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

2692 June 1 3:35 PM - 3:55 PM

Abdominal Trauma - FootballJonathan 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 flail 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 pneumoperitoneum
Ultrasound FAST exam – Free peritoneal and retro-vesicular fluid
CT Abdominal/Pelvis – Grade 3 Liver laceration (7.9 cm) and Grade 1 Splenic laceration

DIFFERENTIAL DIAGNOSIS:

1. Liver laceration
2. Rib fracture
3. Pneumothorax/hemopneumothorax
4. Diaphragm spasm

FINAL/WORKING DIAGNOSIS:

Grade III Liver and grade I 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 full 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 Lymphangioliomyomatosis Following Exercise TrainingThomas W. Lowder. *University of Central Arkansas, Conway, AR.**(No relevant relationships reported)*

HISTORY: Lymphangioliomyomatosis (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 Tuberous Sclerosis Complex (TSC) at after 5 and LAM at age 21, underwent 12mo of high-intensity exercise 2d/wk. Prior to training and every 3mo pulmonary function, oxygen uptake (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 (angiomyliomas, 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 (FEV₁) by 9%, FEV₁/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

Evaluating The Effectiveness Of The Girls On The Run Program With Respects To Self-esteem, Self-perceived Body Image, And Aerobic Capacity.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 o,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' overall 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

Hematuria - Cross CountryPeter 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 normal with EOM intact. No 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 tenderness to palpation, no masses, and no organomegaly. There was no costovertebral angle tenderness and no pelvic tenderness. Normal mood and affect. No visible skin lesions.

DIFFERENTIAL DIAGNOSIS:

1. Pyelonephritis
2. Post streptococcal glomerulonephritis
3. Rhabdomyolysis
4. Nephrolithiasis
5. Cancer
6. IgA nephropathy
7. Idiopathic exercise induced hematuria

TESTS & RESULTS:

CMP: unremarkable
ANA screen: negative
C3/C4: normal
Antistreptolysin: normal
ANCA screen: negative
24 hour urine total protein: normal
Renal/bladder ultrasound: unremarkable

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.
- Referred 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

F-51 Free Communication/Poster - Energetics

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

2718 Board #1 June 1 2:00 PM - 3:30 PM

Energetic Profile of a Wheelchair Racing 1500 m Simulation Test

Lingling Zhang¹, Xueping Wu², Yongming Li². ¹Shanghai University of Finance and Economics, Shanghai, China.
²Shanghai University of Sport, Shanghai, China.

(No relevant relationships reported)

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,Ploar 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, Gemany). The energetic contribution was measured with the maximal accumulated oxygen deficit (MAOD).

RESULTS: Results showed that the accumulate 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 mM, 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($r=-0.638$ 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. 11DZ2261100).

2719 Board #2 June 1 2:00 PM - 3:30 PM

Leucocyte Telomere Length of Master Endurance Athletes is Associated to Resting Nitric Oxide: Possible Role of Redox Balance.

CAIO V. SOUSA, SAMUEL S. AGUIAR, PATRICK A. SANTOS, LUCAS P. BARBOSA, LYSLEINE A. DEUS, THIAGO S. ROSA, ROSÂNGELA V. ANDRADE, HERBERT G. SIMÕES. UNIVERSIDADE CATÓLICA DE BRASÍLIA, BRASÍLIA, Brazil.

(No relevant relationships reported)

PURPOSE: Leukocyte telomere length (LTL), a biological marker of aging, is longer in elderly endurance runners than age-matched controls, but the underlying mechanisms are poorly investigated. The LTL, nitric oxide (NO) and redox balance of master endurance runners (ER) were analyzed and compared to untrained middle-aged (MC) and young controls (YC). We hypothesized that NO and redox balance at baseline would be related to longer LTL in ER. **METHODS:** Participants (n = 38) from both ER (n = 10; 51.6 ± 5.2yrs; 28.4 ± 9.4yrs of experience), MC (n = 17; 46.6 ± 7.1yrs) and YC (n = 11; 21.8 ± 4.0yrs) attended to the laboratory for anamnesis, anthropometrics and blood collection for biochemical and molecular analyzes. Pro and antioxidant measures as well as DNA extraction were performed using commercial kits following the fabricant protocols. Relative LTL was measured using qPCR analysis.

RESULTS: The LTL of YC group (T/S = 1.85 ± 1.59) was longer than MC (T/S = 0.47 ± 0.51; $p < 0.05$) but did not differ from ER (T/S = 0.89 ± 0.50; $p > 0.05$). A large effect-size between TL of ER and MC ($d = 0.85$) was also observed. The comparison of antioxidant/pro-oxidant ratios indicated a better redox balance for the ER and young adults in comparison to middle aged untrained participants, which showed lower values for TEAC/TBARS, SOD/TBARS and CAT/TBARS ($p < 0.05$). Furthermore, the NO levels for the ER (175.2 ± 31.9µM) were higher ($p < 0.05$) than MC (67.2 ± 23.3µM) and YC (129.2 ± 17.3µM), with a positive and strong correlation with LTL ($r = 0.766$; $p = 0.02$). **CONCLUSIONS:** In conclusion, master endurance runners have longer LTL than age-matched controls, what in turn may be related to their better NO bioavailability and redox balance status.

2720 Board #3 June 1 2:00 PM - 3:30 PM

The Energy Expenditure and Relative Exercise Intensity During Pound

Abigail L. Ryskey, John P. Porcari, 54601, FACSM, Kimberly Radtke, Susan Bramwell, Carl Foster, FACSM. University of Wisconsin - La Crosse, La Crosse, WI. (Sponsor: John Porcari, FACSM)

(No relevant relationships reported)

A new fitness program that has become popular is Pound®. Pound® incorporates both Pilates and drumming movements into a full-body workout. During a session of Pound® participants use Ripstix. Ripstix are drumsticks that weigh a quarter of a pound (0.11 kg) each and are used to "pound" to the beat of the music together with choreographed body movements. **Purpose:** This study was designed to determine the energy expenditure and relative exercise intensity of a Pound® cardio-jam session. Twenty-two volunteers (6 males; 16 females) between the ages of 18-25 years performed a maximal exercise test on a treadmill. Each subject then completed 2-3 practice session of Pound®, following a DVD. Once proficient, they completed a 38-minute Pound® cardio-jam session. Heart rate and VO₂ were monitored every minute throughout the workout and perceived exertion was recorded approximately every 4 minutes throughout the session using the Borg 6-20 RPE scale. **Results:** It was found that both % HRmax (males: 68 ± 5.2; females: 73 ± 6.8) and % VO₂max (males: 39 ± 4.5; females: 42 ± 6.6) were within ACSM guidelines for improving cardiorespiratory endurance. Throughout the workout subjects considered the workout to be of "somewhat hard" intensity (average RPE = 12.7 ± 1.91). Energy expenditure for both males (280.8 ± 41.38 kcal/session) and females (221.8 ± 34.35 kcal/session) was within ACSM guidelines. Males had a significantly higher energy expenditure than females due to higher body mass (75.1 ± 8.9 kg vs. 67.9 ± 7.3 kg). **Conclusion:** The Pound® cardio-jam session meets standards set forth by ACSM for improving cardiorespiratory fitness and body composition. Collectively, the findings of this study suggest that Pound® may be an enjoyable option for individuals seeking an alternative to traditional aerobic exercise programs.

2721 Board #4 June 1 2:00 PM - 3:30 PM

Validation of Overall Energy Expenditure Measurements in the Fitbit Charge HR 2 and Apple Watch

Kaigang Li, Kayla Nuss, Elizabeth A. Thomson, Ashley Comstock, Sophie Blake, Steven Reinwald, Richard E. Pimentel, Brian Tracy, FACSM. Colorado State University, Fort Collins, CO.

(No relevant relationships reported)

PURPOSE: To determine the validity of the energy expenditure (EE) estimation for the Fitbit Charge HR 2 and the Apple Watch devices. **METHODS:** Thirty young adults (15 females, 15 males, aged 23.5±3.0 years) completed the Bruce Protocol. Gross EE of participants was measured by PARVO metabolic cart and estimated by Fitbit Charge HR 2 and Apple Watch devices. A concordance correlation coefficient (CCC, r_c) was conducted to examine the strength of the relationship of PARVO measured EE with EE estimated by each device. Relative error rates (RER) were calculated to indicate the difference between each device and PARVO. **RESULTS:** For the Apple Watch, the relative error was 24.25% for overall, 18.58% for males, and 29.93% for females. For the Fitbit, the relative error was 20.07% for overall, 24.17% for males, and 16.72% for females. Moderate Concordance correlations between estimated EEs and PARVO measured EEs were found for both Apple Watch ($r_c = 0.65, 0.43, \text{ and } 0.39$ for overall, males and female) and Fitbit Charge HR 2 ($r_c = 0.53, 0.39, \text{ and } 0.21$ for overall, males and females). In addition, stronger relationships were found between PARVO EE and Apple Watch EE than those between PARVO EE and Fitbit Charge HR 2 EE for overall, males and females. **CONCLUSIONS:** This was one of the first studies to examine the accuracy of overall energy expenditure estimated by Apple Watch and Fitbit Charge HR 2. Neither of the two devices showed accurate results compared to the measured EE by the standard approach. The Apple Watch revealed overestimated EE for females but underestimated EE for males. The Fitbit underestimated EE for both males and females. Researchers, practitioners and personal users should consider these results when designing programs or personal training plans targeting physical activity related EE with a wearable device.

2722 Board #5 June 1 2:00 PM - 3:30 PM
Comparison of Reported Energy Expenditure from Polar M430 vs. Polar V800 vs. Actual Energy Expenditure

Olivia Hanzel, Grace Shryack, Joshua Patterson, Courtney Willoughby, Bryan Smith. *Southern Illinois University Edwardsville, Edwardsville, IL.*
 (No relevant relationships reported)

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 ± 2.0 kg/m²) and ten males (age = 22.8 ± 1.0 y, BMI = 26.1 ± 1.3 kg/m²) reporting to the lab and were fitted with a chest strap HR transmitter (Polar H7) to measure and transmit HR data to the V800. The M430 was fitted on the participant's wrist according to the manufacturer's instructions. Participant's then completed four, 5-min bouts of exercise which consisted of the following: walking 3.5 mph at 0% grade, walking 3.5 at 5% grade, running at 5.5 mph at 0% grade, and running at 5.5 mph at 5% grade. Indirect calorimetry was used to measure actual ExEE.

RESULTS: There were no significant differences between the three methods when walking at 0% or 5%. When running at 0% there was a significant difference between methods (p=0.044), with the M430 underestimating ExEE when compared to indirect calorimetry (5.8±2.0 kcal, p=0.045). When running at 5% there was a significant difference between methods (p=0.001). The M430 underestimated ExEE when compared to the V800 (7.5±2.1 kcal, p=0.018) and when compared to indirect calorimetry (14.5±3.7 kcal, p=0.008).

CONCLUSIONS: The V800 provided accurate estimates of ExEE during each bout of exercise. The M430 provide 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.

2723 Board #6 June 1 2:00 PM - 3:30 PM
Comparison of Exercise Energy Expenditure Values Obtained from the Garmin Forerunner 230 and 235

Courtney A. Willoughby, Olivia Hanzel, Joshua Patterson, Grace Shryack, Bryan Smith. *Southern Illinois University Edwardsville, Edwardsville, IL.*
 (No relevant relationships reported)

The recent trend in activity tracking has increased the demand for smart watches that can provide estimates of exercise energy expenditure (ExEE) during different types of exercise based upon the heart rate response to that exercise. The Garmin Forerunner 230 (230) and Forerunner 235 (235) are similar watches with the only difference being how heart rate (HR) is measured. The 230 uses a wireless chest transmitter that is held in place with a chest strap while the 235 uses an optical sensor that is built directly into the watch. **PURPOSE:** The purpose of this study was to compare the ExEE values obtained from the 230 and the 235 to ExEE values measured using indirect calorimetry during different bouts of exercise. **METHODS:** Two females (BMI=24.2 ± 2.8 kg/m², age=20 ± 1.4 y) and ten males (BMI=26.1 ± 4.1 kg/m², age=22.8 ± 3.3y) reported to the Exercise Physiology Lab at Southern Illinois University Edwardsville where they were fitted with a wireless chest transmitter and chest strap for the 230. The 235 was fitted on the participant's wrist according to the manufacturer's instructions. The exercise consisted of two, 5-min walking intervals (3.5 mph + 0% incline and 3.5 mph + 5% incline) and two, 5-min running intervals (5.5 mph + 0% incline and 5.5 mph + 5% incline) with 3-min of rest between each exercise bout. Indirect calorimetry was used to measure actual ExEE. **RESULTS:** There were no significant differences between the three methods during the 5% walk or the 0% run. During the 0% walk, there was a significant difference between methods (p=0.048) with the 235 overestimating ExEE when compared to the 230 (7.2±3.2 kcal, p=0.044). During the 5% run, there was a significant difference between methods (p=0.002). Both the 230 and 235 underestimated ExEE when compared to indirect calorimetry (12.3±3.6 kcal, p=0.024 and 10.0±3.3 kcal, p=0.043, respectively). **CONCLUSION:** The 230, which uses a wireless chest transmitter, provides accurate estimates of ExEE in all but the most intense exercise bout. The 235, which uses an optical sensor, varies in its ability to estimate ExEE in that it overestimates at the lower exercise intensities

and underestimates at the highest exercise intensity. Caution should be taken when using ExEE values from both the 230 and 235 for weight management or exercise prescription purposes.

2724 Board #7 June 1 2:00 PM - 3:30 PM
Predicting Energy Expenditure of an Acute Bout of Resistance Exercise in Men and Women

Danielle M. Kravits¹, Brad S. Lambert², Jason R. Lytle¹, Stephen E. Martin¹, John S. Green, FACSM¹, Stephen F. Crouse, FACSM¹. ¹Texas A&M University, College Station, TX. ²Houston Methodist, Houston, TX. (Sponsor: Stephen F. Crouse, FACSM)
 (No relevant relationships reported)

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 as predictors. **METHODS:** Fifty-two healthy, active subjects (27 men, 25 women, age 20-58 yrs, height 174.1 ± 10.5 cm, weight 188.7 ± 42.6 kg, VO_{2max} 36.8 ± 9.2 ml/kg/min) 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, 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. **Results:** Table.

EXERCISES	REGRESSION COEFFICIENT							MODEL FIT	R Square	SEE
	HT (cm)	AGE (y)	GENDER (m=1, f=0)	FATMASS (kg)	LEANMASS (kg)	WEIGHT (kg)	VOLUME m3			
TOTAL	0.874	-0.596		-1.016	1.638		2.461	-110.742	0.773	28.465
LEG.PRESS	0.12	-0.093		-0.252	0.297		1.169	-13.837	0.83	4.40
CHEST.PRESS	0.186	-3.173		-0.198	0.271		4.211	-28.468	0.68	4.70
LEG.CURL		-0.129			0.245	-0.1	5.189	6.633	0.62	5.36
LAT.PULL		-0.165		-0.128	0.187		4.725	8.483	0.67	4.96
LEG.EXTENSION		-0.08	-1.635	-0.185	0.394		4.252	1.444	0.70	5.31
TRICEPS.PUSH	0.255		-5.124	-0.239	0.39		1.919	-44.891	0.72	4.99
BICEPS.CURL	0.292	-0.091	-7.068		0.351	-0.156	15.059	-44.262	0.62	5.603

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.

2725 Board #8 June 1 2:00 PM - 3:30 PM
The Garmin Vivosmart HR vs the Cosmed K4B2 Metabolic Backpack: Validating Measurement of Energy Expenditure

Brandi R. Washell. *Coastal Carolina University, Conway, SC.*
 (Sponsor: George Lyerly, FACSM)
 (No relevant relationships reported)

Wearable 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) watch and the Cosmed K4b2 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 kcal (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 and G was 47.42 ± 19.7.

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.

2726 Board #9 June 1 2:00 PM - 3:30 PM
Validating The Garmin Vivosmart Hr Vs The Actigraph Gt3x Accelerometer In Measuring Energy Expenditure.
 Ethan Hayes. *Coastal Carolina University, Conway, SC.*
 (Sponsor: George Lyerly, FACSM)
(No relevant relationships reported)

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 kcal. **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, RBP, and RHR were obtained. We recruited 19 subjects, 18 years and older, of varying activity levels. **Results:** The mean EE from A was 83.92 ± 24.58 , 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.

F-52 Free Communication/Poster - Methodology

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

2727 Board #10 June 1 2:00 PM - 3:30 PM
Haematological Response To Altitude And Differentiation From rHuEpo Abuse
 Shaun Sutehall. *University of Cape Town, Cape Town, South Africa.* (Sponsor: Yannis Pitsiladis, FACSM)
(No relevant relationships reported)

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 rHuEpo abuse from altitude exposure. **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 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%). **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 $43.8 \pm 2\%$, $P < 0.01$) and remained significantly elevated 27 days after return ($44.6 \pm 2\%$, $P < 0.01$). There were no significant differences in RET%. These results show HGB and HCT increased by 14.2% and 13.6% respectively, which is similar to the increase following rHuEpo administration (10.5% and 11.5%, respectively, Wang et al, 2017). **Conclusion:** Following 27 days of altitude exposure, there are significant increases in HGB and HCT but a blunted response in RET%. There appears to be a similar response to altitude exposure and rHuEpo on HGB and HCT, further analysis is required. Ongoing analysis of transcriptomic markers may aid differentiation between altitude and rHuEpo abuse. This work was supported in part by a grant from WADA.

2728 Board #11 June 1 2:00 PM - 3:30 PM
Validity Of Pushup As Predictor Of Success In Law Enforcement
 Paul O. Davis, FACSM. *First Responder Institute, Burtonsville, MD.*
(No relevant relationships reported)

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:** 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 (JTA) 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

2729 Board #12 June 1 2:00 PM - 3:30 PM
Diagnostic Value Of An Impedance-technology Based Health Risk Assessment For Hypertension, Hyperglycemia And Hyperlipidemia
 Wang xiaofei¹, Zhu Weimo, FACSM², Zhang Bing¹. ¹Tsinghua University, Beijing, China. ²University of Illinois, Urbana, IL.
(No relevant relationships reported)

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 ($p > .05$) 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

	Hypertension	Hyperglycemia	Hyperlipidemia
True Health Status (%)	38.272	32.099	49.383
Prediction by ITHRAS (%)	40.741	35.802	45.679
Chi-square test (p-value)	0.774	0.629	0.581
ROC (AUC)	0.947	0.933	0.808

CONCLUSION: The predictive validity of ITHRAS in preliminary screening of hypertension and hyperglycemia was confirmed. But the accuracy of hyperlipidemia

detection also needs to be improved. Due to its non-invasive, short detection time, and non-radiation characteristics, ITHRAS should be applicable and welcomed in large-scale hypertension and hyperglycemia status screening.

2730 Board #13 June 1 2:00 PM - 3:30 PM
Determining Consistency And Agreement Of Scores Across Two Measurements Of The Visual System: Test-retest Reliability

Stephanie Long¹, Suzanne Leclerc², David Tinjust³, Russell Steele¹, Tibor Schuster¹, Ian Shrier, FACSM¹, ¹McGill University, Montreal, QC, Canada. ²Institut National du Sport du Quebec, Montreal, QC, Canada. ³Apexx Inc, Montreal, QC, Canada.

(No relevant relationships reported)

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)), saccades, anatomic deviation (AD) at 30cm and 3m, and the eye's ability to move/focus in-sync [convergence motor punctum proximum (CMPP), binocular fusion with convergence (BFC) and divergence (BFD) at 30cm and 3m, convergence fusional proximum (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) 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), CMPP (0.54), BFC (0.54) and BFD (0.66) at 30cm, and CFP (0.64). There was poor reliability for saccade (0.34), and BFC (0.49) and BFD (0.43) at 3m. LoA was best for saccade ($\pm 34\%$) and worst for AD 30 cm ($\pm 121\%$), and ranged from $\pm 58\%$ to $\pm 70\%$ for 7/8 other tests. For AD 3m, LoA ($\pm 200\%$) 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, the other scored 0 and 2.

CONCLUSIONS: Our results demonstrate moderate to good test-retest reliability for 7 out of 10 BVTs, and poor reliability for saccades, and BFC and BFD at 3m. 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.

2731 Board #14 June 1 2:00 PM - 3:30 PM
Hit Or Miss: Kinematic Predictors Of In-game Performance In Collegiate Pitching

Victoria R. Mitchell, William P. Lydon, J. Mark VanNess, John Mayberry, Joey Rossi, Courtney D. Jensen. University of the Pacific, Stockton, CA.

(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 (SPI), 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, SPI, and FIP; each of these was calculated as a season statistic. Multiple linear regressions tested the SpartaTrac outputs on dependent performance variables, holding significant confounders constant. **RESULTS:** In our cohort of pitchers, winning percentage was $41.9\% \pm 26.2\%$, ERA was 6.5 ± 5.1 , FIP was 6.0 ± 3.5 , and SPI was 0.8 ± 0.5 . Holding confounding variables constant, predictors of winning percentage were Load ($\beta=0.004$; $p=0.047$), Explode ($\beta=-0.011$; $p<0.001$), and Drive ($\beta=-0.016$; $p<0.001$); the overall model was significant ($R^2=0.516$; $p<0.001$). Predictors of ERA were Load ($\beta=-0.138$; $p=0.008$) and Explode ($\beta=0.213$; $p<0.001$); the overall model was significant ($R^2=0.442$; $p<0.001$). Predictors of SPI were Load ($\beta=-0.095$; $p=0.013$), Explode ($\beta=0.267$; $p<0.001$), and Drive ($\beta=0.161$; $p=0.001$); the overall model was significant ($R^2=0.501$; $p<0.001$). Predictors of FIP were Load ($\beta=0.012$; $p=0.039$) and Explode ($\beta=-0.034$; $p<0.001$); the overall model was significant ($R^2=0.313$; $p<0.001$). **CONCLUSIONS:** SpartaTrac data correlate with on-field performance of collegiate

pitchers, although the effects are not always encouraging. Out of the four evaluated performance metrics, Load and Explode each improved two and worsened two. Drive improved one, worsened one, and was irrelevant in two. Before coaches, scouts, and trainers can predict how Sparta data affect pitching performance, more analyses must be done on larger pools of pitchers.

2732 Board #15 June 1 2:00 PM - 3:30 PM
Gender Differences In The Association Of Grip Power With Other Physical Strength Among Japanese

Yasushi Sera, Koichiro Azuma, Shiori Horisawa, Shogo Tabata, Masafumi Nagano, Hiroyuki Ishida, Hideo Matsumoto. KEIO UNIVERSITY SCHOOL OF MEDICINE, Tokyo, Japan.

(No relevant relationships reported)

Coming super-aging society, grip power has been regarded as a vital sign among older adults, since it can be evaluated with ease and safety and is associated with a lot of health-related consequences.

PURPOSE: The purpose of the study is to evaluate the association between grip power and more time-consuming assessments of physical strength, especially focusing on the gender differences. **METHODS:** Among a total of 236 Japanese subjects (F127/M109, 59-14 yrs, BMI 26.2 ± 5.9), various physical strength including grip power, one foot standing (balance), finger-foot distance (FFD, flexibility), quadriceps muscle strength by hand-held dynamometer, 2 step length (surrogate index for gait speed), and peak oxygen uptake by stress test using gas-analyzer (aerobic fitness), were assessed. Quadriceps muscle strength and 2 step length were expressed as a percentage of body weight, and that of height, respectively. **RESULTS:** Despite of the similar age (F 59 ± 14 , M 59 ± 14 yrs) and BMI (F 26.2 ± 6.6 , M 26.3 ± 5.2), grip power, quadriceps/weight, 2 step/height, and peak oxygen uptake were much lower in women vs men (22.7 ± 4.8 vs 36.1 ± 8.7 kg, 44 ± 13 vs 57 ± 15 %, 1.37 ± 0.18 vs 1.45 ± 0.20 , 22.8 ± 6.1 vs 25.7 ± 7.6 ml/min.kg, respectively, all $p<0.01$), whereas FFD was much greater in women vs men (4.1 ± 10.3 vs -7.3 ± 12.8 cm, $p<0.01$). The association of grip power with quadriceps/weight was much stronger in men ($r=0.55$, $p<0.01$), while it was not significant in women ($r=0.18$, ns). Similarly, grip power was associated with other physical strength to a lesser degree in women. This was partly due to negative association between BMI and various physical strength including quadriceps/weight ($r=-0.42$, $p<0.01$), only in women, while only grip power was positively associated with BMI ($r=0.44$ in women, $r=0.33$ in men, both $p<0.01$).

CONCLUSION: Grip power was associated with other physical strength in men, whereas the association was not significant or present to a lesser degree in women, partly due to declined physical strength except grip power with increasing BMI.

2733 Board #16 June 1 2:00 PM - 3:30 PM
The Validity Of Age-based Maximal Heart Rate Equations In Youth: A Systematic Review And Meta-analysis

Zackary S. Cicone, Clifton J. Holmes, Michael V. Fedewa, Haley V. MacDonald, Michael R. Esco, FACSM. University of Alabama, Tuscaloosa, AL.

(No relevant relationships reported)

Maximal heart rate (MHR) is an important physiological reference for prescribing and monitoring exercise in both clinical and sports settings. Because obtaining a true MHR via graded exercise test (GXT) is often impractical or undesirable, equations are used to predict MHR from age. Unfortunately, these equations were developed in adult populations, potentially limiting their applicability to youth populations. **PURPOSE:** The primary aim of this systematic review and meta-analysis was to examine the validity of age-based MHR prediction equations in children and adolescents.

METHODS: Included studies were peer-reviewed, published in English, and compared measured MHR to predicted MHR using the Fox and/or Tanaka equations in participants <18 years of age. The difference between measured and predicted MHR was assessed using Hedges' d effect size (ES) to adjust for small sample bias, and random-effects models were used to calculate the mean ES and explore potential moderators. **RESULTS:** Six articles published between 2011 and 2015 met our inclusion criteria. The cumulative results of 18 effects indicated that MHR prediction equations may not be accurate in children and adolescents (ES = 0.7317, 95% CI 0.2967 to 1.1666). Post-hoc analyses indicated that the Fox equation (MHR = 220 - age) overestimated MHR by roughly 12.933 BPM, ($k = 11$, ES = 1.4131, 95% CI 1.1035 to 1.7227), and the Tanaka equation (MHR = 207 - 0.7*age) underestimated MHR by roughly 2.0999 BPM ($k = 7$, ES = -0.3850, 95% CI -0.7578 to -0.0122).

CONCLUSIONS: The Tanaka equation resulted in smaller mean differences between measured and predicted MHR than the Fox equation. However, neither equation accounted for the large range in variability of MHR between subjects, which suggests that age may not be the only predictor of MHR in younger populations. Caution should be exercised when using these equations for prescribing and monitoring exercise intensity in children and adolescents.

2734 Board #17 June 1 2:00 PM - 3:30 PM

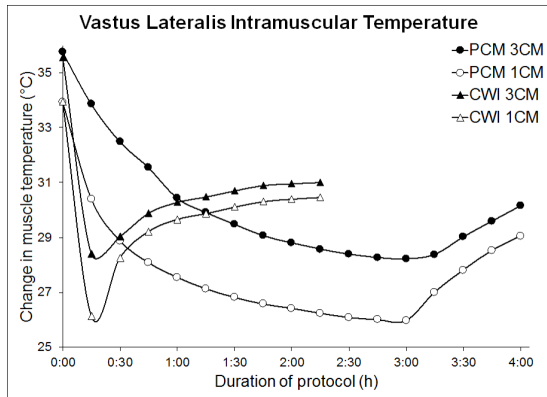
Effect of Cold Water Immersion versus Phase Change Material Cooling On Core and Intramuscular Temperature

Susan Y. Kwicien¹, Malachy P. McHugh, FACSM¹, Stuart Goodall², Kirsty M. Hicks², Angus M. Hunter³, Glyn Howatson, FACSM². ¹Lenox Hill Hospital, New York, NY. ²Northumbria University, Newcastle upon Tyne, United Kingdom. ³University of Stirling, Scotland, United Kingdom. (Sponsor: Malachy P. McHugh, FACSM)

(No relevant relationships reported)

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 (27±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 30 min post CWI, -0.19°C 2 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.



2735 Board #18 June 1 2:00 PM - 3:30 PM

Validity Of A High Incline Vo₂max Walk Test

David E. Lankford, FACSM, Alex D. Gidley, Nate Lewis, Keegan Huntsman, Tyler Hook, Cody Pexton, Haley Dimond, Justin Harris. Brigham Young University Idaho, Rexburg, ID.

Reported Relationships: D.E. Lankford: Consulting Fee; Icon Health and Fitness.

PURPOSE: The purpose of this study was to validate two high incline graded exercise VO₂max tests designed for individuals not accustomed to running on a treadmill. **METHODS:** Participants consisted of 31 (18 men, 13 women) individuals aged 18-29 yrs. All participants completed a Bruce Protocol VO₂max test as well as two high incline graded exercise tests in a randomized order. The high incline VO₂max tests were performed at a constant speed of 3.6 mph and increased in incline 5% every 3-minutes until volitional exhaustion. The difference between the two high incline protocols (5-5, 10-5) was the starting incline following a 30-second warmup. The first stage of the 5-5 test was 5% grade and the first stage of the 10-5 test was 10% grade. A 1x3 repeated measures ANOVA was used to compare VO₂max data between tests. Pearson Correlation and Bland-Altman plots were used to analyze relationships between the two high incline tests (5-5, 10-5) and the Bruce Protocol individually.

RESULTS: There were no differences in VO₂max between tests (Bruce= 46.9 ± 7.7, 5-5= 45.7 ± 7.9, 10-5= 44.7 ± 78.3, p = 0.51). VO₂max of the Bruce Protocol was strongly related to both 5-5 (r= 0.96) and 10-5 (r= 0.90) tests. Bland-Altman plots between 5-5 test and the Bruce Protocol revealed 93% of data falls within ± 4.5ml*kg⁻¹*min⁻¹ and 100% fall within 5ml*kg⁻¹*min⁻¹.

CONCLUSIONS: These results suggest that both the 5-5, and 10-5 tests are valid alternatives to the Bruce Protocol. Additionally, these results demonstrate that a non-running VO₂max test is effective in determining VO₂max in a healthy population.

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

Elizabeth Thomson. Colorado State University, Fort Collins, CO.

(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_c) 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. 128.83±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. 180.3±9.13 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±6.93 vs. 104.24±9.09 BPM, P<.01), for moderate intensity (116.66±23.74 vs 127.79 ± 10.27 BPM, P<.01), for vigorous intensity for males (143.00±13.61 vs 159.39±9.58 BPM, P<.001) and for females (137.24±18.86 vs 155.11±9.86 BPM, P<.05) and for very vigorous intensity (157.47±15.44 vs 181.35±9.44 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_c>.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 Variability in Healthy Subjects

Emily L. Roessel, Evelyn N. Delgado, Megan L. Darling, Nathaniel J. Holmgren, Courtney D. Jensen, J. Mark VanNess. University of the Pacific, Stockton, CA.

(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-age 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 illustrates why results appear homogenous. Thirteen of the 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

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

James L. Ramsey¹, Justin Burley², Shel Levine², John W. Carbone², Rebecca W. Moore². ¹Eastern Michigan University, Ypsilanti, MI. ²Eastern Michigan University, Ypsilanti, 48197, MI. (Sponsor: Lanay Mudd, FACSM)
 (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. On day 2, 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 were 22.96 ± 3.72 years old, had a height of 170.1 ± 9.3 cm, and weighed 73.7 ± 11.50 kg. A significant difference was observed and the maximal strength was greater for the bilateral condition (495 ± 209 lbs) compared to the unilateral condition (387.7 ± 208 lbs). **Conclusion:** A BLD was not observed in this study. Research suggests 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. Bergstrom¹, Terry J. Housh, FACSM², Kristen C. Cochran-Snyman³, Nathaniel D.M. Jenkins⁴, M. Travis Byrd¹, Taylor K. Dinyer¹, Richard J. Schmidt², 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 [$\dot{V}O_2$]) and neuromuscular (electromyographic amplitude [EMG AMP]) responses during exercise above and below CP. **Methods:** Six women and six men (mean \pm SD age: 21 ± 2 year) performed a graded exercise test to exhaustion (GXT) to determine the $\dot{V}O_{2peak}$ and peak power output (W_{peak}). 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% ($CP_{-10\%}$) and CP plus 10% ($CP_{+10\%}$). The $\dot{V}O_2$ and EMG AMP (measured from the vastus lateralis) as well as times to exhaustion (T_{lim}) were recorded during the GXT and continuous rides. The $\dot{V}O_2$ at exhaustion from the $CP_{-10\%}$ and $CP_{+10\%}$ rides were compared with $\dot{V}O_{2peak}$ using a one-way repeated measures ANOVA and follow-up pairwise comparisons ($p < 0.05$). Linear regression was used to examine the individual $\dot{V}O_2$ and EMG amplitude responses after the first 3 min to T_{lim} . **Results:** The $CP_{-10\%}$ ($74\%W_{peak}$) and $CP_{+10\%}$ ($90\%W_{peak}$) rides resulted in T_{lim} of 24.61 ± 9.29 min (range = 15.02 - 38.87 min) and 7.67 ± 4.08 (range = 3.65 - 15.57 min), respectively. The mean $\dot{V}O_2$ at exhaustion for $CP_{-10\%}$ (3.086 ± 0.995 L \cdot min⁻¹), but not $CP_{+10\%}$ (3.511 ± 1.170 L \cdot min⁻¹), was significantly lower than $\dot{V}O_{2peak}$ (3.488 ± 1.060 L \cdot min⁻¹). Two of the 12 subjects at $CP_{-10\%}$ and 9 of the 12 subjects at

$CP_{+10\%}$ reached $\dot{V}O_{2peak}$ at exhaustion. The $\dot{V}O_2$ increased for all 12 of the subjects from 3 min to T_{lim} at $CP_{-10\%}$ and for 9 of the 12 subjects at $CP_{+10\%}$. At $CP_{+10\%}$, there was no change over time for 3 of the 12 subjects and the $\dot{V}O_2$ was maintained within 3% of $\dot{V}O_{2peak}$. The EMG AMP increased for 6, decreased for 4, and did not change for 2 of the 12 subjects at $CP_{-10\%}$. At $CP_{+10\%}$, 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 $\dot{V}O_{2peak}$ at $CP_{-10\%}$. 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 $\dot{V}O_2$ 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

ILIAS ZACHAROGLIANNIS, Paradisis Georgios, Papavasiliou Thomas, Poulos Stellios, Piliandis Theofilos, Zacharogianni Aggeliki. National and Kapodistrian University of Athens, ATHENS, Greece.

(No relevant relationships reported)

Since relative maximum heart rate (%HRmax) correlates highly ($r \geq 0.98$) with relative maximum oxygen uptake (% $\dot{V}O_{2max}$) 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 % $\dot{V}O_{2max}$ for training and racing purposes by knowing only the value of HRmax. The effect of equal cycle and running training (Triathlon) on the relationships of the %HRmax with % $\dot{V}O_{2max}$ for cycle and running exercise is not clear. **Purpose:** The purpose of this study was to examine the relationships among %HRmax and % $\dot{V}O_{2max}$ in trained triathletes during running and cycling exercise. **Methods:** Sixteen male trained triathletes (33.2 ± 4.3 yr 78.61 ± 3.42 kg, 12.6 ± 1.8 % body fat) performed an incremental maximal exercise test to exhaustion on cycle ergometer (30-watt increment 3min stages) and on a treadmill (1km \cdot h⁻¹ increment 3min stages) with 3-4 days apart. Individual linear regressions based on HR and $\dot{V}O_2$ values measured of each stage and maximum, were used to calculate slopes and intercepts, to predict % $\dot{V}O_{2max}$ from %HRmax, for given exercise intensities (50, 60, 70, 80, 90 and 100%HRmax). **Results:** Mean prediction \pm sd of the % $\dot{V}O_{2max}$ 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 ± 4.37 v 51.65 ± 4.54 ; 80%: 71.59 ± 3.03 v 67.45 ± 4.07). The prediction of the running % $\dot{V}O_{2max}$ 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% $\dot{V}O_{2max} = 0.738 * \%HRmax + 26.67$ and Cycle% $\dot{V}O_{2max} = 0.620 * \%HRmax + 37.85$ ($R^2 = 0.99$). Mean % $\dot{V}O_{2max}$ 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 R. Turley, FACSM. Harding University, Searcy, AR. (Sponsor: Kenneth R. Turley, FACSM)

(No relevant relationships reported)

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

Purpose: This study's purpose was to determine if an individual could perform the test correctly using only 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, when the values of the individuals 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 mathematical 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 must be taken by both a 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.

2742 Board #25 June 1 2:00 PM - 3:30 PM
Ramp Incremental Cycling Protocol Underpredicts VO_{2max} in Sedentary Normal-Weight and Overweight/Obese Adults

Avigdor D. Arad¹, Kaitlyn Bishop¹, Peter Adintori¹, Deena Adimoolam¹, Jeanine B. Albu¹, Fred J. DiMenna². ¹ICAHN School of Medicine at Mount Sinai, Mount Sinai Hospital, New York, NY. ²Teachers College Columbia University, New York, NY.
 (No relevant relationships reported)

The maximum rate of oxygen consumption (VO_{2max}) is the gold-standard index for assessing cardiorespiratory fitness. The presence of a VO_2 /work-rate plateau at the highest work rates during incremental testing represents the primary way to confirm that a "true VO_{2max} " was attained; however, such a plateau is often lacking. Instead, VO_{2max} is often confirmed using "secondary criteria" based on arbitrarily-determined values for heart rate, RPE, RER and/or blood-lactate concentration. A constant-work-rate "verification bout" can also confirm VO_{2max} ; however, support for this practice comes predominantly from studies performed on recreationally-active/athletic populations. **PURPOSE:** To compare the peak VO_2 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⁻¹) to limit of tolerance on a lower-body ergometer followed (10 minutes) by constant-work-rate cycling to limit of tolerance at the highest work rate attained. **RESULTS:** Intraclass correlation coefficient (.980) and coefficient of variation ($4.64 \pm 3.69\%$) indicate good reliability for peak VO_2 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 $\geq 2\%$ above that derived from incremental testing. This implies that incremental testing does not reveal a true VO_{2max} for a substantial proportion of these subjects. However, the peak incremental response would have been accepted as VO_{2max} 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. Indeed, despite the lower peak VO_2 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 VO_{2max} in normal and overweight/obese sedentary adults. Use of secondary criteria resulted in false VO_{2max} acceptance in 32% of subjects.

2743 Board #26 June 1 2:00 PM - 3:30 PM
Ultrasonic Device as a Novel Method for Assessing Muscular Power During Vertical Jump

Mario Leone¹, Maxime Allisse¹, Patrick Desjardins¹, Alain Steve Comtois², Hung Tien Bui¹. ¹University of Quebec in Chicoutimi, Chicoutimi, QC, Canada. ²University of Quebec in Montreal, Montreal, QC, Canada.
 (No relevant relationships reported)

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 methods based on time-of-flight offer a good compromise but are dependent on the take-off and landing positions. To alleviate this constraint, we propose a novel method of assessing vertical jump height using a low cost ultrasonic ranging technology. The proposed method consists of placing the system on the ceiling and continuously measuring the distance to the closest body part (head). The purpose of this study is to demonstrate the proposed principle and determine its validity. **Methods:** The validity of the device was tested both in a static and a dynamic context. Static tests were performed by placing the ultrasonic sensor at 10 known distances from the top of the participant's head, ranging from 20cm to 110cm. Average and maximum errors were calculated. In the dynamic portion of the test, a participant was asked to perform 5 test jumps and to land in the same position as the one during take-off. The height of each jump was evaluated using both a time-of-flight device and the proposed method. The measurements from both devices were compared using the Student t-test for repeated measures. **Results:** No significant differences were observed between the proposed

method (22.1 ± 3.1 cm) and the time-of-flight method (22.6 ± 3.1 cm). 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 polynomial curve-fitting in order to filter 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 to time-of-flight methods.

2744 Board #27 June 1 2:00 PM - 3:30 PM
Comparison of Physiological Stress in Two Different Step Test Exercise Protocols in Elderly People.

Lutz Baumgärtel, Martin Weigert, Nico Nitzsche, Christiane Lösch, Henry Schulz. Chemnitz University of Technology, Chemnitz, Germany.
 (No relevant relationships reported)

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 (VO_2) 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 (67 ± 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 (spm), every two minutes, from 10 to 30 spm). 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 spm. HR, VO_2 , blood lactate (La) and evaluation of perceived exertion (RPE) was recorded before (T_{Rest}), at the end of each stage ($T_1 - T_5$) and three minutes afterwards ($T_{Recovery}$). For 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 T_{Rest} , T_1 , T_2 and T_4 ($0.23 - 0.38$ mmol/l), the highest differences were found in T_3 , T_5 , and $T_{Recovery}$ with $0.52 - 0.66$ mmol/l. The VO_2 differs about $0.9 - 2.3$ ml/min/kg, with the highest amount in T_5 , RPE was significantly higher at T_2 in P2 (Wilcoxon $p < 0.05$).

CONCLUSION

The measured differences are close to the expected day by day variations in step tests. Despite the 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.

2745 Board #28 June 1 2:00 PM - 3:30 PM
The Reliability of the Anaerobic Dummy Throw Test in High School Wrestlers: A Pilot Study

Eric Lopez¹, Abigail Larson¹, Ryan Luke², Chad Harris, FACSM³, Kent J. Adams, FACSM², Mark DeBeliso, FACSM¹. ¹Southern Utah University, Cedar City, UT. ²California State University Monterey Bay, Seaside, CA. ³Metropolitan State University of Denver, Denver, CO. (Sponsor: Mark DeBeliso, FACSM)
 (No relevant relationships reported)

Anaerobic power (AP) output is an important physical characteristic that is required to succeed in sports such as wrestling. The Wingate test is considered the Gold Standard for assessing AP but is not specific to the sport of wrestling. **PURPOSE:** The purpose of this study was to examine the reliability of a novel field test known as the Lopez Dummy Throw Test (LDTT) 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 (WU) that included three practice dummy throw attempts (dummy mass = 31.75 kgs). Following the dynamic WU (≈ 5 minutes), the participants performed two trials of the LDTT. In order to perform the LDTT, 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 waist of the dummy and on the signal "go" the wrestlers quickly exploded up, lifting the dummy by getting triple extension with the ankles, knees and hips as one would in a power clean. After the wrestler was fully extended, he turned in midair in order to drive the dummy onto its stomach on the ground, where the wrestler was on top of the back of the dummy (a common position after an opponent has been thrown). The participant then repositioned the dummy to the original position to execute another throw. The participants completed as many dummy throws as possible during the one minute trials. The LDTT trials were separated by 15 minutes. **RESULTS:** The trial scores were 15.6 ± 2.5 and 17.2 ± 1.5 throws respectively. The interclass and intraclass reliability coefficients were $r=0.84$ and $ICC=0.80$. The standard error of the measure was $SE_m=1.0$ throws with 90% confidence limits of $U_L: 1.7, L_U: 0.7$. The mean difference between trials was 1.6 ± 1.4 throws (90% confidence limits of $U_L: 2.4, L_U: 0.8$). Bland-Altman plots suggested agreement between trials with no evidence of heteroscedasticity. **CONCLUSION:** The LDTT exhibits moderate to high reliability as an assessment of AP. 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.

2746 Board #29 June 1 2:00 PM - 3:30 PM
Test-retest Reliability of Velocity Assessments for Free Weight and Machine Exercises
 Karolina J. Koziol, Ryan M. Miller, Eduardo D. S. Freitas, Aaron D. Heishman, Japneet Kaur, Michael G. Bembem, FACSM. *The University of Oklahoma, Norman, OK.* (Sponsor: Dr. Michael G. Bembem, FACSM)
 (No relevant relationships reported)

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 Fitrodyne 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 183.1 ± 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 $n = 30$, \bar{x} leg press = 189.5 ± 49 kg and bench press 66.8 ± 32.4 kg; females $n = 15$, \bar{x} leg press = 163.2 ± 33.3 kg and bench press = 40.9 ± 13.8 kg; males $n = 15$, \bar{x} 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 (70-80% 1RM), especially for the leg press compared to the bench press. Additionally, males had slightly stronger test-retest correlations compared to the females.

2747 Board #30 June 1 2:00 PM - 3:30 PM
Development and Validation of an Equation to Estimate Peak Power from Vertical Jump in Youth
 Matthew T. Mahar, FACSM¹, Gregory J. Welk, FACSM², Patrick M. Rider³, Michael J. Duncan⁴. ¹San Diego State University, San Diego, CA. ²Iowa State University, Ames, IA. ³East Carolina University, Greenville, NC. ⁴Coventry University, Coventry, United Kingdom.
 (No relevant relationships reported)

Lower body muscular power is related to bone density in youth and is therefore a component of health-related physical fitness. **PURPOSE:** To develop and validate an equation to estimate peak power from vertical jump performance, body mass, age, and sex. **METHODS:** Peak power (PP) and vertical jump (VJ) were assessed on 217 youth between the ages of 9 and 18 years (mean = 14.5 ± 2.5 years). Two samples were combined for analyses. In one sample VJ was assessed with a Vertec and PP was assessed with a triaxial force plate. In the other sample, PP and VJ were assessed with a Quattro Jump Portable Force Platform System. Participants performed three maximal effort countermovement jumps. The highest of the three trials was used for statistical analyses. Multiple regression analysis was used to develop an equation to predict PP on a random sample of two-thirds of participants ($n = 145$). The resulting equation was cross-validated on the remaining one-third ($n = 72$). Two previously

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:** Results from 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). A small mean bias was observed for the Sayers et al. ($p = .04, ES = 0.08$) and Duncan et al. ($p < .01, ES = 0.15$) equations, but not for the new equation ($p = .98, ES = 0.00$). **CONCLUSIONS:** The following equation developed on the entire sample ($N = 217$) can be used to estimate PP: Watts = $-1613.26 + (59.54 * VJ [cm]) + (34.89 * \text{body mass [kg]})$, $R = .95, SEE = 414$ 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.

2748 Board #31 June 1 2:00 PM - 3:30 PM
Countermovement Jump Reliability when Performed With and Without an Arm Swing in NCAA Division 1 Basketball Players
 Aaron D. Heishman, Ryan M. Miller, Eduardo D.S. Freitas, Japneet Kaur, Bianca A.R. Galletti, Karolina J. Koziol, Michael G. Bembem, FACSM. *University of Oklahoma, Norman, OK.* (Sponsor: Michael Bembem, FACSM)
 (No relevant relationships reported)

The countermovement jump (CMJ) is routinely used to quantify adaptations 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 1 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: $ICC=0.442, CV=25.8\%$) 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.

2749 Board #32 June 1 2:00 PM - 3:30 PM
Characterizing The Ventilatory Response To Constant Load Exercise Above And Below Critical Power
 Keren Constantini, Cameron A. Nowrouzi, Courtney E. Wheelock, Robert F. Chapman, FACSM. *Indiana University, Bloomington, IN.* (Sponsor: Robert F Chapman, FACSM)
 (No relevant relationships reported)

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 in 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 workloads 10% below and above CP. **Methods:** Ten highly trained subjects (6M/4W; age: 24 ± 4 yrs; height: 1.76 ± 0.10 m; weight: 66.3 ± 9.1 kg; VO_{2max} : 59.1 ± 7.3 ml/kg/min) performed a ramp incremental test, a 3MT (275 ± 75 W), and two constant load cycling trials to exhaustion at 10% below (CP_{-10}) and 10% above (CP_{+10}) 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 CO_2 ($P_{et}CO_2$), ventilatory equivalents for O_2 (VE/VO_2) and CO_2 (VE/V_{O_2})] and metabolic

parameters, dyspnea and arterial oxyhemoglobin saturation (SpO₂) were compared at 25, 50, 75 and 100% of time to exhaustion (TTE) within each trial. The same variables were compared between CP₋₁₀ and CP₊₁₀ at exhaustion.

Results: TTE was 1215 ± 396 and 288 ± 95 s for CP₋₁₀ and CP₊₁₀, respectively. Within each constant load trial heart rate, fb, VE/VO₂, and VE/VCO₂ were significantly ($p < 0.05$) higher and PetCO₂ significantly ($p < 0.05$) lower at 75 and 100% compared to 25% of TTE. During CP₊₁₀ VE, TV, VO₂ were also different ($p < 0.05$) between 75 and/or 100% compared to 25% TTE. However, measured variables were not different at 75 and 100% of TTE within each trial indicating a delayed steady state was achieved at both CP₋₁₀ and CP₊₁₀. VE, TV, PetCO₂, VE/VCO₂, SpO₂, VO₂ were different ($p < 0.05$) at exhaustion between CP₋₁₀ and CP₊₁₀.

Conclusion: Despite reaching different values at exhaustion, ventilatory parameters stabilized during exercise at 10% below and above CP. Furthermore, subjects reached exhaustion, on average, within <25 min at CP₋₁₀, suggesting CP may be overestimated in highly trained subjects when CP is defined using the 3MT.

2750 Board #33 June 1 2:00 PM - 3:30 PM

Evaluation Of The Accuracy Of The ACSM Walking Metabolic Equations During The Bruce Protocol

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

(No relevant relationships reported)

Evaluation of the Accuracy of the ACSM Walking Metabolic Equations During the Bruce Protocol

Kayla E. Brennan, Patricia I. Fitzgerald, Kristofer S. Wisniewski, 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). **PURPOSE:** 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 mean measured values ± SD of stages 1-3 were 16.3 ml/kg/min and 15.5 ± 1.8 ml/kg/min ($p < 0.05$), 24.7 ml/kg/min and 22.3 ± 2.3 ml/kg/min ($p = 0.0001$), and 35.6 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 44 (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.

2751 Board #34 June 1 2:00 PM - 3:30 PM

Reproducibility of Force-Velocity Test Outputs Using 10-s Sprints Against Different Braking Forces

João Valente-dos-Santos¹, Ricardo Rebelo-Gonçalves², Diogo V. Martinho², João P. Duarte², Daniela Costa², Paulo Sousa-e-Silva², Vítor Severino², Vasco Vaz², Rui S. Gonçalves³, Antonio Tessitore⁴, António Figueiredo², Manuel J. Coelho-e-Silva².

¹Faculty of Physical Education and Sport, Lusófona University of Humanities and Technologies, Lisboa, Portugal. ²CIDAF (UID/DTP/04213/2016), University of Coimbra, Coimbra, Portugal. ³School of Health and Technology, Polytechnic Institute of Coimbra, Coimbra, Portugal. ⁴University of Rome Foro Italico, Rome, Italy.

(No relevant relationships reported)

PURPOSE: The current study was aimed to examine the reproducibility of estimated peak power (PP) and estimated pedal 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 (23.50±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 derived. The short-term power outputs were assessed from the force-velocity test (FVT), using a friction-braked ergometer on two repeated occasions. Differences between repeated measurements were examined with paired t-test and effect sizes calculated. **RESULTS:** Mean values for session 1 (898 Watt, 142 rpm) and session 2

(906 Watt, 142 rpm) did not differ ($p > 0.05$). Moreover, test-retest procedure evidenced reasonable intra-individual stability for estimated PP output. Technical error of measurement (TEM) was 31.9 Watt; % coefficient of variation (CV) was 3.5% and intra-class correlation coefficient (ICC) was 0.986. For PV, TEM was 5.4 rpm, %CV was 3.8 and ICC was 0.924. **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 (FVT) and measured outputs using the Wingate Anaerobic Test protocol using the optimal load from the FVT.

Supported by FCT Grants SFRH/BPD/100470/2014, SFRH/BD/101083/2014 and SFRH/BD/121441/2016.

2752 Board #35 June 1 2:00 PM - 3:30 PM

A Validated Model to Predict Maximal Oxygen Consumption Using a 9-minute Walk Test

Taylor Rowley, Chris Cho, Ann Swartz, FACSM, Nora Miller, Scott Strath, FACSM. *University of Wisconsin- Milwaukee, Milwaukee, WI.* (Sponsor: Dr. Scott Strath, FACSM)

(No relevant relationships reported)

Introduction: Assessing maximal oxygen consumption (VO_{2max}) is not always feasible, so alternative testing methods to predict VO_{2max} have been established. The purpose of this study was to assess and validate a field test to predict VO_{2max} 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 VO_{2max}, 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 VO_{2max} 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, VO_{2max} 34.7 ml/kg/min, and RHR 60.5 ± 9.2 bpm. Model 1 included age, gender, and body mass (R²=.717). Model 2 included variables from model 1 entered in step 1, with the addition of gait speed for each 3-min stage (R²=.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 VO_{2max} (R²=.804, RMSE=4.651 ml/kg/min). Bias between the original model and the jackknife sample (R²=.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 VO_{2max}, which is in line with previously published field tests.

2753 Board #36 June 1 2:00 PM - 3:30 PM

Your Activities of Daily Life, YADL_Ballet: An Image-based Survey Technique for Healthy and Injured Dancers

Marijeanne Liederbach¹, Evangelos Pappas². ¹NYU Langone Orthopedic Hospital, New York, NY. ²University of Sydney, Sydney, Australia. (Sponsor: Malachy P. McHugh, FACSM)

(No relevant relationships reported)

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 patient 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 ($p < 0.000$). **METHODS:** 241 elite classical dancers (21.5±5.0 years; 69 men, 172 women) who received regular onsite care consented to participate in pre-season screenings, ongoing PRO monitoring and injury surveillance. Data were 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=0.242, adjusted R²=0.205). **CONCLUSION:** Compliance with personal device image-based survey data capture was excellent, further suggesting that injury prevention screening tactics for dancers should include serial PRO score assessments to predict those at greatest risk for time loss injury. <!--EndFragment-->

2754 Board #37 June 1 2:00 PM - 3:30 PM
The Test-retest Reliability And Learning Effect Of The Modified Ctsib Balance Protocol
 Harold S. Kieffer, FACSM, Paula Johnson, Ashley Carroll, Emily Walter, Emily Brocht. *Messiah College, Mechanicsburg, PA.*
(No relevant relationships reported)

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 (day) 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 ± 0.03 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.

F-53 Free Communication/Poster - Monitoring

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

2755 Board #38 June 1 2:00 PM - 3:30 PM
Adapted Wii Fit Controller for Active Videogaming in Individuals with Mobility Impairments
 Laurie A. Malone, FACSM, Sangeetha Padalabalanarayanan, Mohanraj Thirumalai. *UAB/Lakeshore Research Collaborative, Birmingham, AL.*
(No relevant relationships reported)

Individuals with physical disabilities have few choices for enjoyable physical activity. One option is playing active video games (AVG), but many are inaccessible or offer limited play options. Making AVGs accessible offers an innovative approach to overcoming many barriers to participation. **PURPOSE:** To examine energy expenditure and enjoyment in persons with mobility impairment during AVG play using an off-the-shelf (OTS) and an adapted Wii Fit balance board (WFBB). **METHODS:** Participants completed a functional assessment and familiarization period. Metabolic data (COSMED) were collected during 20-minute baseline, followed by four 10-minute bouts of game play. Participants performed two 10-minute bouts of select Wii Fit Plus games on the OTS and adapted WFBB. During rest participants completed the PACES enjoyment scale. Data were analyzed by player ability game play groups: 1) both boards standing (StdStd), 2) seated OTS board, standing adapted board (xStd), and 3) seated on OTS board only (xSit). **RESULTS:** Sample included 58 participants, 31 men, mean age 41.21 (±12.70) yrs. Energy expenditure (METs) during game play was significantly greater than rest for all players. Only 17 participants (StdStd group) were able to play using the OTS board. During game play on the adapted WFBB average MET values for the three groups on the two game sets respectively were: xSit (n=31) 2.26±0.72, 2.23±0.75 kcal/kg/hour; xStd (n=10) 3.15±1.03, 2.99±1.12; StdStd (n=17) 2.89±0.82, 2.88±0.90. PACES scores indicated that all players enjoyed the AVGs with median scores of 4 on a 5-point scale. **CONCLUSION:** The adapted WFBB provided an opportunity for persons with mobility impairments, including wheelchair users, to engage in AVG. All participants were able to utilize and enjoyed the adapted WFBB activity. Although average MET values achieved during AVG 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 familiarization, 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.

2756 Board #39 June 1 2:00 PM - 3:30 PM
Differences of Skin Temperature during a Treadmill Test in High vs Moderately Fit Male Triathletes
 Jonathan Galan Carracedo¹, Myriam Guerra Balic¹, Andrea Suarez Segade². ¹*Blanquerna, Ramon Llull University, Barcelona, Spain.* ²*Clinical Center, Cornellia, Barcelona, Spain.*
 (Sponsor: Dr. Bo Fernhall, FACSM)
(No relevant relationships reported)

Skin temperature (T_{skin}) 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 exhausting 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 T_{skin}, and the aerobic capacity in high (HT) and moderately fit (MT) male triathletes. Further, we aimed to determine the relationship between T_{skin} peak and cardiorespiratory fitness 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±4.4 ml/kg/min). HT and MT levels were defined by their cardiorespiratory fitness classification (VO₂peak) based on ACSM. T_{skin} (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=.000), T_{skin} peak (p=.026), peak run speed (p=.000), HR (p=.001); VE (p=.000), T_{skin} baseline (p=.003) and were older (p=.004) with higher BMI (p=.000) compared with HT. T_{skin} peak correlated with VO₂peak, age and RER (p<0.05). **Conclusion:** Our data show that higher levels of VO₂ peak 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.

Variables	HT (n=37)	MT (n=55)	p
Age (years)	33±9	39±7 †	.004*
BIM (kg.m-2)	22.9±1.6	24.8±2.1	.000*
Peak run speed (km/h)	7.3±1.4	14.8±1.3	.000*
VO2 peak (ml/kg/min)	57.1±3.4	47.1±4.4	.000*
HR (bpm)	185±9.7	178±8.9	.001*
RER	1.05±0.53	1.04±0.51 †	0.327
VE (l/min)	146.5±19.9	129.1±15.6	.000*
Tskin baseline (°C)	34.55±0.73 ‡	34.06±0.77 †	.003*
Tskin peak (°C)	35.97±0.94	35.45±1.14	.026*
Tskin end (°C)	35.20±1.40 ‡	35.03±1.46 †	0.594
Tskin recovery (°C)	35.97±1.25 ‡	35.55±1.20 †	0.111

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

Variable	Age	BMI	Peak Run	VO2 peak	HR	RER	Tskin Bas	Tskin End	Tskin Rec	
Tskin peak (°C)	r	-0.3	-0.12	-0.269	0.279	0.08	-0.227	0.62	0.903	0.882
	p	.004*	0.256	.009*	.007*	0.43	.030*	.000*	.000*	.000*

* Significant correlation (p < .05)

2757 Board #40 June 1 2:00 PM - 3:30 PM
Use Of Player Worn Sensors To Identify Fatigue During A USA Select National Hockey Development Camp

D Stojanov, K Martel, A Workman, S J. McGregor. *Eastern Michigan University, Ypsilanti, MI.* (Sponsor: Mark Peterson, FACSM)

(No relevant relationships reported)

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 3v3 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, ... 3600s) time domains to determine relevant physiological fatigue factors. DYNA (g's) were determined for time frames longer the AN domain. Peak HR (bpm) 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 ($\alpha = .05$), 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), while P were greater than G for ACC from 300 - 3600 s; ($p < .05$). DYNA were greater for G than P for AN (60 s) and AE (90 - 180; 1200 - 1800 s; $p < .05$) respectively. HR was greater at AE (300 - 1200 s; $p < .05$) domain for P vs G. Non-significant, small effects ($\eta_p^2 = .01 - .042$) were seen for reduced accelerations in the NM (10 s), AN (20-60 s) and AE domains (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 DYNA 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 DYNA 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 DYNA 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

2758 Board #41 June 1 2:00 PM - 3:30 PM
The Accuracy of Wrist-Worn Heart Rate Monitors Across a Range of Exercise Intensities

Paul Hough. *St Mary's University, Twickenham, United Kingdom.*

(No relevant relationships reported)

Purpose: This study investigated the accuracy of four wrist-worn HR monitors (Apple Watch Series 1, Fitbit Charge, TomTom Touch, and Mio Fuse). **Methods:** Eighteen adults completed three trials on a cycle ergometer wearing a chest-worn HR monitor (Polar). Trial 1 established the HR-power output relationship, and resting and maximum HR. In trials 2 and 3, participants were fitted to an electrocardiogram (ECG) and completed a step test consisting of 5 x 3 minute stages at 40 - 80% of HR reserve (determined in trial 1) whilst wearing two wrist-worn HR monitors. **Results:** Relative to ECG, there were no differences in HR between the devices during exercise ($p = 0.239$), and no device × exercise intensity interaction ($p = 0.370$). There were no instances where ECG and Polar data differed by ≥ 5 b·min⁻¹. Conversely, there were two instances (2.2%) with the Apple, four (4.4%) with the Mio, 10 (11.1%) with the TomTom, and 19 (21.1%) with the Fitbit. **Conclusions:** A chest-worn HR monitor offers greater accuracy compared to wrist-worn devices.

2759 Board #42 June 1 2:00 PM - 3:30 PM
Validity And Reliability Of A Shirt-based Integrated Gps Sensor

Gabrielle E. W. Giersch¹, Robert A. Huggins¹, Courtney L. Benjamin¹, William M. Adams², Luke N. Belval¹, Ryan M. Curtis¹, Jussi T. Peltonen³, Yasuki Sekiguchi¹, Douglas J. Casa, FACSM¹. ¹University of Connecticut, Storrs, CT. ²University of North Carolina at Greensboro, Greensboro, NC. ³Polar Electro Oy, Jyväskylä, Finland.

(No relevant relationships reported)

PURPOSE: To examine the validity and reliability of a novel shirt-based 10Hz GPS and inertial movement device (TeamPRO[®], Polar Electro Oy., Finland) for the assessment of distance during linear and agility-based movements.

METHODS: Fifteen male collegiate soccer players (mean± SD, age 20±1 years; height 177.0±7.5 cm; mass 71.57±7.17 kg) volunteered to participate in this study. Subjects performed a linear task consisting of two trials at each velocity: walking 4.8-7.9 km·h⁻¹ (W), jogging 8.0-12.7 km·h⁻¹ (J), running 12.8-20.0 km·h⁻¹ (R), and sprinting >20.1 km·h⁻¹ (S) with timing gates placed at 40m and 100m. Peak velocities were verified using a laser gun. Subjects also performed two trials of an agility task (team-sport simulated circuit, TSSC) through a 120m course, at various velocities, accelerations, decelerations, changes in direction, and stopping. Validity of total distance (TD) during the linear tasks and TSSC were established using the mean difference (MD) and independent t-tests ($p < .05$) compared to criterion measures. Reliability for TD was determined independently during linear and TSSC tasks via coefficient of variation (%CV).

RESULTS: TD during the 40m was significantly less than the criterion measure during the J (MD±SD, -1.04 ±1.18m, $p < .001$), R (-1.48±1.22m, $p < .001$), and S (-2.78±2.99m, $p < .001$). TD during the 100m was overestimated during the W (1.18±1.18m, $p < .001$), but underestimated during the S (-2.28 ±2.63m). With the exception of the S during the 40m (%CV=8.02), the reliability (%CV) of the units for measuring TD during the 40m and 100m tasks was <5% for the W, J, R, and S. The device did not differ compared to criterion (tape measured distance) for TD during the TSSC (0.23±1.15m; $p = 0.339$) with a very small error (<1.0%). TD during the TSSC was found to be reliable (CV=0.96%).

CONCLUSIONS: Overall these results indicate that the novel shirt-based GPS device was a valid measure of TD during the 100m for the R and J velocity zones. As velocity increased, MD for TD was also increasingly underestimated. Reliability data for TD suggest that the shirt-based sensor demonstrated good levels of consistency in all but one linear (40m S) and sport-specific tasks. The practical value of this device for athletes and coaches should be noted despite the statistically significant differences.

2760 Board #43 June 1 2:00 PM - 3:30 PM
Using the Hexoskin Smart Garment to Measure Cardiorespiratory Variables During High Intensity Functional Training

Terence A. Moriarty¹, Yuri Feito, FACSM², Jessica Monahan², Cassie Williamson². ¹University of New Mexico, Albuquerque, NM. ²Kennesaw State University, Kennesaw, GA. (Sponsor: Dr Yuri Feito, FACSM)

(No relevant relationships reported)

Wearable devices are common in the health and fitness industry, and provide valuable information to improve and achieve fitness goals. **Purpose:** The purpose of this pilot study was to compare the Hexoskin smart garment (Hx) to established methods during a maximal graded exercise test (GXT) and a High-Intensity Functional Training (HIFT) session. **Methods:** Eight healthy individuals (31.0 ± 7.6 years, 76.4 ± 11.4 kg; 1.7 ± 0.1 m) volunteered for this study and completed a GXT and a HIFT exercise session. During both testing sessions, respiratory measures [Respiratory Rate (RR), and Respiratory Volume (RV)] were assessed using a portable metabolic system (Cosmed K₄b²; K₄), and heart rate (HR) was determined via ECG in a standard 12-lead configuration. The Hx was worn during both sessions. HR, RR, and RV were collected and monitored continuously at rest (Rt), throughout both exercise bouts (GXT & HIFT) and during cool down (Cd). **Results:** Repeated measures ANOVA revealed significant differences between Hx and K₄ for RR-Rt (15.5 ± 5.3 vs. 33.0 ± 4.8 breaths/min, $p < .0001$) and RR-Cd (29.5 ± 4.8 vs. 44.4 ± 7.0 breaths/min, $p < .0001$) during the GXT, as well as for RV-GXT (57.8 ± 14.9 vs. 77.3 ± 18.2 L/min, $p = 0.004$). During HIFT, HR-HIFT was significantly lower for the Hx when compared to ECG (141.5 ± 36.5 vs. 167.0 ± 13.2 beats/min, respectively; $p = 0.038$). Additionally, differences existed between the Hx and K₄ for RR-Rt (18.4 ± 3.9 vs. 35.6 ± 4.9 breaths/min, $p < .0001$) and RR-Cd (27.8 ± 9.8 vs. 47.7 ± 7.9 breaths/min, $p = 0.001$). **Conclusion:** The results of this pilot study suggest that the Hx smart garment may be suitable to measure cardiorespiratory data during a GXT (i.e. HR & RR) and HIFT bout (i.e. RR & RV). However, additional studies should be conducted to elucidate the differences seen in HR measurement during HIFT.

2761 Board #44 June 1 2:00 PM - 3:30 PM
Not All Are Created Equal: A Meta-Analysis of Wearable Devices for Tracking Physical Activity.
 Jaehun Jung, Chun Wai Leung, Layne Katherine Case, Joonkoo Yun. *Oregon State University, Corvallis, OR.*
(No relevant relationships reported)

TITLE: Not All Are Created Equal: A Meta-Analysis of Wearable Devices for Tracking Physical Activity.

Wearable physical activity trackers have become popular and many vendors introduce various products. Currently, there are more than fifteen vendors competing in a share-market that projected over \$19 billion by 2018. Physical activity trackers are being used in research studies as well as self-monitoring, reinforcement, and measurement. Many previous studies have examined the quality of commercially available devices. However, fragmentary results from individual studies may not help users when selecting physical activity trackers for multiple purposes, including tracking and monitoring their daily physical activity patterns. **PURPOSE:** To compare convergent validity of different commercially available trackers from various vendors using meta-analysis. **METHODS:** Four databases including Medline, were searched using key words representing physical activity tracker, physical activity, and validation studies. Inclusion criteria were the studies examining convergent validity evidence between consumer wearable activity trackers and research graded accelerometers (e.g., ActiGraph GT3X+). Physical activity trackers that had less than two previous independent studies were excluded. A total of 70 studies were identified through the systematic search and thirteen articles met the inclusion criteria, including nine different products introduced by seven different vendors. **RESULTS:** The sample 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 .8, three products demonstrated good validity and had both the mean validity coefficient and CIs were above the criteria. The mean validity coefficients of four products were the above .8, but lower limits of CIs were below the criteria while the mean validity coefficients of two products were below expected value. 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.

2762 Board #45 June 1 2:00 PM - 3:30 PM
Accuracy Of The Polar M430 To Predict VO^2_{max} Using Optical Technology
 Grace Shryack, Joshua Patterson, Olivia Hanzel, Courtney Willoughby, Bryan Smith. *Southern Illinois University - Edwardsville, Edwardsville, IL.*
(No relevant relationships reported)

There are a number of fitness watches currently on the market that can predict VO^2_{max} 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 new technology will accurately estimate VO^2_{max} . **PURPOSE:** The purpose of this study was to compare predicted VO^2_{max} values obtained from the Polar M430 watch (M_{max}) and actual VO^2_{max} values (A_{max}) obtained from indirect calorimetry. **METHODS:** Seven females (age = 24.0 ± 4.5 y, BMI = 26.3 ± 5.9 kg/m²) and fourteen males (age = 24.9 ± 4.5 y, 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. Following the rest, the M430 was then fitted to the participant according to the manufacturer instructions and the resting fitness test was started in order to obtain (P_{max}). A treadmill ramp protocol using indirect calorimetry was used to obtain A_{max} . **RESULTS:** There were no significant differences between M_{max} and A_{max} (48.2±13.5 and 45.3±9.4 ml/kg/min, respectively). In males, there were no significant differences between M_{max} and A_{max} (52.5±13.6 and 50.4±5.8 ml/kg/min, respectively). In females, there were no significant differences between M_{max} and A_{max} (41.8±10.4 and 38.1±10.5 ml/kg/min, respectively). **CONCLUSIONS:** This evidence suggests that the optical technology used in the M430 provides an estimate of VO^2_{max} based upon resting HR that is comparable to a VO^2_{max} obtained via indirect calorimetry. The ability to accurately estimate VO^2_{max} under resting conditions removes many of the barriers that are associated with a true VO^2_{max} test. Removing barriers of a true VO^2_{max} test will allow individuals to quantify and make their training more efficient.

2763 Board #46 June 1 2:00 PM - 3:30 PM
Comparison of Two Heart Rate Technologies to Predict VO_{2max}
 Joshua Patterson, Olivia Hanzel, Grace Shryack, Courtney Willoughby, Bryan Smith. *Southern Illinois University Edwardsville, Edwardsville, IL.*
(No relevant relationships reported)

Currently, there are heart rate (HR) monitors manufactured by Polar® that estimate VO_{2max} from resting conditions. A majority of these monitors measure HR via a wireless chest transmitter but they also have monitors that measure HR via optical sensors that are built directly into the watch. Although the optical sensors have the ability to accurately measure resting HR when compared to a wireless chest transmitter, it is not known if the VO_{2max} estimates from optical sensors are comparable to the values obtained from a wireless chest transmitter.

PURPOSE: The purpose of this study was to compare VO_{2max} estimates obtained from the Polar M430 which utilizes optical sensors (O_{max}) to measure HR to values obtained from the Polar V800 which utilizes a wireless chest transmitter (CT_{max}) to measure HR. **METHODS:** Seven females (BMI = 26.3 ± 5.9 kg/m², age = 24.0 ± 4.6 yrs) and 14 males (BMI = 28.1 ± 5.2 kg/m², age = 24.9 ± 4.5 yrs) reported to the lab and then were instructed to lie in a supine position to rest for 10-min. Following the 10-min rest, participants were fitted with a wireless chest transmitter which was held in place with a chest strap. This transmitter sent HR information to the V800. The M430 was then fitted to the participant's wrist according to the manufacturer's instructions. Once HR values were being displayed on all watches, the resting fitness test was started in order to obtain VO_{2max} values from each watch. At the end of the test, the VO_{2max} values were recorded from the watch.

RESULTS: There were no significant differences between O_{max} and CT_{max} (48.2±13.5 and 48.3±12.9 ml/kg/min, respectively). In males, there were no significant differences between O_{max} and CT_{max} (52.0±14.2 and 51.9±13.8 ml/kg/min, respectively). In females, there were no significant differences between O_{max} and CT_{max} (41.8±10.4 and 42.2±9.2 ml/kg/min, respectively).

CONCLUSIONS: This data shows that there are no significant differences between the VO_{2max} estimates based upon resting HR values obtained from optical sensors (M430) or from a wireless chest transmitter (V800). Although both technologies produce similar estimates of VO_{2max} , this project does not examine the accuracy of these estimates when compared to an individual's actual VO_{2max} .

2764 Board #47 June 1 2:00 PM - 3:30 PM
Comparing Positional Differences In Physical and Performance Assessments Among Acrobatics and Tumbling Athletes
 Nicole J. Uccello, Courtney L. Stack, Michael J. Ryan, Paul D. Reneau, Shinichi Asano. *Fairmont State University, Fairmont, WV.*
(No relevant relationships reported)

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 endurance and strength and cardiorespiratory endurance, was given to each participant. **RESULTS:** The mean value of flexibility (cm ± SD) was significantly higher in tops (T=43.9±2.2, B= 37.5±7.0, $p < .05$). Body Composition (% ± SD) showed a difference between the groups Body composition showed a significant difference ($p < 0.05$) within the tops and bottoms (T=23.7±2.2, B=26.4±2.2, $p < .05$). Muscular strength and endurance, cardiovascular endurance and vertical jump height do not show significant differences. **CONCLUSIONS:** 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.

2765 Board #48 June 1 2:00 PM - 3:30 PM
Accuracy Of VO_{2max} Prediction Using A GPS Watch Following A 15-minute And Three Subsequent Runs
 Andrew G. Pearson, Brandon Bastianelli, Andrea D. Workman, Christopher W. Herman, Jeff Schulz, Andrew Cornett, Rebecca W. Moore. *Eastern Michigan University, Ypsilanti, MI.* (Sponsor: Lanay Mudd, FACSM)
(No relevant relationships reported)

Commercially available GPS sports watches are now able to estimate VO_{2max}. **Purpose:** To examine predicted VO_{2max} from a GPS watch compared to measured VO_{2max}. A secondary purpose was to determine if fitness level affects the ability of the watch to predict VO_{2max}. **Methods:** Twenty-eight participants, (14 M, 14 F; age 18-55 yr) came to the laboratory on two occasions. On day one, participants completed a treadmill graded exercise test to determine measured VO_{2max} (MVO_{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_{2max} (PVO_{2max}). PVO_{2max} was predicted based on subject characteristics, distance, pace, time, and heart rate measured at the radial pulse. Participants were then required to record three additional runs of at least 30 minutes on their own time to produce a modified VO_{2max} (ModVO_{2max}). Participants were separated into two groups determined by MVO_{2max} (high (n=17, VO_{2max} > 50 ml/kg/min) or low (n=11, VO_{2max} < 50 ml/kg/min)). A two-way repeated measures ANOVA was conducted to determine if there was a significant difference among MVO_{2max}, PVO_{2max}, and ModVO_{2max}. A one-way repeated measures ANOVA was conducted to determine if a significant difference in recorded VO_{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_{2max} variables (MVO_{2max}: 55 ± 10 ml/kg/min, PVO_{2max}: 52 ± 5 ml/kg/min, and ModVO_{2max}: 51 ± 6 ml/kg/min, P < 0.05 for all). After participants had been separated by fitness, a significant difference remained between MVO_{2max} and PVO_{2max} (mean difference = 6.9 ml/kg/min, P < 0.05) and MVO_{2max} and ModVO_{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_{2max}. After subjects had been stratified into groups based on measured VO_{2max}, the GPS watch was able to accurately predict VO_{2max} in the low fitness group but was unable to accurately predict VO_{2max} in the high fitness group.

2766 Board #49 June 1 2:00 PM - 3:30 PM
The Validity Of A Commercially-available, Low-cost Accelerometer In A Free-living Setting
 Andrew Newton¹, Ellen Glickman, FACSM², Curtis Fennell³, Jacob E. Barkley². ¹Jacksonville State University, Jacksonville, AL. ²Kent State University, Kent, OH. ³University of Montevallo, Montevallo, AL.
(No relevant relationships reported)

Wearable activity monitors are a popular tool for the measurement of physical activity in the consumer market. However, much of the existing evidence assessing the validity of these commercially-available activity monitors is laboratory-based. Because these monitors will typically be used by consumers outside of a laboratory setting additional research assessing the validity of wearable activity monitors in free-living environments is warranted. **Purpose:** To assess the ability of a low cost, wearable activity monitor marketed to consumer (Movband 3) to measure physical activity behavior in a free-living setting against a previously-validated, research-grade accelerometer (Actigraph GT1M). **Methods:** Sixteen participants (n = five females, 27.0 ± 6.0 years old) were given both the commercially-available Movband (mounted on the wrist) and the research-grade Actigraph (mounted on the waist) to wear over the period of one week during free-living activity. Participants were required to simultaneously wear the two monitors for a minimum of five hours per day on five of the seven days. Participants completed daily diaries indicating the time of day in which the two monitors were worn. Physical activity data from each monitor was then divided by the duration of time participants wore the two monitors. Therefore, physical activity data for each monitor was expressed as activity counts/minute worn for each day. Pearson's correlation analyses were then performed to assess the relationship between counts/minute of the two monitors for each participant individually across all days the two devices were worn for a minimum of five hours. These individual correlation coefficients were then averaged across all participants and presented as a single value. **Results:** There was a large, positive effect size for the association (r = 0.57) between Movband and Actigraph activity counts/minute during free-living activity. In other words, as physical activity counts/minute increased in the Movband, activity also increased in the Actigraph. **Conclusion:** The low-cost, commercially-available wearable activity monitor (Movband) appears to provide a valid assessment of physical activity behavior in a free-living setting.

2767 Board #50 June 1 2:00 PM - 3:30 PM
Validating Heart Rate In The Garmin Vivosmart HR Monitor Versus The Cosmed K4b2 Metabolic Backpack
 Alexandra Lucas. *Coastal Carolina University, Conway, SC.* (Sponsor: George Lyerly, FACSM)
(No relevant relationships reported)

In today's fitness society, the growth of activity monitors is becoming more notable. The Cosmed K4b2 (K4) is one of the most highly accurate systems used to measure heart rate (HR), while the Garmin Vivosmart HR (GV) is one of the newest and more advanced activity monitors on the market. The GV has yet to be tested to prove its accuracy of its heart rate monitor in comparison to the K4B2. With a growing number of people relying on these activity monitors to give them accurate data on their activity levels, it should be known how accurate is the data being given. **PURPOSE:** To determine the accuracy of the heart rate monitor of the GV to that of the K4b2. **METHODS:** 19 individuals wore both the GV and the K4 while walking on a treadmill for 10 minutes. The measures taken were HR on both devices. Prior to exercise, participants had their weight, height, BP, and HR measured. Participants were asked to walk normally and not hold on with GV hand. **RESULTS:** The mean HR for the K4B2 was 102.00 ± 13.77, while GV was 100.26 ± 12.66. **CONCLUSION:** Our data indicated a positive correlation found between the K4B2 and GV with an r-value = 0.550; p-value = 0.022. Thus, the data suggests that the GV is as accurate as the K4 in measuring heart rate. The data also suggests that the GV may be a cheaper alternative to the K4 for tracking HR with researchers. Further testing with a larger population is warranted to help determine the accuracy between both pieces of equipment.

2768 Board #51 June 1 2:00 PM - 3:30 PM
Validation Of Step Frequency Estimation From A Wearable Device On A Treadmill And Indoor Track
 Rhiannon M. Seneli, Stephanie N. Driskell. *St. Ambrose University, Davenport, IA.*
(No relevant relationships reported)

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 volunteers (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.

	Step Frequency (steps·min ⁻¹)				
	Treadmill 6 mph	Treadmill 7 mph	Treadmill 8 mph	Indoor Track Jog	Indoor Track Sprint
Actual	160.0 ± 9.8	165.8 ± 11.4	172.7 ± 12.4	168.7 ± 10.6	213.5 ± 18.0
Garmin	161.6 ± 9.3	166.5 ± 10.8	171.7 ± 12.1	169.1 ± 10.1	206.7 ± 24.5
Significance	.08	.21	.31	.45	.27

Table 1. Mean ± SD of actual step frequency and estimated step frequency from the Garmin wearable device for each of the 5 running trials.

F-54 Free Communication/Poster - Injury/Injury Prevention/Recovery/Rehabilitation

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

2769 Board #52 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, FACSM)

(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 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 (N=9) 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.

2770 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) with no history of an ankle sprain were recruited for this study. Participants were randomly divided into three groups (hot, cold, control) and 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 rotation (IE) was measured by an ankle arthrometer. Next, participants received the intervention of their assigned group. After the intervention, another measurement was taken. Three trials of each measurement was taken and averaged. Data were analyzed using a repeated measures ANOVA among the three groups between the pre-and post-measurements. **RESULTS:** A significant time by group interaction was found for AD (p=0.004), but not IE (p=0.859). In the AD direction, there was a significant increase in ligament laxity in the hot group and a significant decrease in ligament laxity in the cold group. However, no changes were detected in the IE direction in any groups. **CONCLUSION:** As expected, the application of heat increased tissue pliability while cold decreased it. However, changes were only found in the AD direction but not the IE direction. Ankle joint motion can be restricted by both ligaments and muscles. Perhaps, alterations from temperature changes differ among different tissue types. However, further research is necessary to determine the molecular changes in different types of tissue (connective, muscular) with temperature changes.

Means, SD, and p-values among groups						
	Pre-AD (mm)	Post-AD (mm)	p-value	Pre-IE (degrees)	Post-IE (degrees)	p-value
Hot	8.97 ± 2.71	9.77 ± 2.92	0.029	43.75 ± 11.49	44.22 ± 12.67	0.613
Cold	9.28 ± 2.43	8.54 ± 2.65	0.023	41.67 ± 11.94	41.48 ± 10.73	0.875
Control	9.30 ± 3.34	9.36 ± 3.40	0.767	45.59 ± 13.14	46.54 ± 10.82	0.703

2771 Board #54 June 1 3:30 PM - 5:00 PM
Artificial CO₂-water Leg-bath Facilitates Recovery From Muscle Hardness Caused By Resistance Exercise

Noriyuki Yamamoto¹, Tadashi Wada², Fumiko Takenoya³, Masaaki Hashimoto⁴. ¹*Japanese Red Cross Hokkaido College of Nursing, Kitami, Japan.* ²*Kokushikan Univ., Tokyo, Japan.* ³*Hoshi Univ., Tokyo, Japan.* ⁴*Teikyo. Univ. Sci., Tokyo, Japan.* (No relevant relationships reported)

Facilitation of the blood stream and oxygen consumption of the muscle by a local immersion of the extremities into high concentration carbon dioxide water (CO₂-water, CO₂≥1000ppm), suggests an improvement of muscle performance and joints flexibility. **PURPOSE:** In the present study, we investigated whether the immersion of extremities including agonist muscles into artificially made CO₂-water influenced recovery of the increased muscle hardness induced by a resistance exercise. **METHODS:** The healthy male college students (n=11, age; 18-19 yrs, height; 168.6±4.5 cm, weight; 66.2±9.3 kg) participated in this study. The subjects performed 100 times calf raise resistance exercise and immersed lower legs into tap-water or artificial CO₂-water at 35 °C for 10 minutes immediately after the exercise. Blood flow in the immersed skin (BF_{skin}) and electrocardiogram (ECG) were recorded continuously throughout the experiment. Hardness of the gastrocnemius medialis (MG) was evaluated using ultrasound real-time tissue elastography. Visual analog scale test on muscle pain (VAS) and muscle hardness measurements were performed at 3 time points (prior to exercise, immediately after exercise, at 10 min after exercise). The strain ratio (SR) between the MG and a reference material was calculated. **RESULTS:** BF_{skin} in the CO₂-water leg-bath was significantly higher than that in the tap-water leg-bath (CO₂-water vs. tap-water, 5.5±1.8 vs. 2.1±1.2 ml·min⁻¹·100g⁻¹, p<0.05). At 10 min after exercise, CO₂-water treatment compared with the tap-water treatment, SR decreased significantly quicker (1.37±0.28 vs. 0.67±0.08, p<0.05). In addition, VAS at recovery 10 min became smaller in the CO₂-water than the tap-water (18.1±10.2 vs. 33.9±16.2 mm, p<0.05). **CONCLUSIONS:** We reported previously that the muscle blood flow in the immersed part was larger in CO₂-water than tap-water of a same temperature. In addition to a local effect of CO₂, suppression of muscular sympathetic activity may also contribute to the increase in local blood flow. Facilitation of muscle hardness recovery shown in this study might be caused by the increased muscle blood flow. The present study suggested that high concentration artificial CO₂-water immersion may contribute to rapid recovery from the high intensity exercise-induced muscle fatigue.

2772 Board #55 June 1 3:30 PM - 5:00 PM
Cold-Water Immersion Attenuated Muscle Soreness after Plyometric Training while having no Impact on Sprint Performance.

Michael J. Ryan, Courtney Webb, Shinichi Asano, Paul Reneau. *Fairmont State University, Fairmont, WV.* (No relevant relationships reported)

PURPOSE: This study aimed to test the effectiveness of lower body cold-water immersion (CWI) on Delayed Onset Muscle Soreness (DOMS) and sprint performance after acute plyometric exercise in Division II athletes. **METHODS:** Female (n=12) and male (n=6) Division II athletes, aged 20.6 ± 1.3 (n=18) were asked to perform two maximal 40-yard (36.58m) dash trials. After which the times were averaged together to determine a pre-treatment value. 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 and the experimental group (CWI) sat submerged to their waste 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 perceived muscle soreness on the same VAS. For the post-treatment values, participants performed the same warm-up, 40-yard dash trials, and cool-down. All procedures were approved by Fairmont State University's IRB and informed consent was given by each participant. **RESULTS:** The average VAS for muscle soreness increased (p≤0.05) from pre-workout (1.2 ± 0.42) to post-workout (2.2 ± 0.43) to 48hrs post workout (6.4 ± 1.8). The 48hrs post workout Con group also reported greater (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 (p≤0.05) found between the Con or CWI group in the pre-treatment 40-yard dash (5.66 sec ± 0.47 vs 5.53 sec ± 0.53). Furthermore, there was no significant

difference ($p \leq 0.05$) found between the Con or CWI group in the post-treatment trials ($5.52 \text{ sec} \pm 0.52$ vs $5.57 \text{ sec} \pm 0.53$). **CONCLUSIONS:** Forty-eight hours after high-intensity plyometric training, perceived 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.

2773 Board #58 June 1 3:30 PM - 5:00 PM
Effects of Two Maximal Isometric Contractions Attenuate Eccentric Exercise-induced Muscle Damage on Surface Electromyographic Activity

Ming-Ju Lin¹, Chin-Yun Huang², Jia-Jhen Cai¹, Jia-Wei Chen¹, Ching-Fei Wang¹, Yu-Wei Hsu¹, Fu-Chen Yang¹. ¹National Chiayi University, Chiayi County, Taiwan. ²Nanhua University, Chiayi County, Taiwan.

(No relevant relationships reported)

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 sporting injuries to clarify whether non-damaging exercise of MVC can be attenuated muscle damage induced by MaxECC of knee flexors (KF). **PURPOSE:** This study investigated the neural factors (surface electromyography, EMG) of two maximal isometric contractions (2MVC) at 20° knee flexion on changes in indirect muscle damage markers following 60 MaxECC of KF performed 2 days later. **METHODS:** Sixteen untrained young males were randomly placed into the control group (CON) that did not perform 2MVC, or the experimental group (2d, n = 8 per group) who performed 2MVC 2 days before MaxECC. Changes in muscle soreness (SOR), non-dominant upper thigh circumference (CIR), resting knee angle (RANG), maximal voluntary isokinetic concentric contraction (MVC-CON), and surface EMG [median frequency (MF), root mean square (RMS)] before, immediately after, and 1-5 days after MaxECC were compared between groups by a mixed-design of two-way ANOVA. **RESULTS:** 1) Significant ($p < .05$) changes in some dependent variables after 2MVC compared to baseline for the 2d group; 2) Changes in the muscle damage variables (e.g. MVC-CON: -13.1%; CIR: +1.5 mm) following MaxECC immediately for the 2d group were smaller than CON group (-22.4%; +4.8 mm); 3) Changes in the surface EMG activity following MaxECC for the 2d group showed smaller changes (MF: 60.2 ± 9.1 Hz) than CON group (70 ± 13.2 Hz). **CONCLUSION:** These results suggest that protective effect conferred by non-damaging exercise of 2MVC against subsequent MaxECC-induced muscle damage is likely to be related to neural adaptations. Therefore, the RBE protocol of this study may provide some useful information for men to minimize muscle damage when they start to participate exercise. It is also required to further understand the underpinning mechanisms of the repeated bout effect in both physiological and pathological contexts.

2774 Board #57 June 1 3:30 PM - 5:00 PM
Systemic and Local Alterations in Extracellular RNA (exRNA) Following Traumatic Knee Injury Implicate Catabolic and Inflammatory Pathways

Anthony J. Griswold, Natalia K. Hofmann, Thomas M. Best, Jeffery M. Vance, Margaret A. Pericak-Vance, Lee D. Kaplan. University of Miami, Miami, FL. (Sponsor: Thomas Best, FACSM)

(No relevant relationships reported)

Traumatic injuries are strong risk factors for future osteoarthritis (OA) of the knee. Molecular changes initiated soon after the trauma may lead to this increased susceptibility. Identification of these pathways could lead to early intervention and potential limitation of damage. One such mechanism may be the release of RNA molecules by the affected tissues.

PURPOSE: This study set out to characterize systemic extracellular RNA (exRNA) by characterizing RNA from plasma following traumatic injury.

METHODS: Our cohort consisted of 14 subjects (ages 19 to 47) undergoing ACL and/or meniscal repair surgery (0.5 to 180 months post injury). Radiograph analysis found no existing OA at the time of surgery, though Outerbridge chondral damage assessment indicated average scores across four knee compartments ranging from 0-1.25. Plasma was isolated from whole blood via centrifugation to remove cells and platelets.

Total RNA was extracted from .05mL of plasma and analyzed via massively parallel sequencing for quantification and characterization of exRNA. Generalized linear models were used to identify RNA differentially present in low vs high (0.5) average Outerbridge scores and acute vs chronic duration of injury (4 months).

RESULTS: exRNA profiles indicated more than 10,000 types of RNA present including fragments of protein coding genes and miRNAs. Profiles were consistent across the samples with no differences when comparing Outerbridge scores or injury

duration. There was noted expression of inflammatory genes (*CXCL5*, *CCL5*, and *IL16*), catabolic genes (*MMP -21*, *-17*, and *-13*, and *ADAMTS8*), and previously reported miRNA biomarkers of arthritis (*MIR16*, *MIR20b*, and *MIR146a*).

CONCLUSIONS: There is an unmet need for determining the etiology and potential novel treatment approaches in patients with knee trauma to mitigate future progression of OA. This study demonstrates that exRNA can be isolated and characterized from plasma in a high throughput manner. Our results indicate that plasma from subjects with injured knees contains inflammatory, catabolic, and potential arthritic biomarkers. Future studies are required to more fully characterize the biological roles of these exRNA and the timing and cadence of their respective release that may lead to translational treatment options for patients with post-traumatic OA.

2775 Board #58 June 1 3:30 PM - 5:00 PM
Effects of Isometric Contractions on Eccentric Exercise-induced Muscle Damage of the Knee Extensors

Kun-Xian Lin¹, Hsiu-Hua Wang², Kuo-Wei Tseng¹, Wei-Chin Tseng¹, Ming-Ju Lin³. ¹University of Taipei, Taipei City, Taiwan. ²National Chung Cheng University, Chiayi County, Taiwan. ³National Chiayi University, Chiayi County, Taiwan.

(No relevant relationships reported)

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 60 maximal isokinetic (30°/s) eccentric exercise (MaxEC). Changes in maximal isokinetic contraction torque (MVC-CON), 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 ($p < .05$). The changes in all variables after MaxEC 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.

2776 Board #59 June 1 3:30 PM - 5:00 PM
Nitric Oxide Donor Treatment Affects Skeletal Muscle Myeloperoxidase And Fibronectin After Contusion Injury In Rats

Kathryn H. Myburgh, FACSM, Christopher Reeves, Carine Smith. Stellenbosch University, Stellenbosch, South Africa. (No relevant relationships reported)

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 gelatine 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 normalized 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 \pm standard deviation. Statistical analysis: Mixed Models ANOVA with post-hoc LSD test. **RESULTS:** MPO peaked five days after injury in placebo (D1: 0.73 ± 0.32 AU; D3: 0.47 ± 0.45 ; D5 8.36 ± 4.92 ; $p < 0.0001$) and NO-treated groups (D1: 1.00 ± 0.23 AU; D3: 0.32 ± 0.29 ; D5 5.57 ± 6.80 ; $p < 0.01$) and resolved by D21 in both groups (Pla: 0.97 ± 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 >1000-fold elevated on D5 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: 3.7 ± 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 enhanced clearance of inflammatory radicals from injured muscle and less secondary injury.

2777 Board #60 June 1 3:30 PM - 5:00 PM
The Effect Of Nitric Oxide Donor Treatment On Skeletal Muscle Repair Following Contusion Injury In Rats
 Tracey Ollewagen, Kathryn H. Myburgh, FACSM. *Stellenbosch University, Stellenbosch, South Africa.* (Sponsor: Prof KH Myburgh, FACSM)
(No relevant relationships reported)

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 effects 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 gastrocnemius of 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=6/group; total n=78). *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 eMHC 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 < 0.001) and new fiber CSA (501 ± 34 μm²) versus other treatments (Plac: 421 ± 27 p < 0.01; L-NAME: 240 ± 38 p < 0.001; Comb: 313 ± 36 μm²; p < 0.001). Picosirius 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 resulting in further 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.

2778 Board #61 June 1 3:30 PM - 5:00 PM
Myotonometric Effect of Foam Rolling Following Strength Training
 Ruediger Reer¹, Jan Schroeder¹, Linda Lueders¹, Mike Schmidt¹, Serge P. von Duvillard, FACSM², Klaus-Michael Braumann¹.
¹University of Hamburg, Hamburg, Germany. ²University of Salzburg, Salzburg, Austria.
(No relevant relationships reported)

Foam Rolling (FR) is widely used as an intervention therapy device to alleviate, treat, and possibly prevent myofasciatic condition in exercise and in high performance sports. Its use may be beneficial on the pressure sensitive muscle tissue via regeneration therapy; however, these effects have not been sufficiently investigated. **PURPOSE:** The aim of this investigation was to assess whether the use of FR may benefit muscle tissue compliance via myotonometric intervention training (MMT) and subsequent muscle regeneration after exhausting high intensity strength training experiment (EXP). **METHODS:** Twenty sport students (7 male and 13 female; age 24.7 ± 2.9 yrs, BMI 22.2 ± 2.4 kg.m²) performed a single exhausting strength training session (leg extension with both legs) followed by FR session (using right leg only). The FR session (2x45s) was conducted again after 24, 48 and 72 hours. The left leg served as a control (CON). Prior to exhaustion and after every FR session, we determined muscle tissue compliance of rectus femoris muscle (MMT). We utilized Hz-frequency analysis to assess tissue compliance. **RESULTS:** The time effect was as follows: (pre: EXP 14.53 ± 1.12, CON 14.37 ± 0.99; post 0: EXP 14.60 ± 1.28, CON 14.63 ± 1.01; post-24: EXP 14.56 ± 1.31, CON 14.25 ± 1.11; post-48: EXP 14.36 ± 1.22, CON 14.33 ± 1.16; post-72: EXP 14.33 ± 1.31, CON 14.25 ± 1.15 Hz). The investigation revealed significant increase in Hz-frequency (greater compliance) immediately post exhausting strength training session but returned to base values day after (P=0.006). There was no significant main effect between EXP and CON (P=0.8). There was also no interaction effect for FR (P=0.399). **DISCUSSION:** Although scientific literature report fatigue and recovery effects; however, we did not find regenerative effects of FR when using MMT. From practical point of view, we were able to document at least partially the regenerative use of MMT immediately after the EXP but we were not able to ascertain that even repeated FR treatment daily will beneficially effect muscle compliance and the desired outcome. Future studies utilizing different dose, duration, and repetitions may yield results that are more promising.

2779 Board #62 June 1 3:30 PM - 5:00 PM
Dysregulated Inflammation And MAPK Signaling In Aged Human Muscle Following Exercise-induced Damage
 Jacob R. Sorensen, Caitlin Skousen, Alex Holland, Kyle Williams, Robert D. Hyldahl. *Brigham Young University, Provo, UT.* (Sponsor: Allen Parcell, FACSM)
(No relevant relationships reported)

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 Biodex 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 multi-plexing 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 (group, p=0.019) that appeared at the later 24 and 72 hour time points. There was also a rapid increase in NF-kb 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 total JNK protein levels increased only in the old (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.

2780 Board #63 June 1 3:30 PM - 5:00 PM
Risk Factors for Knee Arthroplasty in Patients with Knee Osteoarthritis Treated with Hylan G-F 20
 Maria Runa¹, Kevin Ong¹, Edmund Lau², William Daley³, Roy Altman⁴. ¹Exponent Inc., Philadelphia, PA. ²Exponent Inc., Menlo Park, CA. ³Sanofi, Bridgewater, NJ. ⁴University of California, Los Angeles, Los Angeles, CA.
Reported Relationships: M. Runa: Salary; Exponent Inc.

PURPOSE: 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 G-F 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 G-F 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 G-F 20 (hylan G-F 20 or hylan G-F 20 single intraarticular injection) as the only HA therapy. Patients were grouped by treatment with hylan G-F 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 G-F 20 to KA. KA risk factors were determined using multivariate Cox regression adjusted for age, race, region, gender, treatment group, year of HA therapy, Charlson comorbidity index (CCI) score, number of HA courses, arthroscopy, physical therapy, ultrasound use, and prescriptions for non-steroidal anti-inflammatory drugs, opioids, or corticosteroids. **RESULTS:** From 4,027,848 knee OA patients, 62,033 were treated with hylan G-F 20 and/or hylan G-F 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 G-F 20 and/or hylan G-F 20 single intraarticular injection were able to avoid KA at 8 years following their first injection. Risk factors for KA from first hylan G-F 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 G-F 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 G-F 20 treatment, and those who received hylan G-F 20 injections with ultrasound guidance were less likely to receive KA. Funded by Sanofi

2781 Board #64 June 1 3:30 PM - 5:00 PM
Efficient Concentration of Plasma and Platelet-WBC-Rich Plasma Proteins Using a Polyacrylamide Device
 Sean M. Muir, Michael Baria, Natalie Reisbig, Christopher C. Kaeding, FACSM, Alicia L. Bertone. *The Ohio State University, COLUMBUS, OH.* (Sponsor: James Borchers, FACSM)
(No relevant relationships reported)

Concentration of functional proteins has used methods such as dialysis, precipitation, and freeze-drying, which are poorly scalable, not compatible with cell viability, and often damages proteins. Currently, platelet-poor-plasma (PPP) is a discarded waste product of platelet-rich plasma (PRP) and may contain valuable chondrogenic proteins. **PURPOSE:** to determine the efficiency of a novel patient-side method of concentrating plasma and platelet- and white blood cell (WBC)-rich plasma as a potential adjunctive therapy for OA. **METHODS:** A laboratory study was conducted, with IRB and IACUC approval, using residual human clinical plasma (PPP) and equine blood samples. Samples and products were characterized for platelet, WBC, and total protein content then quantified by enzyme-linked immunosorbent assays specific to IGF-1, TGF- β , IL-1ra, and IL-1 β as anabolic and inflammatory mediators to cartilage. **RESULTS:** Plasma total and IGF-1 protein were concentrated by the device in both human ($P<0.001$) and equine ($P<0.0001$) plasma. TGF- β , IL-1 and IL-1ra were very low in plasma. The polyacrylamide concentrator device highly concentrated platelets, WBCs, and plasma proteins over PRP and whole blood, most dramatically TGF- β ($P<0.001$; 29-fold over blood) and IL-1ra ($P<0.001$; 70-fold over plasma) resulting in a >2000 -fold increase in IL-1/IL-1ra ratio over plasma ($P<0.001$) and 1668-fold increase over PRP ($P<0.001$). Interestingly, patients with OA had a lower anabolic protein profile (IGF-1 and TGF- β) and a higher inflammatory-related protein profile (IL-1 β and IL-1ra) compared to healthy equine athletes without OA. This work identified concentrated plasma as a unique resource for IGF-1 not found in PRP and that further protein concentration of PRP can produce greater platelet proteins such as TGF- β and greater anti-inflammatory proteins such as IL-1ra. **CONCLUSION:** the polyacrylamide device efficiently concentrated plasma and PRP proteins and is commercially available as an injectable biotherapy.

2782 Board #65 June 1 3:30 PM - 5:00 PM
Hip Muscle Strength Analysis of Individuals with Chronic Low Back Pain
 Minjia wang, Yushi Hu, Yuanpeng Liao, Kaiwen Li, Siqi Song, Xiaofan Pang. *Chengdu Sport Institute, Chengdu, China.*
(No relevant relationships reported)

Chronic Low back pain (CLBP) is a common clinical disease, and most individuals require 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 \pm 1.5 years, 34 males and 30 females, body weight: 66.5 \pm 3.7kg) were recruited as C group (experimental group), while 29 health subjects (age: 39.2 \pm 1.8 years, 16 males and 13 females, body weight: 64.8 \pm 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 (Contrex System Top) to test the hip isokinetic muscle strength. Analysis the differences between C group and Y group, and the differences between the CLBP ones with different degree of pain (according to the VAS). **RESULTS:** 1) There were no differences of hip flexor, extensor or abductor between C group and Y Group ($P>0.05$); 2) Hip flexor/ extensor ratio (isokinetic strength) of C group were significant 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 compares with the flexor, and this also indicate the coordination of these two muscle groups maybe decrease 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, according VAS score, the strength of flexor, extensor and abductor of mild ones (VAS 0-3) were significantly higher than moderate ones (VAS 4-7) ($P<0.05$), 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 compares with the flexor, and this indicate the coordination of these two muscle groups maybe decrease in the CLBP ones; And the more pain of CLBP, these muscle strength decrease more.

2783 Board #66 June 1 3:30 PM - 5:00 PM
High Incidence Of Lumbar Intervertebral Disk And A Possible Risk Factor For Collegiate Weightlifters
 Kenshiro Ohya¹, Koichi Nakazato¹, Koji koyama², Kazuo Funato¹, Naoyuki Kobatake¹, Toshiya Kita¹, Seiji Kubo¹, Fukuji Goto¹, Kenji Hiranuma¹. ¹*Nippon sport science university, tokyo, Japan.* ²*Tokyo Ariake University of Medical and Health Science, tokyo, Japan.*
(No relevant relationships reported)

Weightlifters experiences high mechanical stresses in their lumbar region. The intervertebral disks act as shock absorbers between each of the vertebrae in the spinal column. The disks of weightlifters may be injured by repetitive overload during weightlifting maneuvers. Previous studies have shown that excessive trunk rotation is a major risk factor for lumbar intervertebral disk degeneration (LIDD) in athletes. Although trunk rotation is not included in most weightlifting maneuvers, we hypothesized that there would be a high incidence of LIDD in collegiate weightlifters. **PURPOSE:** The purpose of this study was to examine the prevalence of LIDD in collegiate weightlifters. We also investigated possible risk factors for LIDD, except for excessive trunk rotation. **METHODS:** Forty Japanese collegiate weightlifters (25 men and 15 women; age, 19.6 \pm 1.1years; starting age, 15.1 \pm 0.9years; height, 164.7 \pm 8.0cm; weight, 71.9 \pm 14.1kg). LIDD were evaluated using T2-weighted magnetic resonance images. Pfirrmann's classification was used to define LIDD and classify the subjects into either the LIDD group or the non-LIDD group. We also investigated physical characteristics such as body composition (height, weight, muscle mass, fat mass), joint range of motion (thoracic, lumbar, and hip), and lumbosacral alignment (lumbar angle, sacral angle, and lumbosacral angle). Student's t-test and logistic regression were used for statistical analyses. **RESULTS:** The prevalence of LIDD among weightlifters was 55.0%(22/40). Weight(77.3 \pm 16.40 vs. 65.7 \pm 10.24, $p=0.02$), fat mass(18.5 \pm 8.07 vs. 12.5 \pm 4.15, $p=0.07$), and body mass index(27.7 \pm 4.78 vs. 24.71 \pm 2.10, $p=0.02$) in the LIDD group were significantly higher than those in the non-LIDD group. Hip flexion angle (left: 121.5 \pm 10.10 vs. 126.9 \pm 6.15, $p=0.05$; right: 121.9 \pm 8.00 vs. 127.9 \pm 7.06, $p=0.04$) and lumbar angle(18.3 \pm 6.04 vs. 24.2 \pm 4.65, $p=0.01$) were lower in the LIDD group compared to the non-LIDD group. By using logistic regression analysis including sex differences, lumbar angle was found to be a significant independent variable for LIDD (odds ratio, 1.34; 95%confidence interval 1.08-1.67, $p=0.01$). **CONCLUSION:** A high incidence of LIDD was observed in Japanese collegiate weightlifters. Lumbar angle is a possible risk factor.

2784 Board #67 June 1 3:30 PM - 5:00 PM
Relationship Between Rotator Cuff Strength & Functional Scores After Bankart Repair
 Geon Park¹, Wonhah Park¹, Dokyung Kim¹, Abhishek Gupta².
¹*Samsung Medical Center, Seoul, Korea, Republic of.* ²*JLN Medical College, Rajasthan, India.*
(No relevant relationships reported)

PURPOSE: The anterior instability is representing approximately 95% of all shoulder instabilities that mainly caused by an abduction, extension, and external rotation of the shoulder movement. However capsular laxity and unstable glenohumeral joint which make the most frequently dislocated joint in shoulder have closely related with rotator cuff weakness. This study examines the association between strength and functional indices in patients with Bankart repair. The purpose of the study is the relationship between internal rotator and external rotator muscle strength, shoulder functional indices (ROWE and ASES scores) post one year of the Bankart repair. **METHODS:** This was a cross sectional study comprising of 40 patients, all males (24.5 \pm 13.5 yrs, ht 169.3 \pm 8.5 kg, and wt 67.8 \pm 11.4 kg) with Bankart lesion who may be treated arthroscopically. Isokinetic internal rotator(IR) and external rotator(ER) strength were evaluated with a CSMI dynamometer, with the subject seated and the shoulder abducted 45 in the scapular plane. Tests were performed at 60/sec concentric mode for both sides. Shoulder strength was analyzed by comparison between involved side strength deficit and uninvolved side (side-to-side differences). Preoperatively and postoperatively, all the ROWE and ASES(American Shoulder and Elbow Surgeons) score was recorded that included subscores for ROM, muscle strength, pain, motion, and function by the same exercise physiologist. **RESULTS:** The patients were divided into 4 groups for comparison in muscle strength deficit- Q1 (less than 20% difference in muscle strength deficit), Q2 (21-35% deficit), Q3 (36-50% deficit), and Q4 (more than 50% difference in muscle strength deficit). In our study, ROWE and ASES score ($r = -.305$; $r = -.382$) were significantly correlative difference in Q1 (less than 20% deficit) group with IR and ER muscle strength. **CONCLUSIONS:** This study suggests that muscle strength of the shoulder after Bankart repair will affect the functional ability more than any other factor. The muscle strength deficits in shoulder joint have significant negative consequences for the long term functional outcome after Bankart lesion. Therefore, it is deemed necessary to measure the muscle strength of the rotator cuff and continue rehabilitation exercise needed for recovery of muscle strength.

2785 Board #68 June 1 3:30 PM - 5:00 PM
Kinesio Tape Fails to Affect Characteristics of Skeletal Muscle Recruitment
 Cali A. VanValkenburg, Angela R. Nuccio, Angela M. D' Souza, Samantha Jamosmos, Cynthia Villalobos, Courtney D. Jensen.
University of the Pacific, Stockton, CA.
(No relevant relationships reported)

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 ($F=0.190$; $P=0.829$) nor effects of treatment group by gender ($F=1.634$; $P=0.226$). 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.

2786 Board #69 June 1 3:30 PM - 5:00 PM
Comparison Between Platelet-rich Plasma Hyaluronic Acid Treatment For Talar Osteochondral Lesions; A Network Meta-analysis Of Randomized Controlled Trials
 Wei Li. *Taipei medical university hospital, Taipei, Taiwan.*
(No relevant relationships reported)

Background: Both platelet-rich plasma (PRP) and hyaluronic acid (HA) with or without surgical intervention can enhance healing and improve function in talar OCLs. However, recent studies on OCLs have not thoroughly investigated the effects among PRP, HA, and conventional treatment.

Purpose: To synthesize evidence by comparing the effects (pain score and foot and ankle condition scores) among PRP, HA, and conventional treatment strategies for talar OCLs with or without surgical intervention.

Methods: All relevant research articles were included using related terms in the PubMed, EMBASE, Web of Science, ScienceDirect, and Cochrane library databases from their inception to June 2017. The screening criteria for this systematic review were as follows: randomized controlled trials (RCTs) that compared PRP with HA, PRP with control, or HA with control in patients with talar OCLs. The risk of bias in the included studies was assessed using the Cochrane Risk of Bias Tool. Data were extracted and recorded as weighted mean difference (WMD) and their standard deviations (SDs) with 95% confidence intervals (CI), consistency I^2 , and I^2 for continuous data in the network meta-analysis.

Results: A total of 1199 references were identified, of which five RCTs were included in the final synthesis. These studies randomized 197 patients into the PRP, HA, and control groups. PRP caused higher reductions in the visual analog scale score than HA and conventional treatment, and the WMDs were -1.109 (95%CI: $-1.716, -0.502$) and -2.301 (95%CI: $-2.825, -1.777$). Moreover, PRP improved the American Orthopedic Foot and Ankle Society score more than the other treatment methods, and the WMDs were 12.448 (95%CI: $7.224, 17.672$) and 18.617 (95%CI: $13.536, 13.698$).

Conclusion: PRP reduced pain and improved ankle conditions to a greater extent than HA and conventional treatment. Therefore, PRP might be recommended for the treatment of talar OCLs. Further investigation is required to guarantee the safety and efficacy of different surgical treatments.

F-55 Free Communication/Poster - Chronic Ankle Instability
 Friday, June 1, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

2787 Board #70 June 1 3:30 PM - 5:00 PM
Influence of Prophylactic Ankle Tapes on Lower Extremity Kinematics during Stop-jump in Chronic Ankle Instability
 Songah Chae¹, Youngmin Chun¹, Adrian Pettaway¹, Emi Takahashi¹, Russell Baker¹, Sae Yong Lee², Hyung-Pil Jun¹.
¹University of Idaho, Moscow, ID. ²Yonsei University, Seoul, Korea, Republic of. (Sponsor: Lee Brown, FACSM)
(No relevant relationships reported)

Numerous tape applications have been used with patients who suffer from chronic ankle instability (CAI). The goal is to control the increased mechanical laxity associated with their condition during dynamic activity. The effect of these prophylactic ankle tapings on lower extremity kinematics has not been fully identified at this time. **PURPOSE:** To investigate the effects of traditional tape (TT), fibular repositioning tape (FRT), and kinesiology tape (KT) on peak joint angles of the lower extremity in individuals with CAI. **METHODS:** 14 individuals with CAI (age: 24.07 ± 4.46 years; height: 175.06 ± 5.09 cm; weight: 82.24 ± 10.38 kg; CAIT = 17.64 ± 4.14 ; FAAM-ADL = 86.69 ± 6.71 ; FAAM-SS = 75.45 ± 6.70) participated in the study. The Foot and Ankle Ability Measure Activity of Daily Living (FAAM-ADL), the FAAM Sports Subscale (FAAM-SS), and the Cumberland Ankle Instability Tool (CAIT) were used to screen subjects for CAI. The order of application of the taping conditions (TT, FRT, and KT) was randomly assigned. Peak angles of the hip, knee, and ankle joint during a stop-jump task, with and without the tape application, were collected using a 3D motion capture system. The following peak angles were measured: hip flexion (Flex), hip adduction (ADD), hip internal rotation (IR), knee Flex, knee abduction (ABD), knee IR, ankle dorsiflexion (DF), ankle inversion (IV), and ankle ADD. To examine differences across the conditions (Baseline, TT, FRT, KT), a repeated measures ANOVA was performed. **RESULTS:** A statistically significant difference in peak angle of each joint across the conditions was not found (hip Flex.: $F_{(3,39)} = .85$, $p = .47$; hip ADD: $F_{(3,39)} = 1.90$, $p = .15$; hip IR: $F_{(3,39)} = .67$, $p = .58$; knee Flex.: $F_{(3,39)} = 1.85$, $p = .15$; knee ABD: $F_{(3,39)} = 1.02$, $p = .39$; knee IR: $F_{(3,39)} = .44$, $p = .73$; ankle DF: $F_{(3,39)} = .66$, $p = .58$; ankle IV: $F_{(3,39)} = 0.85$, $p = .47$; ankle ADD: $F_{(3,39)} = 2.23$, $p = .10$). **CONCLUSION:** The application of different taping techniques did not significantly change peak joint angles of the lower extremity during a stop-jump task. The results contradict previous research suggesting ankle taping restricts joint range of motion. Therefore, further investigation is needed to examine the influence of different prophylactic ankle taping techniques on sports performance, as well as muscle activation, during dynamic tasks.

2788 Board #71 June 1 3:30 PM - 5:00 PM
Bracing Effects on Lower Extremity Movement Dynamics in Individuals With and Without Chronic Ankle Instability
 Adam E. Jagodinsky¹, Rebecca Angles¹, Christopher Wilburn², Wendi H. Weimar². ¹Illinois State University, Normal, IL. ²Auburn University, Auburn, AL. (Sponsor: David Q. Thomas, FACSM)
(No relevant relationships reported)

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 ankle 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 of systemic 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 performed 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 kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments 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 [$F(2, 45) = 7.51$, $p = .002$, partial $\eta^2 = .25$]. Paired samples t-tests revealed that for H, %CV was significantly lower during

B (11.85±3.06%) compared to NB (16.17±8.61%) ($p=.02$). For LAS, %CV was significantly greater during B (23.66±9.84%) compared to NB (20.06±6.48%) ($p=.05$). **CONCLUSION:** Bracing had a diminishing effect on %CV in the H group suggesting a limited capacity to adapt to task and environmental perturbation. Bracing had the opposite effect in the LAS group, suggesting that the motor system of “copers” may be more attuned to adaptation in response to neuromusculoskeletal constraints. More research is needed to explore how individual joint kinetic adaptations contribute to the %CV measure across groups and in response to bracing.

2789 Board #72 June 1 3:30 PM - 5:00 PM

History of Ankle Sprains Related to Hindered Proprioception in College-Age Male Soccer Players

Paul N. Whitehead¹, Kim Beals², Mita Lovalekar², Kentaro Onishi², Takashi Nagai³, Chris Connaboy². ¹The University of Alabama in Huntsville, Huntsville, AL. ²University of Pittsburgh, Pittsburgh, PA. ³Mayo Clinic, Rochester, MN.
(No relevant relationships reported)

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 correctively during perturbations. **PURPOSE:** To examine the role of ankle injury history on TTDPM. **METHODS:** Fifty-eight male, club-level soccer players were divided into two equal groups: those with chronic ankle instability as a result of LAS (CAI-LAS; $n=29$, 22.8±4.5 yr, 78.1±11.1 kg, 180.0±8.7 cm) and those with no history of ankle injuries (CON; $n=29$, 21.5±3.1 yr, 78.2±11.6 kg, 180.6±6.7 cm). Subjects were positioned in an isokinetic dynamometer testing chair to align the heel with the axis of rotation. Visual and auditory cues were masked during testing. Trials were initiated at ~7 degrees of inversion, with the dynamometer moving at 0.25°/sec. When movement could be detected, subjects pressed a button to stop the dynamometer. Six successful trials were randomly collected and averaged for inversion and eversion. The primary outcome variable was angle error, measured as the number of degrees toward inversion or toward eversion from the initial position. Higher TTDPM values indicate worse proprioception. Following tests for normality of data distribution, Mann-Whitney U tests were used to compare group differences. Alpha level of 0.05, 2-sided was set *a priori* as a significance level. **RESULTS:** There was a significant difference between groups for inversion ($p=0.016$), with a 56.5% greater median angle error in CAI-LAS. Although there was not a statistically significant difference for eversion ($p=0.181$), CAI-LAS had 24.1% greater median angle error compared to CON. **CONCLUSION:** If TTDPM is used as a screening tool, it may highlight individuals at an increased risk of injury, signifying the requirement for corrective balance and/or strength training to be implemented as a means of preventing injury occurrence. Supported by the Freddie H. Fu, MD Dissertation Research Award; the SHRS Research Development Grant at the University of Pittsburgh.

2790 Board #73 June 1 3:30 PM - 5:00 PM

Effects of Three Prophylactic Tape Methods on Kinematics and Muscle Pre-activation in Chronic Ankle Instability

Adrian Pettaway¹, Youngmin Chun¹, Emi Takahashi¹, Songah Chae¹, Russell Baker¹, Sae Yong Lee², Hyung-pil Jun¹.
¹University of Idaho, Moscow, ID. ²Yonsei University, Seoul, Korea, Republic of. (Sponsor: Lee Brown, FACSM)
(No relevant relationships reported)

Prophylactic taping of the ankle is commonly used to prevent ankle sprains. Data supports the use of ankle taping strategies for limiting excessive range of motion often associated with ankle injuries. However, there is a paucity of evidence regarding the effects of ankle taping techniques on kinematics and muscle pre-activation in patients with chronic ankle instability (CAI). **PURPOSE:** To observe the effects of traditional tape (TT), fibular repositioning tape (FRT), and kinesiology tape (KT) on kinematics and muscle pre-activation during a stop-jump task in individuals with and without CAI. **METHODS:** A total of 28 subjects (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, height = 175.06 ± 5.09 cm, weight = 82.24 ± 10.38 kg) participated in the study. After collecting EMG data of reference voluntary contraction (RVC) by maximal vertical jump, all 6 EMG signals (tibialis anterior [TA], soleus [SOL], rectus femoris [RF], peroneus longus [PL], biceps femoris [BF], gluteus medius [GM]) were normalized by RVC. % RVC and lower extremity kinematics in the frontal and sagittal planes were collected at 100 ms prior to initial contact. All participants were assigned to three different tape applications applied in a randomized order. Participants executed the stop-jump task baseline assessment without tape and then with TT, FRT, and KT respectively. To examine differences in muscle pre-activation and kinematics, a 2-way mixed ANOVA (2 groups * 4 condition) was performed. **RESULTS:** A significant

interaction was observed in soleus pre-activation ($F_{(3,78)} = 5.913$; $p < .05$; $\eta^2 = .185$). The CAI group demonstrated significantly decreased SOL pre-activation after applying FRT and KT (baseline = 3.76 ± 2.41%; FRT = 1.40 ± 1.22 %, $P < .05$; KT = 1.45 ± 1.08 %, $P < .05$). The healthy group only displayed significantly reduced SOL pre-activation after receiving the KT application (baseline = 2.70 ± 1.47 %; KT = 1.20 ± 1.14 %, $P < .05$). No significant differences in joint angles were found between condition or group. **CONCLUSION:** In contrast to previous findings, KT application reduced SOL pre-activation. Further research is needed to examine if reduced SOL pre-activation after KT and FRT influences joint mechanics, which may affect the efficacy of the taping techniques.

2791 Board #74 June 1 3:30 PM - 5:00 PM

Prolonged Kinesiotaping Does Not Improve Balance and Functional Performances in People with Chronic Ankle Instability

Hoon Kim¹, Kota Z. Takahashi², Terry L. Grindstaff³, Adam B. Rosen². ¹Marquette University, Milwaukee, WI. ²University of Nebraska at Omaha, Omaha, NE. ³Creighton University, Omaha, NE.
(No relevant relationships reported)

Individuals with chronic ankle instability (CAI) often have balance and performance impairments. The use of Kinesio Tape (KT) to address these impairments has mixed findings with little evidence beyond immediate effects. **PURPOSE:** To assess the prolonged use of KT versus a sham tape on static balance and functional performance in individuals with CAI. **METHODS:** Twenty people with CAI (Age: 23.4±3.1 years; height: 169.3±8.3 cm; mass: 71.7±12 kg; Cumberland Ankle Instability Tool: 19.3±3.5) 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 taping (T3). Primary outcome measures included the velocity (cm/s) of the center of pressure in the mediolateral direction ($VCOP_x$), anteroposterior direction ($VCOP_y$), and total excursion ($VCOP_z$) during SLSB and total time (s) to perform SHT. A two-way repeated measure multi-analyses of variance was used for data analysis. **RESULTS:** There was no significant interaction effect between time points in the KT compared to ST groups on SLSB and SHT ($p > .05$). While $VCOP_x$ (T1: 5.02±1.46, T2: 4.53±1.71, T3: 4.13±1.91), $VCOP_y$ (T1: 6.19±2.6, T2: 5.3±2.54, T3: 4.79±2.66), $VCOP_z$ (T1: 8.83±3.08, T2: 7.7±3.25, T3: 7.02±3.57), and 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 $VCOP_x$ (T1: 5.08±1.69, T2: 4.83±1.93, T3: 5.32±2.43), $VCOP_y$ (T1: 6.62±3.36, T2: 6.36±3.41, T3: 5.99±2.7), $VCOP_z$ (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. This study was supported by the University of Nebraska at Omaha University Committee on Research and Creative Activity.

2792 Board #75 June 1 3:30 PM - 5:00 PM

Altered Movement Dynamics Between Individuals With and Without Chronic Ankle Instability Before and After Bracing

Rebecca S. Angles¹, Adam E. Jagodinsky¹, Christopher Wilburn², Wendi H. Weimar². ¹Illinois State University, Normal, IL. ²Auburn University, Auburn, AL. (Sponsor: Dave Thomas, FACSM)
(No relevant relationships reported)

INTRODUCTION: Sports medicine paradigms stress the importance of introducing variability into interventions aimed at improving function in individuals with chronic ankle instability (CAI). However, questions remain surrounding systemic variability patterns exhibited by CAI groups, particularly when additional constraints (i.e. brace) are imposed on the system. Analysis of support moment (MS) variability during walking can provide information of systemic kinetic adaptations that occur in response to neuromusculoskeletal constraints acting on the system. **PURPOSE:** Examine MS variability characteristics during walking in healthy (H), ankle sprain “coper” (LAS), and CAI groups during brace (B) and no brace (NB) conditions. **METHODS:** 48 individuals (16 per group) participated in the study. Participants performed 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 kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments 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 group effects during B and NB conditions. **RESULTS:** A significant condition by group interaction was observed [$F(2, 45) = 7.51, p = .002$, partial $\eta^2 = .25$]. Post-hoc tests for NB revealed that CAI ($13.04 \pm 3.46\%$) had significantly lower %CV compared to LAS ($20.09 \pm 6.48\%$) ($p = .011$). For B, CAI ($13.06 \pm 2.93\%$) and H ($11.85 \pm 3.06\%$) had significantly lower %CV compared to LAS ($23.66 \pm 9.84\%$) ($p < .001$). **CONCLUSION:** Individuals with CAI exhibit less %CV compared to LAS during stance phase of walking. 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.

2793 Board #76 June 1 3:30 PM - 5:00 PM

Effects of Three Tape Methods on Static Postural Control of Individuals with Chronic Ankle Instability

Youngmin Chun¹, Jinah Kim², Songah Chae¹, Emi Takahashi¹, Adrian Pettaway¹, Russell Baker¹, Sae Yong Lee², Hyung-pil Jun¹. ¹University of Idaho, Moscow, ID. ²Yonsei University, Seoul, Korea, Republic of. (Sponsor: Lee Brown, FACSM) (No relevant relationships reported)

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 ± 5.10 cm; weight = 82.24 ± 10.38 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_{ML} , SD_{AP}), COP excursion ($Range_{ML}$, $Range_{AP}$), the velocity of COP (Vel_{ML} , Vel_{AP}) 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_{ML} 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_{ML} (BL = 5.21 ± 0.83 cm/s; FRT = 4.43 ± 0.68 cm/s; $p < .05$) and Vel_{AP} (BL = 4.47 ± 0.70 cm/s; FRT = 3.85 ± 1.01 cm/s; $p < .05$) was also found. The application of KT significantly reduced Vel_{ML} (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_{AP} , $Range_{AP}$, and COP area. The application of TT produced increased SD_{AP} (TT = 1.33 ± 0.20 cm, FRT = 1.20 ± 0.16 cm; $p < .05$), $Range_{AP}$ (TT = 5.98 ± 0.98 cm; FRT = 5.67 ± 0.68 cm; $p < .05$), and COP area (TT = 26.52 ± 6.33 cm²; $p < .05$; FRT = 22.83 ± 4.86 cm²; $p < .05$) compared to FRT application. **CONCLUSION:** Based on our findings, FRT is a more effective technique to enhance static postural control than TT, KT, 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.

2794 Board #77 June 1 3:30 PM - 5:00 PM

Altered Movement Neuromechanics during Jump Landing and Cutting in Patients with Chronic Ankle Instability

Hyunsoo Kim¹, S. Jun Son², Matthew K. Seeley², J. Ty Hopkins, FACSM². ¹West Chester University, West Chester, PA. ²Brigham Young University, Provo, UT. (Sponsor: J. Ty Hopkins, FACSM) (No relevant relationships reported)

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 a multiplanar, single-leg landing and cutting task for CAI patients. **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 ± 2 yrs, 174 ± 10 cm, 71 ± 14 kg, $82 \pm 9\%$ FAAM ADL, $62 \pm 13\%$ FAAM Sports, 4.5 ± 2.6 ankle sprains) and 100 controls (22 ± 3 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 (hip) joint with heightened 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.

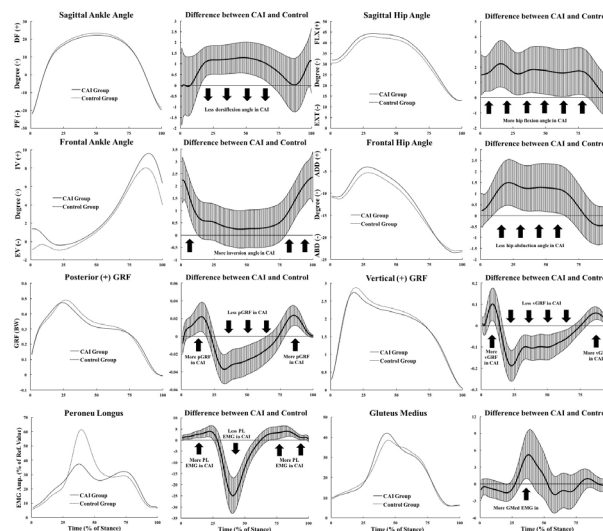


Figure 1. Plantar flexion/dorsiflexion (PF/DF), hip flexion/inversion (FL/EXT), inversion/eversion (IV/EV), hip abduction/adduction (AB/ADD) angle, posterior and vertical ground reaction force (GRF), and EMG amplitude for peroneus longus (PL) and gluteus medius (GMED) during stance phase of jump landing/cutting tasks. Mean differences (bold solid curve) and corresponding 95% CI (shaded area) are plotted as a function of time. When the shaded area does not overlap with the zero line (bold horizontal line), a significant difference ($p < 0.05$) is indicated between groups.

2795 Board #78 June 1 3:30 PM - 5:00 PM

Dorsiflexion Range of Motion Alters Energy Absorption and Generation during Landing/Cutting in Chronic Ankle Instability

Andrew Harris, S. Jun Son, Dustin Bruening, Brent Feland, Matthew Seeley, Ty Hopkins, FACSM. Brigham Young University, Provo, UT. (Sponsor: J. Ty Hopkins, FACSM) (No relevant relationships reported)

Decreased dorsiflexion range of motion (DFROM) has been identified as a risk factor for ankle sprains. Patients with chronic ankle instability (CAI) demonstrate reduced DFROM during walking, running, landing, and cutting. However, variation in DFROM exists within a CAI population. It remains unclear whether varied DFROM affects lower extremity joint energetics during a jump landing/cutting task.

PURPOSE: To examine a relationship between varied DFROM within the CAI population and lower extremity energy absorption (eccentric power) and generation (concentric power) during jump landing/cutting.

METHODS: 100 CAI subjects were classified into 3 subgroups based on DFROM, measured by the weight-bearing lunge test: a Hypo ($14M, 10F; \leq 39^\circ; 35 \pm 2.5^\circ, 23 \pm 2$ yrs, 176 ± 13 cm, 80 ± 13 kg), Normal ($25M, 32F; 40-50^\circ; 46 \pm 2.6^\circ, 21 \pm 2$ yrs, 174 ± 7 cm, 72 ± 14 kg), and Hyper DFROM group ($11M, 8F; \geq 51^\circ; 54 \pm 3^\circ, 22 \pm 2$ yrs, 175 ± 11 cm, 74 ± 14 kg). Subjects performed 5 jumps consisting of a max vertical jump-landing plus a side-cut. Functional liner models were used to detect between-group differences. If 95% confidence intervals did not cross zero, differences were significant.

RESULTS: Figure 1 shows that CAI subjects with Hypo DFROM showed decreased ankle and knee energy absorption and generation power and increased hip absorption and generation power compared to Normal and/or Hyper DFROM groups ($p < 0.05$).

CONCLUSIONS: While CAI subjects with Normal and Hyper DFROM show similar lower extremity energetic patterns during the task, CAI patients with Hypo DFROM appear to have a limited ability to absorb and generate kinetic energy in the ankle and knee, which seems to increase a kinetic compensation at the hip (greater energy absorption and generation). These kinetic alterations may increase injury risk and performance deficits.

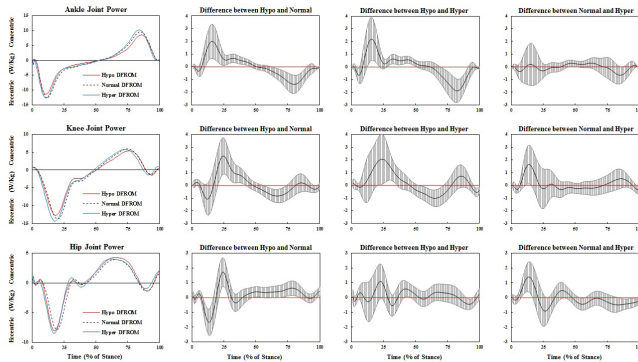


Figure 1. Grand averages for sagittal plane joint moments in the lower extremity during a jump landing/cutting task between the Hypo, Normal, and Hyper DFCOM groups. 0% of stance indicates initial foot contact, 50% of stance indicates peak ankle dorsiflexion and knee flexion, and 100% of stance indicates toe-off during the task. When 95% confidence intervals (shaded area) did not cross the zero (horizontal red line), between-group differences were significant.

2796 Board #79 June 1 3:30 PM - 5:00 PM
Immediate Effects of Ankle Tapes on Dynamic Postural Control and Kinematics in Chronic Ankle Instability
 Emi Takahashi¹, Youngmin Chun¹, Jinah Kim², Adrian Pettaway¹, Russell Baker¹, Sae Yong Lee², Hyung-pil Jun¹.
¹University of Idaho, Moscow, ID. ²Yonsei University, Seoul, Korea, Republic of. (Sponsor: Lee Brown, FACSM)
 (No relevant relationships reported)

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 (2 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, η² = .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 ± 6.49%; p < .05, TT = 86.63 ± 6.83%; p < .05, FRT = 87.88 ± 8.39%; p < .05). The CS was also significantly increased when comparing KT to BL (Healthy: BL = 90.91 ± 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, η² = .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.

2797 Board #80 June 1 3:30 PM - 5:00 PM
Joint Stiffness Alterations, Grouped by Movement Strategy, in Chronic Ankle Instability
 J. Ty Hopkins, FACSM¹, S. Jun Son¹, Hyunsoo Kim², Matthew K. Seeley¹. ¹Brigham Young University, Provo, UT. ²West Chester University, West Chester, PA.
 (No relevant relationships reported)

Subgroups of ankle instability (AI) subjects, based on specific movement strategies, allow for evaluation of neuromechanical deficits that are specific to the adopted movement. Joint stiffness provides important information as to stability and loads directed to each of the lower extremity joints. **PURPOSE:** to describe lower extremity stiffness of 6 subgroups (clusters) of patients with AI compared to an uninjured control group. **METHODS:** 200 CAI patients (22±2 yrs, 174±10 cm, 73±14 kg, 84±7% FAAM ADL, 65±11% FAAM Sports, 4.1±2.4 ankle sprains) and 100 controls (22±3 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports) participated. Participants performed five successful trials of a jump landing/cutting task. Lower extremity sagittal and frontal plane kinematics (ankle, knee, and hip) were reduced to single

representative curves using principle component analysis, and the resultant curves were simultaneously used to cluster movement with a Dirichlet process. Six distinct clusters were identified, and joint stiffness values for each of the clusters were calculated and compared to a control group using functional linear models (P<0.05). **RESULTS:** Table 1. Several clusters demonstrated reduced stiffness at the ankle (C1, 3, 5), reduced stiffness at the knee (C1-4), and increased stiffness at the hip (C1, 2, 6). **CONCLUSIONS:** Multiple, distinct joint stiffness patterns were identified in clusters of AI subjects. Generally, distal joint stiffness was less than controls, while proximal joint stiffness was greater than controls, supporting the idea that the hip plays a key role in controlling lower extremity movement in AI subjects. Joint stiffness varies according to the movement strategy adopted by each AI subject, and alterations in joint stiffness patterns are a potential source of acute and chronic (re)injury.

Table 1. Joint stiffness means ± SD (Nm/kg°) for each of the clusters.

* Represents different from control (P≥0.05).

Cluster	Ankle	Knee	Hip
C1	0.044±0.014*	0.047±0.020*	0.11±0.12*
C2	0.048±0.019	0.041±0.020*	0.15±0.31*
C3	0.047±0.035*	0.041±0.017*	0.088±0.052
C4	0.046±0.020	0.040±0.016*	0.092±0.062
C5	0.048±0.012*	0.056±0.021	0.10±0.078
C6	0.062±0.034	0.055±0.025	0.13±0.076*
Normal	0.055±0.031	0.058±0.022	0.092±0.065

2798 Board #81 June 1 3:30 PM - 5:00 PM
Recommended Number of Trials for Balance and Hopping Tests between Male and Female CAI Subjects
 Jordan R. Read¹, S. Jun Son², Dustin Bruening², Brent Feland², Matthew Seeley², Ty Hopkins, FACSM². ¹University of North Texas Health Science Center, Fort Worth, TX. ²Brigham Young University, Provo, UT. (Sponsor: Ty Hopkins, FACSM)
 (No relevant relationships reported)

The recommended number of practice trials for the Biodex static balance (3 trials) and star excursion balance test (SEBT; 4-9 trials) are available in the literature, but previous studies on these tests did not report the recommendations for male and female and used a small sample size (n = 16-20). Moreover, no data are available for the recommended number of practice trials for triple cross-over hop and figure 8 hop tests. Considering physiological differences in gender, a large sample size is necessary to clarify this issue.

PURPOSE: To determine the number of practice trials necessary to achieve functional performance for static and dynamic balance and hopping tests between male and female.

METHODS: 50 male (22±2 yrs, 182±8 cm, 81±12 kg) and 50 female (21±2 yrs, 166±6 cm, 67±12 kg) subjects with chronic ankle instability (CAI) performed 6 practice and 3 test trials of the Biodex static balance test (single-leg), SEBT (anterior, posterolateral, posteromedial), triple cross-over hop for distance test, and figure 8 hop for time test, 2-3 days apart. The order of the tests were randomized. One-way repeated-measures ANOVAs with multiple comparisons using Dunnett's Method were used to detect time and gender effect (p < 0.05).

RESULTS: Table 1 shows that the required number of practice trials for the hopping tests is 3-4 for male and 2-3 for female subjects prior to testing. The number of required trials for the SEBT is 2-5 for male depending on the direction and 3 for female. For the Biodex static balance, 5 practice trials are needed for both male and female prior to testing.

CONCLUSIONS: Considering physiological differences in gender, the required number of practice trials appears to vary in the SEBT, triple cross-over and figure 8 hop test between genders. Male subjects may need more practice trials than female to achieve their best performance. Researchers should allow subjects to perform practice trials based on gender to obtain accurate data on these functional performance tests.

Table 1. Results of the recommended number of practice trials for each of four functional tests.

Gender	Practice 1		Practice 2		Practice 3		Practice 4		Practice 5		Practice 6		Test 1	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Figure 8 hop (sec)	11.44(1.7)	13.94(2.0)	10.94(1.5)	13.84(2.0)	10.84(1.5)	13.54(2.0)	10.64(1.4)	13.44(2.4)	10.54(1.3)	13.44(2.3)	10.34(1.4)	13.44(2.2)	10.04(1.2)	12.94(1.1)
Triple cross-over (m)	4.74(0.8)	3.54(0.6)	5.04(0.9)	3.84(0.7)	5.24(0.9)	3.84(0.7)	5.34(0.9)	3.84(0.7)	5.44(1.0)	3.94(0.7)	5.54(0.9)	4.04(0.7)	5.74(0.9)	4.14(0.7)
Biodex Static Balance (overall stability index)	1.14(0.3)	1.04(0.2)	1.14(0.3)	0.94(0.2)	0.94(0.2)	0.84(0.2)	1.04(0.3)	0.94(0.2)	0.94(0.2)	0.94(0.2)	0.94(0.2)	0.84(0.2)	0.84(0.2)	0.74(0.2)
SEBT-ANT (%)	59(7.2)	61(5.1)	60(7.2)	63(5.1)	61(7.6)	64(5.6)	62(7.6)	65(5.6)	62(7.5)	65(7.0)	62(7.0)	65(7.3)	63(7.4)	65(5.9)
SEBT-PM (%)	104(7.5)	98(10)	103(9.3)	100(8.9)	104(8.3)	101(8.0)	105(7.9)	103(7.3)	104(7.7)	104(6.7)	107(7.2)	104(7.0)	108(7.1)	105(5.9)
SEBT-PL (%)	94(9.4)	92(9.9)	95(9.9)	94(9.9)	94(8.3)	95(10)	94(8.3)	95(9.6)	100(8.9)	97(10)	101(8.8)	99(8.8)	102(8.5)	100(9.7)

Abbreviations: SEBT, star excursion balance test; ANT, anterior; PM, posteromedial; PL, posterolateral. Triple cross-over hop distance was normalized to leg length (anterior superior iliac spine to medial malleolus). SEBT reaching distance was normalized (% of leg length x 100). Test 1 score was mean of the best 2 of 3 test trials, and acquired 2-3 days after the practice trial session (Practice 1 – 6 trials). *Significant difference from Actual 1 for male (P < .05). †Significant difference from Actual 1 for female (P < .05).

F-56 Free Communication/Poster - Jumping and Landing

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

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

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

John R. Harry¹, Leland A. Barker², Janet S. Dufek, FACSM², C. Roger James, FACSM³. ¹Texas Tech University, Lubbock, TX. ²University of Nevada, Las Vegas, Las Vegas, NV. ³Texas Tech University Health Sciences Center, Lubbock, TX. (Sponsor: Janet S. Dufek, FACSM)

(No relevant relationships reported)

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 ± .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 ± .05 m) and poor (n = 6; .33 ± .05 m) groups were determined by the median CMVJ height ($v_{to}^2/2g$) for the sample. Groups were compared at each data point using effect sizes (large ≥ .80). 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 performance 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.

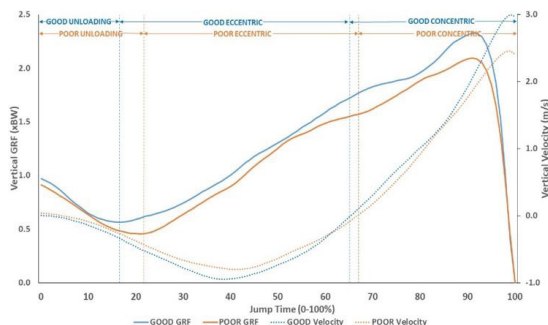


Figure 1. Ensemble Mean Vertical GRF and Velocity Profiles for Good and Poor Jumpers

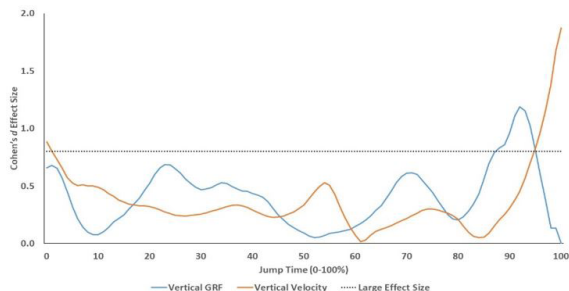


Figure 2. Cohen's *d* Effect Sizes for the Vertical GRF and Velocity Comparisons Between Good and Poor Jumpers

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

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

Jerry Zoubek, Timothy Kranz, Lindsay Perotti, Elle Stark, Michelle Stella, Adam S. Lepley. *University of Connecticut, Storrs, CT.*

(No relevant relationships reported)

Medial posting is a common therapeutic midsole 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 without, with the order randomized. Max 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 $P \leq 0.05$. **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°; $t = 1.96$, $p = 0.05$) 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.

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

Influence of Holding a Lacrosse Stick on Jump Landing Mechanics

Kylie Calandra, Dr. Matthew Moran. *Sacred Heart University, Fairfield, CT.*

(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° ± 3.9°, $p < 0.01$), 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.

2802 Board #85 June 1 3:30 PM - 5:00 PM
Mechanical Differences between Adolescents and Adults during Two Landing Phases of a Drop Jump Task

Gavin L. Moir, Shawn N. Munford, Brandon W. Snyder, Shala E. Davis, FACSM. *East Stroudsburg University, East Stroudsburg, PA.* (Sponsor: Shala E. Davis, FACSM)
 (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 0.40 m. Force plates (1000 Hz) and an 8-camera 3-D motion analysis system (200 Hz) were used to determine vertical landing velocity (v_{LAND}), the duration of the absorption phase (AT), countermovement depth during absorption phase (CM), normalized peak vertical force during absorption (PF_{NORM}), and the normalized peak extensor moments at the hip (PM_{HIP}), knee (PM_{KNEE}), and ankle (PM_{ANKLE}) joints during absorption.
RESULTS: Adults produced significantly greater v_{LAND} than the adolescents (mean difference [MD]: 0.21 m/s, $p=0.004$) and v_{LAND} 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 PF_{NORM} during each landing compared to the adults (MD: 1.34 BW, $p=0.003$) and PF_{NORM} 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 joint 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_{HIP} was significantly greater than PM_{KNEE} (MD: 1.75 - 3.48 Nm/kg, $p<0.001$) while PM_{KNEE} was significantly greater than PM_{ANKLE} (MD: 1.73 Nm/kg, $p<0.001$). The increase in the PM_{ANKLE} between the first and second landing was significantly greater than PM_{HIP} (MD: 1.89 Nm/kg, $p=0.003$) and PM_{KNEE} (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.

2803 Board #86 June 1 3:30 PM - 5:00 PM
Alternate Forms Reliability of Reactive Strength Assessments during Depth and Repetitive Countermovement Jumping

Jake Rosburg, Nile Banks, Jordan Preuss, Lara Boman, Talin Louder. *The University of South Dakota, Vermillion, SD.*
 (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 scores across protocols, it is important to assess the extent that reactive strength scores achieved in the depth jump protocol translate to scores achieved in the RCM jumping protocol.
PURPOSE: The purpose of this study was to assess the alternate forms reliability of reactive strength scores achieved in the depth jumping protocol and in the RCM jumping protocol.
METHODS: Thirty-four young adults from the general community and 21 NCAA Division I basketball players performed five RCM jumps and depth jumps from 0.51 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 Regressions and intraclass 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 (RSK), 0.84 to 0.88 (RSI), and -0.01 to -0.05 (CoR). Regressions detected significant associations between RSK ($R^2=0.31 - 0.48, p<0.000$) and RSI ($R^2=0.53 - 0.59, p<0.000$) scores in depth jumping versus RCM jumping. Regressions failed to detect significant associations between CoR scores in depth jumping versus RCM jumping ($R^2=0.00$).
CONCLUSION: RSK and RSI scores in depth jumping explained between 31 and 59% of the variance in reactive 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.

2804 Board #87 June 1 3:30 PM - 5:00 PM
Differences in Joint Mechanics Between Adolescent and Adult Males Performing Countermovement and Drop Jump Tasks

Shawn N. Munford, Brandon W. Snyder, Gavin L. Moir, Shala E. Davis, FACSM. *East Stroudsburg, East Stroudsburg, PA.*
 (No relevant relationships reported)

Purpose: To investigate the differences in joint mechanics between adolescent and adult males performing countermovement and drop jump tasks. **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 countermovement jump (CMJ) and a drop jump from a height of 0.40 m (DJ). Force plates (1000 Hz) and an 8-camera 3-D motion analysis system (200 Hz) were used to determine the following kinetic variables for the hip, knee, and ankle joints during the propulsive phase of each jump: normalized work performed by the moment (JW_{NORM}), normalized power output of the moment (JPO_{NORM}), and normalized joint stiffness (JS_{NORM}). **Results:** The adults produced significantly greater JW_{NORM} across the two jumps (mean difference [MD]: 0.32 J/kg, $p=0.014$). JW_{NORM} at the knee was greater than that at the hip (MD: 2.09 J/kg, $p<0.001$) and the ankle (MD: 2.61 J/kg, $p<0.001$), while JW_{NORM} was greater at the hip compared to the ankle (MD: 0.52 J/kg, $p=0.001$). The adults performed greater JW_{NORM} at the hip compared to the adolescents (MD: 0.75 J/kg, $p=0.005$). JPO_{NORM} at the knee was greater than that at the hip (MD: 4.49 W/kg, $p<0.001$) and ankle (MD: 4.32 W/kg, $p<0.001$) across the two jumps while JPO_{NORM} was significantly greater in DJ compared to CMJ (MD: 0.49 W/kg, $p=0.10$). The adolescents produced significantly greater JPO_{NORM} at the ankle compared to the adults (MD: 1.35 W/kg, $p=0.002$). The adolescents produced significantly greater JS_{NORM} compared to the adults (MD: 0.021 Nm/kg/deg, $p<0.001$). Both groups produced significantly greater JS_{NORM} in DJ compared to CMJ (MD: 0.015 Nm/kg/deg, $p=0.001$) with significant increases in JS_{NORM} at the knee joint from CMJ to DJ (MD: 0.02 Nm/kg/deg, $p<0.001$). The increase in JS_{NORM} at the hip (MD: 0.025 Nm/kg/deg, $p=0.033$) and knee (MD: 0.023 Nm/kg/deg, $p=0.046$) was significant between CMJ and DJ was significantly greater in adolescents compared to adults. **Conclusion:** Adolescent males produce different joint mechanics compared to adults during jumping tasks and rely on a strategy of increasing joint stiffness at the hip and knee joints when performing DJ. These differences may have implications for musculoskeletal injuries in adolescent males.

2805 Board #88 June 1 3:30 PM - 5:00 PM
Effect of Fatigue on Leg Muscle Activation and Tibial Acceleration during a Jumping Task

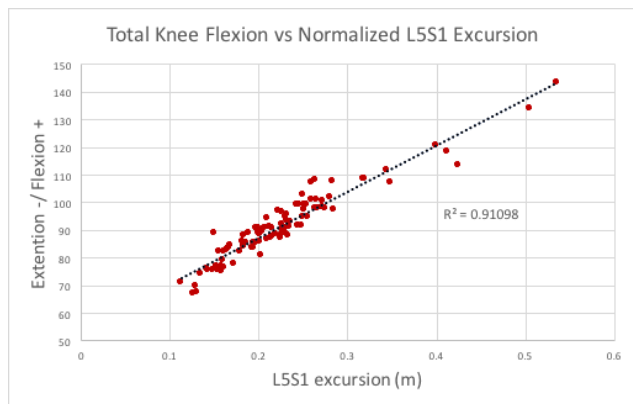
Michelle A. Sandrey, Yu-Jen Chang, Krista Meder, Jean L. McCrory, FACSM. *West Virginia University, Morgantown, WV.* (Sponsor: Jean L. McCrory, FACSM)
 (No relevant relationships reported)

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 tibia pre-to-post fatigue following a jumping task. **METHODS:** Thirty active college-aged subjects with and without a previous history of stress fractures were recruited (15 male, 15 female, 21.5±5.04 yrs, ht=173.5±12.7cm, wgt=72.65 16.4±kg) 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 raises on a custom built platform at a pace controlled by a metronome until task failure was reached was used for the fatiguing 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 ($P=.050$) with a difference between stress fracture and control posttest ($P=.05$). 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 ($P=.111$). There was a significant difference for tibial acceleration for leg ($P=.029$) in the stress fracture contralateral leg in comparison to the control leg at takeoff ($P=.042$). At landing, there was a significant difference for test ($P<0.01$) as tibial acceleration increased post-test ($P<0.01$) and leg ($P=.019$) where there was a difference between stress fracture injured with stress fracture contralateral ($P=.014$). **CONCLUSIONS:** Attention should be directed to the MG and TA muscles and in providing landing and take-off guidance upon return to activity.

2806 Board #89 June 1 3:30 PM - 5:00 PM
L5S1 Excursion Reflects Knee Flexion Angle During A Drop Landing Task

Yunae Lee, Ming-Sheng Chan, SM Sigward. *University of Southern California, Los Angeles, CA.*
 (No relevant relationships reported)

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. **Purpose:** 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 land (36cm 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 land 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 nL5S1ex ($r^2=0.91$; $p<0.00$; prediction equation: $L5S1ex = -0.27 + (0.005 * pkkn)$). **Conclusion:** Vertical L5S1 excursion during a drop land is reflective of knee flexion angle explaining 91% of the variance. When considering the difference between actual pkkn and pkhp calculated with the prediction equation the differences ranged from 0.03-11.37 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 land. Further research is needed to investigate the relationship between L5S1ex and shock attenuation.



2807 Board #90 June 1 3:30 PM - 5:00 PM
Sagittal And Frontal Plane Knee Angles Between Pre-adolescent Sexes Are Not Different During Jump-landing.

Kenneth C. Holford¹, Michael Torry¹, Adam Jagodinsky¹, Jeff Cowley², Steve McCaw³. ¹Illinois State University, Bloomington, IL. ²University of Michigan, Ann Arbor, MI. ³San Francisco State University, San Francisco, CA.
 (No relevant relationships reported)

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. **Purpose:** The purpose of this study is to examine the 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 female. **Methods:** Thirty-two subjects (16 females and 16 males; aged 6 to 10 yrs) 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: $\alpha \leq 0.05$.

RESULTS: Valgus angle at initial contact displayed no difference (males: $-4.81 \pm 7.83^\circ$; females: $-3.01 \pm 8.99^\circ$; $p=0.40$). It was found that knee flexion at initial contact was different (males: $16.1 \pm 10.5^\circ$; females: $20.7 \pm 8.10^\circ$; $p=0.05$). No differences were observed in valgus ROM (males: $2.75 \pm 17.3^\circ$; females: $6.68 \pm 14.2^\circ$; $p=0.32$) nor knee flexion ROM (males: $37.1 \pm 19.0^\circ$; females: $40.2 \pm 10.7^\circ$; $p=0.42$). **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.

2808 Board #91 June 1 3:30 PM - 5:00 PM
Mechanics of Countermovement and Drop Jump Tasks Performed by Adolescent and Adult Males

Brandon W. Snyder, Shawn N. Munford, Gavin L. Moir, Shala E. Davis, FACSM. *East Stroudsburg University, East Stroudsburg, PA.*
 (No relevant relationships reported)

Purpose: To investigate the mechanical differences between adolescent and adult males performing countermovement and drop jump tasks. **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 countermovement jump (CMJ) and a drop jump from a height of 0.40 m (DJ). Force plates (1000 Hz) and an 8-camera 3-D motion analysis system (200 Hz) were used to determine the jump height (JH), the duration of the propulsion phase (PT), countermovement depth during the absorption phase (CM), normalized work during the propulsive phase (W_{NORM}), normalized peak power output during the propulsive phase (PO_{NORM}), and normalized vertical stiffness (VS_{NORM}) during each jumping task. **Results:** JH (mean difference: 0.05 m, $p<0.001$) and PO_{NORM} (mean difference: 2.4 W/kg, $p=0.031$) were significantly greater during CMJ compared to DJ with no significant differences between the adolescents and adults. PT were significantly greater during CMJ compared to DJ (mean difference: 0.03 s, $p=0.033$). The adolescents produced significantly shorter PT (mean difference: 0.08 s, $p<0.001$) and significantly lower CM (mean difference: 0.13 m, $p<0.001$) than the adults across the jumping tasks. Significantly greater W_{NORM} was performed during the CMJ compared to the DJ task (mean difference: 1.10 J/kg, $p<0.001$) and the adults performed more work during the propulsive phases of both jumping tasks compared to the adolescents (mean difference: 1.48 J/kg, $p<0.001$). The adolescents produced significantly greater VS_{NORM} during both jumps compared to the adults (mean difference: 39.6 kN/m/kg, $p<0.001$). **Conclusion:** Adolescent and adult males use different neuromuscular strategies to attain similar power outputs during jumping tasks with the adolescents producing shorter propulsion times through the modulation of vertical stiffness while the adults generate a greater amount of work over a longer duration.

2809 Board #92 June 1 3:30 PM - 5:00 PM
Patellofemoral Joint Loading During a Variation in Jump-landing Movements

Naghme Gheidi, Thomas W. Kernozek, FACSM, Katie L. Hanson, Cheyanne N. Massie. *UWL, La-Crosse, WI.* (Sponsor: Thomas Kernozek, FACSM)
 (No relevant relationships reported)

Patellofemoral pain syndrome (PFPS) is common in athletes. Increased patellofemoral joint stress (PFJS) may contribute to PFPS. Few studies have investigated PFJS during jump-landing. PFJS may be different during jump-landing in different directions. **Purpose:** Examine PFJS during bilateral (B)/unilateral (U) jump-landing and the effect of direction (side (S)/ forward-backward (FB)). **Methods:** Nineteen males (Age: 22.2 ± 1.6 yrs.; Height: 177.7 ± 8.1 cm; Mass: 74.5 ± 11.1 kg) performed 4 jump-landing variations: bilateral (B) forward-backward (FB), bilateral (B) side (S), unilateral (U) forward-backward (FB), and unilateral (U) side (S). Kinematic and kinetic data were collected. Quadriceps muscle forces (QF) were determined from static optimization. PFJS were estimated using a patellofemoral joint model. A repeated measures multivariate analysis of variance with two within-subjects factors [leg (U/B) and direction (S/FB)] was used to examine differences in knee range of motion (KROM), quadriceps force (QF), and PFJS ($\alpha=0.05$). **Results:** There were multivariate effects for leg (U/B) ($p<0.001$) and a leg (U/B) by direction (S/FB) interaction ($p<0.001$). No direction (S/FB) main effect ($p=0.81$) occurred. Univariate tests revealed greater KROM ($p<0.0001$) but lower QF and PFJS during B jump-landing ($p<0.0001$). Leg by direction interaction indicated KROM had greater differences between directions (S/FB) during the U jump-landing ($p=0.012$) showing lower KROM during S jump-landing. The interaction also revealed higher QF and PFJS during the B S jump-landing compare to the B FB jump-landing ($p<0.0001$). QF and PFJS were lower during the U S jump-landing compared to the U FB jump-landing ($p<0.0001$). **Conclusion:** U jump-landing had greater PFJS than B jump-landing. The effect of direction (S/FB) depended on leg use (U/B). Results may provide insight into both training and rehabilitation efforts in those with PFPS.

2810 Board #93 June 1 3:30 PM - 5:00 PM
Knee Kinematics During a Single-Leg Backwards Jump-Landing With and Without External Load
 Colin W. Bond¹, Alexander J. Hron², Benjamin C. Noonan¹.
¹Sanford Health, Fargo, ND. ²University of North Dakota, Grand Forks, ND.
 (No relevant relationships reported)

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 ± 3.3 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; BW10% = 42.3° [36.0 - 48.7]; BW = 38.8° [33.4 - 44.2]). 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° [0.5 - 15.2]; BW = 2.4° [-4.2 - 8.9]) resulting in similar sagittal plane angles at peak vGRF (*d* = 0.20; BW10% = 34.5° [28.2 - 40.7] BW = 36.4° [30.2 - 42.6]). Participants were in a comparable valgus position at IC (*d* = 0.00; BW10% = 2.2° [-1.1 - 5.4]; BW = 2.1° [-1.3 - 5.5]) and moved similarly towards a varus position during the weight acceptance phase (*d* = 0.08; BW10% = -1.7° [-3.0 - -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.

2811 Board #94 June 1 3:30 PM - 5:00 PM
Trunk Muscle Fatigue and Activation are Associated with Drop Jump Performance
 Yasuyuki Uchida¹, Makoto Iguchi², Norihiro Shima³, Yohei Shimokochi¹. ¹Osaka University of Health and Sport Sciences, Osaka, Japan. ²Kansai University of Health Sciences, Osaka, Japan. ³Tokai Gakuen University, Aichi, Japan.
 (No relevant relationships reported)

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 168.4±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 contraction force. Before and after this fatiguing task, maximum voluntary isometric trunk flexor contraction force (MVIC), and double- and single-leg DJ height (DJH), contact time (CT), and DJ index (DJI; DJH/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 fatiguing task were examined using paired-sample t-tests. Simple linear regression analyses tested the relation of relative changes before and after the fatiguing task in the jump performance index and trunk muscle activation during preactivation, braking, and push off phase of each DJ. **RESULTS:** After the fatiguing task, MVIC was significantly decreased to 68.8±11.5% (*p*<0.01). DJI (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 cm vs. 20.01±5.24 cm, 13.21±3.04 cm vs. 11.07±3.64 cm) were significantly decreased (*p*<0.01), and CT (0.19±0.02 s vs. 0.22±0.03 s) was significantly extended (*p*<0.01). Regression analyses revealed that greater ensemble trunk muscle preactivation reduction rate was associated with CT lengthening rate in double-leg DJ (*R*²=0.582, *B*=-0.257, *p*=0.046), and DJI reductions rate in single-leg DJ (*R*²=0.910, *B*=-0.309, *p*=0.001) and that greater rectus abdominus (*R*²=0.779, *B*=0.138, *p*=0.008) and external oblique activations reduction rate during braking phase (*R*²=0.703, *B*=0.276, *p*=0.018) were associated with greater DJI reduction rate.

CONCLUSIONS: Trunk muscle fatigue and decreased trunk flexor muscle activation during DJ have negative effects on both double- and single-leg DJ.

2812 Board #95 June 1 3:30 PM - 5:00 PM
Effect of Cognitive Dual Tasks on Lower Extremity Kinematics and Ground Reaction Force during Repeated Tuck Jump Landings
 Jae P. Yom, Amber Schnittjer, Janet Simon, Dustin Grooms.
 Ohio University, Athens, OH.
 (No relevant relationships reported)

Effect of Cognitive Dual Tasks on Lower Extremity Kinematics and Ground Reaction Forces during Repeated Tuck Jump Landings
 Jae P. Yom¹, Amber Schnittjer¹, Janet Simon¹, Dustin Grooms¹
¹Ohio University, Athens, OH
 Many sports-related injuries occur due to a combination of physical, high joints load during sport-specific maneuvers and cognitive factors, such as keeping other players or the ball in short-term memory. This addition of cognitive challenges can degrade physical performance and increase joint loading. However, previous studies have focused on a single movement and it is unknown how cognitive load influences repeated landing that better simulate the continuous demand of athletic performance. **PURPOSE:** To determine if a cognitive challenge during tuck jumping affect lower extremity landing biomechanics. **METHODS:** Recreational collegiate athletes (N=20, 71.7±11.9kg, 171.1±9.7cm) participated in this study. A baseline: BASE condition of repeated tuck jumps and a cognitive: COG condition of tuck jumps while performing an addition problem from a stream of digits on a computer screen. The tuck jump consisted of 3 sets of 10 seconds repeated double leg vertical tuck jumps. Dominant-side sagittal plane lower extremity angular kinematics and vertical ground reaction forces (VGRF: 1,000 Hz) were compared between the two conditions paired t-tests (*p*<.05). **RESULTS:** COG, compared to the BASE, resulted in increased ankle angle (30.1±1.7° and 29.3±0.7°) and decreased knee angle (20.5±0.6° and 21.5±0.6°) at initial contact. Also, decreased ankle (21.8±1.4° and 22.4±1.0°) and knee (63.0±0.7° and 67.9±0.9°) maximum angle occurred. Additionally, COG resulted in an increased ankle (52.6±0.9° and 51.6±0.9°), decreased knee (42.5±1.2° and 46.4±0.8°) and hip (31.7±1.1° and 33.0±0.7°) displacements. No significant differences were found in VGRF between conditions. **CONCLUSION:** We surmised that COG, compared to the BASE, change lower extremity biomechanics that may increase injury risk and knee loading. The more extended knee position at initial contact and reduced sagittal displacement during the COG condition may contribute to increased injury risk when under cognitive load. However, greater ankle displacement during the COG condition may be adaptation strategy to protect the knee under cognitive load.

2813 Board #96 June 1 3:30 PM - 5:00 PM
Effect of External Load on Lower Extremity Stiffness and Time to Stabilization During Jump-Landing
 Alexander J. Hron¹, Benjamin C. Noonan², Colin W. Bond².
¹University of North Dakota, Grand Forks, ND. ²Sanford Health, Fargo, ND.
 (No relevant relationships reported)

External loads similar to common protective athletic equipment may impair the ability to effectively control motion during a jump-landing, increasing non-contact anterior cruciate ligament (ACL) injury risk. **Purpose:** To determine the effect of external load on time to stabilization (TTS) and lower-extremity vertical stiffness (*K_{vert}*) during backwards single-leg jump-landings. It was hypothesized that both TTS and *K_{vert}* would be greater in the loaded condition compared to the non-loaded condition. **Methods:** Eleven recreationally active males and females (23.1 ± 3.3 y, 1.78 ± 0.08 m, 78.2 ± 11.5 kg) completed three trials of a backwards single-leg jump-landing on the dominant leg with and without a weight vest on that was adjusted to 10% body weight in a randomized order. Participants jumped backwards off their dominant foot over a 15 cm hurdle, landed on the same foot, and stabilized. Trials were performed on an in-ground force plate and kinematics were quantified using three-dimensional motion capture. TTS was defined as the time required for vertical ground reaction force (vGRF) to stabilize within 5% of the participant's body mass, which was adjusted for external load condition, for one second after landing. *K_{vert}* was calculated as the relative peak vGRF divided by the change in center of mass vertical position between initial contact and peak vGRF. Effect size (*d*) was used to assess the magnitude of the standardized difference in the means between conditions. **Results:** Small effects (*d* = 0.20) were demonstrated between conditions for TTS because the participants took slightly longer to stabilize in the loaded condition (1.31 s [0.98 - 1.65]) than in the non-loaded condition (1.21 s [0.88 - 1.55]). Small effects (*d* = 0.49) were also demonstrated between conditions for *K_{vert}* since the participants had greater stiffness during the weight acceptance period in the loaded condition (0.25 kN m⁻¹ kg⁻¹ [0.19 - 0.31]) compared to the non-loaded condition (0.21 kN m⁻¹ kg⁻¹ [0.17 - 0.26]). **Conclusion:** Greater TTS and *K_{vert}* when externally loaded with a weight similar to protective athletic equipment may challenge the neuromuscular system's ability to safely

attenuate ground reaction forces. Although small, these impairments may increase ACL injury risk and be heightened with greater loads, fatigue, and unanticipated movements.

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

Yohei Shimokochi¹, Kanae Hosaki², Akiko Takiguchi³, Issei Ogasawara⁴. ¹Osaka University of Health and Sport Sciences, Sennan-gun, Osaka, Japan. ²Funabashi Orthopedic Hospital, Funabashi-shi, Chiba, Japan. ³Tsujimoto Orthopedic Clinic, Amagasaki-shi, Hyogo, Japan. ⁴Osaka University, Toyonaka-shi, Osaka, Japan.

(No relevant relationships reported)

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 triplanar 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). In EC, transcutaneous electrical stimulation was applied to increase GM activation immediately before FC and during single-leg landing. Kinetic and kinematic data were collected using a 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×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: $-13.2 \pm 7.8^\circ$ vs. $-9.5 \pm 6.3^\circ$, $-8.9 \pm 7.7^\circ$ vs. $-4.9 \pm 6.8^\circ$, $-3.3 \pm 8.9^\circ$ vs. $-2 \pm 6.5^\circ$) and external rotation ($-14.8 \pm 8.5^\circ$ vs. $-9.8 \pm 9.9^\circ$, $-8.0 \pm 3.6^\circ$ vs. $-3.6 \pm 9.7^\circ$, $-6.1 \pm 9.7^\circ$ vs. $-1.6 \pm 11.2^\circ$) at all time points in EC than in CC. The sacrum showed more lateral inclination toward the supporting leg at all time points ($14.3 \pm 6.4^\circ$ vs. $11.1 \pm 6.4^\circ$, $12.1 \pm 6.4^\circ$ vs. $9.0 \pm 6.1^\circ$, $8.9 \pm 7.1^\circ$ vs. $6.7 \pm 6.2^\circ$) and more erect position at KEMpk in EC ($-1.0 \pm 10.6^\circ$) than at CC ($-4.6 \pm 10.5^\circ$). 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.

2815 Board #98 June 1 3:30 PM - 5:00 PM
Relationship between Take-Off Force Profiles and Single Leg Hop Distance

Christopher Ballance, Maria Talarico, Daniel Clifton, Michael McNally, James Onate. *The Ohio State University, Columbus, OH.*

(No relevant relationships reported)

The anterior single leg hop for distance test (SLHOP) is a functional performance 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 tests 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 between 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 were 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 maximum 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.

2816 Board #99 June 1 3:30 PM - 5:00 PM
The Relationship Between Side Hop Test Endurance And Energy Absorption

Samantha Price, Chelsey Roe, Haley Reed, Gaelen Athanaze, Jessica Schilling, Kylie Davis, Brian Noehren, FACSM. *University of Kentucky, Lexington, KY.* (Sponsor: Brian Noehren, FACSM)

(No relevant relationships reported)

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 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 performed the best were able to maintain energy absorption throughout the testing protocol. Potentially, the ability to maintain the ability to absorb energy while fatigued may reduce of 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.

2817 Board #100 June 1 3:30 PM - 5:00 PM
Relationship between Single Leg Hop Distance and Descending Phase Force Variables

Maria Talarico, Christopher Ballance, Daniel Clifton, Michael McNally, James Onate. *The Ohio State University, Columbus, OH.*

(No relevant relationships reported)

Anterior single leg hop for distance (SLHOP) is a common functional assessment used to evaluate lower extremity power and dynamic postural stability. Peak force and rate of force development (RFD) have been used to quantify strength and power, but little is known of the relationship between these measures and SLHOP distance. **PURPOSE:** To determine the relationship between vertical and anterior force variables during the descending phase 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 SLHOP for maximal distance on their dominant limb, taking off a tri-axial force plate. Kinetic data were collected during the descending phase of the SLHOP to identify peak force in the vertical (Fz) and anterior-posterior (Fy) axes and average rate of force development (RFD), the rate of change in the force-time curve. Two start events were used to calculate RFD: 1) RFDnegative: point of maximum center of mass downward acceleration (subject moving down, acceleration negative) and 2) RFDzero: point when ground reaction force equals body weight (subject moving down, acceleration zero). The RFD end event was peak force (near the lowest point of descending). Forces were normalized to body weight and SLHOP distances were normalized to leg length. A linear regression with best subset selection method was performed to identify which combination of variables were most related to SLHOP distance with an alpha level set a priori at $p < 0.05$. **RESULTS:** Peak Fy (Beta= 189.32 , $95\%CI=133.04$, 245.61 , $p < 0.001$) and RFDzero in the vertical axis (Beta= -2.94 , $95\%CI=-5.48$, -0.40 , $p=0.03$) were significantly related to SLHOP distance (model adjusted $R^2=0.69$). **CONCLUSION:** Female soccer players who maximized anterior force and minimized vertical RFD during the descending phase of SLHOP achieved greater SLHOP distances. Results suggest maximal SLHOP distance warrants both vertical and anterior force generation. However, these movement strategies may not translate across different jump tasks (i.e. vertical jump, etc.) or different sports. Further research is

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 preschoolers. **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, FACSM³. ¹*Eastern Oregon University, La Grande, OR.* ²*Oregon State University, Corvallis, OR.* ³*Northern 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 after-school program that utilized outdoor resources. **METHODS:** Get Outside - After School Activity Program (GO-ASAP), a 20-wk (2d-wk⁻¹ 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⁻¹ (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 Martinez¹, Oswaldo Ceballos Gurrola², Raúl Lomas Acosta³, José Alberto Valadez Lira², Armando Cocca². ¹*Benemerita Escuela Normal Manuel Avila Camacho., Zacatecas, Mexico.* ²*Universidad Autónoma de Nuevo León., San Nicolás de los Garza, Nuevo León., Mexico.* ³*Secretaria 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 same 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 obesogenic 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 51 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 significant 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 < 0.005) and into EG2 (p < 0.001)

CONCLUSIONS:

The School-based Exercising And Nutrition Counseling shows favorable effects in the reduction of cortisol levels y ansiedad, 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 offer 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-test measures.

After controlling for pre-test scores, athletic ($F(1, 25) = 18.577, p < .001, \eta^2 = .426$) and scholastic ($F(1, 25) = 4.462, p < .05, \eta^2 = .151$) competence increased for non-minority and decreased for minority participants. There were no significant changes in PA enjoyment. Ego goal orientation decreased among male participants $F(1, 26) = 5.972, p < .05$. Weekly physical activity minutes increased from pre to post-test, $F(1, 27) = 53.115, p < .001, \eta^2 = .663$. **CONCLUSIONS:** Participating in the after-school jump rope program did not show consistent increases in assessed psychological variables however there were positive trends in goal orientation, weekly PA, and. Participants were involved in multiple after-school programs which may have influenced the data. Accelerometer data shows that the jump rope program elicited 45.3 minutes of MVPA including an average of 9 minutes of very vigorous PA creating an interval training type program. Further examination of how this type of program impacts self-perceptions is needed.

2822 Board #105 June 1 2:00 PM - 3:30 PM
Cardiorespiratory Fitness Moderate the Prospective Association Between Physical Activity & Cardiometabolic Risk Factors in Children

Turid Skrede¹, Eivind Aadland¹, Lars Bo Andersen¹, Mette Stavnsbo¹, Sigmund Alfred Anderssen², Geir Kåre Resaland¹, Ulf Ekelund, FACSM². ¹Western Norway University of Applied Sciences, Sogndal, Norway. ²Norwegian School of Sport Sciences, Oslo, Norway.
 (No relevant relationships reported)

Physical activity (PA) and cardiorespiratory fitness (CRF) are independently associated with lower cardiometabolic risk, and may affect risk through different pathways. PA and CRF are two different constructs (behaviour 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 in 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 accelerometry (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 ($PA \times CRF$) 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 resistance independent of WC ($P < 0.022$). When stratified by CRF level (low/high), PA and MVPA predicted lower insulin resistance [MVPA $\beta = -0.119$ (95% CI: -0.207, -0.038); $P = 0.008$] and clustered cardiometabolic risk [MVPA $\beta = -0.092$ (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.

2823 Board #106 June 1 2:00 PM - 3:30 PM
Physical Activity Influence On Behavior Of Children With ADHD & DBD During Instruction Using Classroom Observation

Jared D. Ramer¹, Catherine L. Davis², Stacy L. Frazier³, David X. Marquez, FACSM¹, Eduardo E. Bustamante, FACSM¹. ¹University of Illinois at Chicago, Chicago, IL. ²Augusta University, Augusta, GA. ³Florida International University, Miami, FL. (Sponsor: Dr. Eduardo Bustamante, FACSM)
 (No relevant relationships reported)

Evidence suggests physical activity influences children's neurocognitive function and ADHD symptoms. ADHD and Disruptive Behavior Disorder (DBD) are highly comorbid. Extra-curricular physical activity programs may improve academic achievement in ADHD and DBD by increasing academic engagement levels during instruction closer to those of typically developing peers. However, few studies have tested the impact of physical activity on objectively-measured classroom behavior in children with ADHD and/or DBD. **PURPOSE:** To evaluate the impact of physical activity on behavior for children with ADHD and/or DBD using a tool which objectively measures classroom behavior.

METHODS: African American children with ADHD and/or DBD were randomized to a 10-week after-school physical activity program ($n=19$) or a sedentary control program ($n=16$). Only 18% had ever received mental health services despite 87% meeting positive or intermediate criteria for ADHD and/or DBD. At posttest, 3 systematic classroom observations were conducted for each student using the BOSS (Shapiro, 2004). For comparison, each BOSS observation also assesses behavior among non-participant classroom peers. ANOVA tested differences in academic engagement and off-task motor (OFT-M) and verbal (OFT-V) behaviors among the physical activity group, control group, and classroom peers. Bivariate correlations tested relationships between program attendance and classroom behavior.

RESULTS: Omnibus tests revealed differences in OFT-M ($F[2,23]=16.9, p < .001$) and a trend for academic engagement ($F[2,23]=2.6, p = .09$). Pairwise comparisons revealed that the physical activity and control groups evidenced 52% and 49% more OFT-M ($ps < .01$), 34% and 33% more OFT-V (ns), and 11% and 15% less academic engagement (ns) than classroom peers. No differences were evident between intervention groups. Large non-significant correlations were found between program attendance and academic engagement in both physical activity ($r = .45, p = .08$) and control ($r = .45, p = .11$) groups.

CONCLUSION: Neither after-school program improved classroom behavior of children with ADHD and/or DBD to levels of classroom peers. Extra-curricular physical activity programs will require greater intentionality to impact classroom behavior in this population.

2824 Board #107 June 1 2:00 PM - 3:30 PM
The Strong Influence of Vigorous Physical Activity on Cardiorespiratory Fitness in Children

Corey A. Selland¹, Jessica R. Meendering², Matthew D. Vukovich, FACSM². ¹Black Hills State University, Spearfish, SD. ²South Dakota State University, Brookings, SD. (Sponsor: Matthew D. Vukovich, FACSM)
 (No relevant relationships reported)

The influence sedentary time has on cardiorespiratory fitness and health has recently received increased attention. Children become less physically active and more sedentary as they advance through childhood to adulthood, contributing to decrements in cardiorespiratory fitness. **PURPOSE:** The current study examined the relationship among objectively measured cardiorespiratory fitness, physical activity, and sedentary time in children.

METHODS: Participants ($n = 35$; 15 girls, 20 boys) had cardiorespiratory fitness measured by a maximal treadmill test with VO_2 assessed continuously. Sedentary time and physical activity were objectively assessed by accelerometry for 7 days. Multiple linear regression analyses were performed to identify independent associations of sedentary time, light, moderate, and vigorous physical activity with cardiorespiratory fitness. ANCOVA was used to evaluate whether VO_{2peak} varied by high/low physical activity/sedentary time groups (high physical activity, low sedentary time; high physical activity, high sedentary time; low physical activity, low sedentary time; low physical activity, high sedentary time). **RESULTS:** VO_{2peak} was negatively associated with sedentary time and positively associated with light, moderate, and vigorous physical activity ($p < 0.05$). Further analysis revealed sedentary time ($\beta = -0.03$), waist circumference ($\beta = -0.63$), and age ($\beta = 2.06$) were significant predictors of VO_{2peak} when not accounting for physical activity in the model. When accounting for physical activity, vigorous physical activity ($\beta = 0.18$), waist circumference ($\beta = -0.92$), age ($\beta = 2.26$), and sex ($\beta = -4.51$) were significant predictors of VO_{2peak} . Lastly, VO_{2peak} was higher in the low sedentary/high physical activity and high sedentary/high physical activity groups compared to the high sedentary/low physical activity group ($p < 0.05$). **CONCLUSIONS:** These results suggest cardiorespiratory fitness is predicted by vigorous physical activity, waist circumference, age, and sex but not sedentary time in children. Strategies aimed to promote and improve cardiorespiratory fitness and health in children should emphasize vigorous physical activity.

2825 Board #108 June 1 2:00 PM - 3:30 PM
The Correlations Between Families' SES and Physical Activity Levels of School-aged Children in China

Fan Xiang¹, Cao Zhen-Bo², Chen Peijie². ¹Shanghai Jiao Tong University, Shanghai, China. ²Shanghai University of Sport, Shanghai, China.
 (No relevant relationships reported)

In recent 30 years, China has made great changes in social and economic. These changes have made a significant impact on health and lifestyle as witnessed by an increased level of physical inactivity among school-aged children. Previous studies have indicated that families' socioeconomic status (SES) can influence children's physical activity (PA), but few studies have explored the correlation between the SES of families and the PA levels of children in China using a large sample survey. **PURPOSE:** To determine the correlation between SES of families and the PA levels of school-aged children in China.

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 children aged 9-17 years old, 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 (Mean \pm SE: 55.4 \pm 1.1) than those who from mid-SES and low SES families (50.1 \pm 0.6, 47.9 \pm 0.6, $P < 0.001$). Regarding the girls aged 12-14 years, those who from high SES families spent more minutes per day in MVPA (47.9 \pm 0.8) than those who from mid-SES and low SES families (47.2 \pm 0.5, 45.2 \pm 0.4, $P < 0.001$). Logistic regression analysis showed that 9-11-year-old children those who from low SES families were less likely to meet MVPA recommendations (boy: adjusted odds ratio (aOR) =0.74, 95%confidence interval (CI): 0.66-0.83; girls: aOR =0.83, 95%CI: 0.75-0.93) compared with children from high SES families. However, girls in age 15-17 years old who from low SES families were found to be more likely to meet recommendations compared with who from high SES families (aOR =1.31, 95%CI: 1.15-1.48). **CONCLUSIONS:** Overall, the average MVPA minutes per day among Chinese school-aged children is low, and families SES may be considered in the development of PA interventions and policies.

2826 Board #109 June 1 2:00 PM - 3:30 PM
Physical Activity in Latina Caregivers of Children with Developmental Disabilities

Jacqueline Guzman¹, Sandra Magaña², Judith S. Rocha¹, Mariana Garcia Torres¹, Miguel Morales¹, David X. Marquez, FACSM¹. ¹University of Illinois at Chicago, Chicago, IL. ²University of Texas at Austin, Austin, TX. (Sponsor: David X. Marquez, FACSM)

(No relevant relationships reported)

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, $M_{age} = 44.2$, 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

2827 Board #110 June 1 2:00 PM - 3:30 PM
Weight Status Influences Effectiveness of Need-Supportive Physical Activity Summer Camp in Girls

Megha Vishwanathan, Marlyse Sifre, Sophie Waller, Mika Manninen, Ellen M. Evans, FACSM, Sami Yli-Piipari. University of Georgia, Athens, GA.

(No relevant relationships reported)

PURPOSE: Habitual physical activity (PA) is a major factor related to obesity risk. Research has shown PA interventions among adolescents to be moderately successful in the short-term but limited to sustained behavior change. Self-determination theory (SDT) postulates that a psychological need-supportive environment (i.e. one that supports competence, autonomy, and social relatedness) is effective in maintaining volitional motivation which can lead to sustained positive behavioral changes including PA. Although research has supported the central tenets of the SDT, there is limited evidence examining whether a summer camp intervention

can sustain improvements in PA motivation and behavior. This study examined the effectiveness of a 1-week need-supportive summer camp to enhance self-determined PA motivation and behavior at 12-weeks post-camp. **METHODS:** Adolescent girls ($N = 42$; $n = 18$ overweight or obese girls (OW/OB, $>85^{th}$ percentile); $M_{age} = 11.7 \pm 1.1$) attended a one-week (5 days) 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 \pm 3.52, 19.88 \pm 3.59; $p > .05$), b) took more steps/day (12,172 \pm 2,103 vs. 7,442 \pm 3,737; $p < .05$), and c) engaged in greater moderate-to-vigorous intensity PA (MVPA) (291.7 \pm 46.4 vs. 185.4 \pm 90.8, $p < .05$). In PA motivation, the repeated measures analysis of variance results showed a significant within-subjects effect ($F[1,38] = 6.83$, $p = .019$, $\eta^2 = .29$). The within-subjects contrast analyses examining the growth trajectories showed a linear and 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: $F[1,19] = 15.83$, $p = .001$, $\eta^2 = .46$; MVPA: $F[1,19] = 21.63$, $p < .001$, $\eta^2 = .52$) with 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.

2828 Board #111 June 1 2:00 PM - 3:30 PM
Safety and Health Outcomes of a Physical Activity Program for Adolescents with Type 1 Diabetes

Garrett I. Ash¹, Kevin L. Joiner², Mary Savoye¹, Julien S. Baker³, James Gerosa⁴, Emma Kleck¹, Neha S. Patel⁵, Matthew Stults-Kolehmainen⁶, Stuart A. Weinzimer¹, Margaret Grey¹. ¹Yale University, New Haven, CT. ²University of Michigan, Ann Arbor, MI. ³University of the West of Scotland, Lanarkshire, United Kingdom. ⁴Southern Connecticut State University, New Haven, CT. ⁵Penn State Milton S. Hershey Medical Center, Hershey, PA. ⁶Yale New Haven Hospital, New Haven, CT. (Sponsor: William J. Kraemer, Ph.D., FACSM, FACSM)

(No relevant relationships reported)

Purpose: Evaluate *Bright 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 \pm 2.3y, female 67%, Black/Latino 67%, BMI 88 \pm 12%^{ile}, annual income 33% $<$ \$20k, 55% $<$ \$40k, A1c 9.5 \pm 2.3%, 79.9 \pm 25.1 mmol \cdot mol⁻¹) participated in group exercise classes (35min @ 60-80%HR_{max}) and self-management education 1x \cdot wk⁻¹ for 12wk. Anthropometrics, glycemic control, brachial blood pressure, fasting lipids, and cardiopulmonary fitness (15m 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 \pm 4.35 mmol \cdot L⁻¹ at start of exercise to 9.16 \pm 2.94 mmol \cdot L⁻¹ at completion ($p < 0.01$). Hypoglycemia (BG ≤ 3.89 mmol \cdot L⁻¹ with signs and/or symptoms) occurred once (0.6%). Average of 8.6 \pm 12.1g carbohydrates were required before, during, and/or after exercise. In the total sample ($n = 18$) there were no changes in BMI, A1c, cardiopulmonary fitness, body fat, waist circumference, mean arterial pressure, or lipid profile ($p > 0.05$). In the 10 completers, cardiopulmonary fitness improved (30.0 \pm 17.3vs37.1 \pm 20.8 MPACER shuttles, $p = 0.04$), LDL increased but within normal ranges (2.23 \pm 0.54vs2.52 \pm 0.59 mmol \cdot 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 completers. Exercise sessions decreased BG into ADA target range (3.9-10.0 mmol \cdot L⁻¹) with low risk of hypoglycemia and minimal need for supplemental carbohydrates (~35 kcal 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 Biobehavioral Lab; NEACSM Young Investigator Award; NIH-UL1TR000142

2829 Board #112 June 1 2:00 PM - 3:30 PM
Variability in Implementation Of A Classroom-based Physical Activity Intervention: Implications For Disparities In Pediatric Physical Activity Participation

Lexie R. Beemer, Tiwaloluwa A. Ajibewa, Molly P. O'Sullivan, Matthew R. Nagy, Ben Ransier, Darin Stockdill, U. Sean Vance, Natalie Colabianchi, Rebecca E. Hasson, FACSM. University of Michigan, Ann Arbor, MI.

(No relevant relationships reported)

PURPOSE: Disparities in physical activity (PA) participation remain a public health concern with higher rates of inactivity reported in ethnic minority and low-income

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 Interrupting Prolonged Sitting with ACTivity (InPACT), 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 in this 16-week study. 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 minutes completed in the classroom per week by school (school 1: 82±11min; school 2: 98±11min; school 3: 50±13min; $p=0.04$). 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 InPACT intervention varied by school with school 3, 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.

2830 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-Briceño, Isaura M. Castillo-Hernández.
University of Costa Rica, San José, Costa Rica. (Sponsor: Ellen M. Evans, FACSM)
(No relevant relationships reported)

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-analytic 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. A random-effects model with a within-group design was 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 yo) 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 ($p \leq 0.001$; $CI_{95\%} = 0.22$ to 0.87; $z=4.58$; $Q=13.38$; $I^2=92.48\%$) was found suggesting a low-moderate effect of the school-based PA programs to enhance HFlex. Neither a) quality of the studies ($r = -0.43$, $p = 0.87$), b) number of intervention sessions ($r = -0.16$, $p = 0.52$), nor c) minutes per session ($r = -0.03$, $p = 0.91$) 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

2831 Board #114 June 1 2:00 PM - 3:30 PM
Interventions for Increasing Physical Activity in Low-Income, Ethnic Minority Children and Youths: Meta Analysis
 Kyungun Kim¹, Seung Ho Chang², Jihyun Lee², Sukho Lee³.
¹University of Central Missouri, Warrensburg, MO. ²San Jose State University, San Jose, CA. ³Texas A&M University-San Antonio, San Antonio, TX. (Sponsor: Minsoo Kang, FACSM)
(No relevant relationships reported)

Ethnic minority and economically disadvantaged children and youths often show high levels of risk and vulnerability to physical inactivity and health issues. **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 modification (used or not 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, .634, $p = .007$), and interventions with behavioral modification (ES = .314, 95% CI = .046, .582, $p = .022$) 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.

2832 Board #115 June 1 2:00 PM - 3:30 PM
Standing Desk Intervention In Elementary School Children: Effects On Physical Activity And Sedentary Behavior
 Ann M. Swartz, FACSM, Nathan Tokarek, Chris C. Cho, Nora E. Miller, Hotaka Maeda, Krista Lisdahl, Scott J. Strath, FACSM. *University of Wisconsin-Milwaukee, Milwaukee, WI.*
(No relevant relationships reported)

Movement is very important for the growth and development of children. However, according to NHANES accelerometer data, children aged 6-11 years spend almost half of their day sedentary. Therefore, identifying ways to increase physical activity is important to the health of children. **PURPOSE:** To determine the effect of replacing traditional sitting desks with standing desks on total daily sedentary behavior (SB) and physical activity (PA) in elementary school children. **METHODS:** A 9-week within-classroom, controlled design, with teacher allocation to either a traditional seated desk (CON) or a standing desk (INT) was conducted during the first part of the school year. Baseline (September) and post assessments (December) included five consecutive weekdays of waking hour, hip-worn accelerometer (Actigraph GT3x+) assessments. Wilcoxon Rank Sum and Kruskal-Wallis Tests were used to detect significant between group differences ($p < 0.05$) in changes in SB, light-intensity PA (LPA), and moderate-to vigorous-intensity PA (MVPA). **RESULTS:** 22 third (8.5 ± 0.7y), 36 third (9.7 ± 0.5y) and 41 sixth (11.7 ± 0.4y) grade students completed the study and provided complete accelerometer data during the school day. During the intervention, students were exposed to the standing desks in the classrooms (homeroom time) for 19h of the possible 34.4h per week that students attended school. While both groups showed an increase in percent of homeroom time sedentary and a decrease in PA, changes in SB and PA were significantly less in the INT group than the CON group (SB, $p=0.033$; LPA, $p=0.004$; MVPA, $p=0.003$). Specifically, the INT increased SB by 1.9% and decreased MVPA by 0.1% of wear time, while the CON group increase SB by 6.2% and decreased MVPA by 3.1% of homeroom time. Similar trends in PA, but not SB or sitting, were seen when examining the entire school day. **CONCLUSIONS:** As the school year progresses, there is a tendency for student to increase sitting and decrease PA. The introduction of the standing desk was shown to positively curtail these trends. Therefore, standing desks may be useful in preventing sedentary activity in elementary school classrooms, especially among younger children.

2833 Board #116 June 1 2:00 PM - 3:30 PM
Impact Of Coordinated-bilateral Physical Activities On Attention And Concentration In School-aged Children
 Weyun Chen, Heidi Harris. *University of Michigan, Ann Arbor, MI.*
(No relevant relationships reported)

PURPOSE: This study examined the effects of a 4-week, daily 6-minute coordinated-bilateral physical activity (CBPA) breaks in classroom on 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 Fitbit Only (Fitbit-O), wore Fitbits 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 .95 to .98. A 2 × 3 ANOVA repeated measures were conducted, followed by the post hoc comparisons. **RESULTS:** The repeated measure ANOVA revealed a significant interaction between time × treatment in processing speed ($F_2 = 3.372, p = .038, = 0.058$), focused attention ($F_2 = 4.37, p = .015, = 0.074$), concentration performance ($F_2 = 13.53, p = .000, = 0.197$), and attention span ($F_2 = 8.04, p = .001, = 0.128$), but not in accuracy. Subsequently, the post hoc comparisons indicated that the CBPA group showed significant increases in processing speed ($F_1 = 6.876, p = .010$), focused attention ($F_1 = 10.688, p = .002$), concentration performance ($F_1 = 26.46, p = .000$), and attention span ($F_1 = 14.090, p = .000$) over the control, but not in accuracy. The CBPA group also showed significant improvement in concentration performance ($F_1 = 24.162, p = .000$) and attention span ($F_1 = 6.891, p = .011$), compared to the Fitbit-O. No significant changes in all five attention parameters were found between the Fitbit-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.

2834 Board #117 June 1 2:00 PM - 3:30 PM
The Impact Of Stand-biased Desks On After-school Physical Activity Behaviors In Children
 Nathan R. Tokarek, Chi C. Cho, Hotaka Maeda, Scott J. Strath, FACSM, Nora E. Miller, Ann M. Swartz, FACSM. *University of Wisconsin - Milwaukee, Milwaukee, WI.* (Sponsor: Ann M Swartz, FACSM)
(No relevant relationships reported)

PURPOSE: To assess changes in after-school time spent performing sedentary behavior (SB), light-intensity physical activity (LPA), and moderate- to vigorous-intensity physical activity (MVPA) among elementary school children in response to the introduction of stand-biased desks in the classroom. **METHODS:** Thirty-one 6th grade participants were assigned by their teacher to either a traditional (TD) (n=16) or stand-biased (SBD) (n=15) desk. After-school PA and SB were measured using accelerometry on four consecutive weekdays at baseline (prior to introduction of the stand-biased desks), and again following 9-weeks of exposure to either a TD or SBD in the classroom. After-school weather conditions and sport participation were recorded during both measurement periods using National Oceanic and Atmospheric Administration (NOAA) data and the Youth Activity Profile Questionnaire (YAP), respectively. Wilcoxon Rank Sum Tests were used to detect significant differences (p<0.10) in changes in after-school SB and PA between groups. **RESULTS:** No significant between group differences were found during the after-school period in pre-post changes in time spent performing SB (p=0.770), LPA (p=0.740), vigorous-intensity PA (VPA) (p=0.599), or MVPA (p=0.470). Significant between group differences in the median change in proportion of time spent performing moderate-intensity PA (MPA) (SBD: -1.4%; TD: -0.2%, p=0.093) were detected, with the SBD group experiencing a decrease of 4.3 minutes/after-school period relative to a 0.1 minute increase among TD participants. Coinciding with a change in PA, it was found that the average after-school temperature decreased from 60.0 °F at pre to 11.4 °F at post, while daylight also decreased by 81 minutes during the after-school period. Further, after-school sport participation between groups also changed from pre-post, with TD experiencing an increase of two after-school sport participants, while SBD experienced a decrease in after-school sport participation of two participants. **CONCLUSION:** Stand-biased desks did not have a negative impact on children's after-school PA and SB. Instead, seasonal variation and the structure of children's after-school schedule may have a greater influence on after-school activity than a mild classroom-based stand-biased desk intervention.

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 and/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. Petushek³, Karin A. Pfeiffer, FACSM³, Joseph J. Carlson³. ¹*Northern Michigan University, Marquette, MI.* ²*Michigan State University Extension, East Lansing, MI.* ³*Michigan State University, East Lansing, MI.* (Sponsor: Karin Pfeiffer, 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 techniques 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

	Body Weight	Body Fat	Waist Circumference	BMI	20-meter Pacer Score	MAP
HDL	-0.268**	-0.292**	-0.264**	-0.239**	0.107	-0.032
LDL	0.305**	0.330**	0.309**	0.334**	-0.151*	0.232**
Total Chol.	0.226**	0.265**	0.241**	0.268**	-0.132*	0.219**

** 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:** Thirteen (6 male, 7 female; Age=12.8±0.7 years) adolescents completed an 8 week HIIT training program. HIIT training consisted of two 30 minutes 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 $\dot{V}O_{2\max}$ test, while the “off” workload was set to be equivalent to 50% of maximal workload. Intensities were adjusted during each session so that RPE 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), $\dot{V}O_{2\max}$ and body composition were assessed before and after the training program. **RESULTS:** Response to the PACES improved 23% following HIIT training (Pre=52±3, Post=64±3; p=0.01). Similarly, $\dot{V}O_{2\max}$ (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 (58%) (Pre=144±7 W, Post=228±18 ml kg⁻¹ min⁻¹; p=0.001) increased as a result of HIIT. In contrast, body fat (Pre=46.6±2.5%, Post=44.9±2.4%; p=0.001) was reduced following 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 Conrad², Jaqueline Buell¹, Julie Young¹, Lihong Huang¹, Anastasia Fischer, FACSM¹. ¹Nationwide Children's Hospital, Columbus, OH. ²Ohio 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 proven to elicit a substantial bone mineral accrual advantage in childhood. The purpose of this study was to evaluate for a change in BMD in female adolescent athletes after a weight bearing physical activity intervention 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 <30kcal/kg 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 16.31±1.19. Fourteen girls were tested immediately after the exercise program and 8 one year after the program. There were no differences in TBLH, lumbar spine or TFFM (p=.22, p=.23, p=.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 in this research cohort.

2839 Board #122 June 1 2:00 PM - 3:30 PM
Objectively Measured Physical Activity in Parent-Child Dyads Exercising Together in Five Activities.

Patrick Filanowski¹, Noelle Merchant¹, Ronald J. Iannotti², Sarah M. Camhi¹, Jessica A. Whiteley¹, Laurie Milliken, FACSM¹.
¹University of Massachusetts Boston, Boston, MA. ²CDM 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 children (C) (6.6 ± 1.8 yrs) and their parents (P) (37.1 ± 7.5 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 GT9X 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 JG (28.2 ± 9.6), BWE (31.0 ± 8.8), 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 ± 00.0), BWE (13.3 ± 6.3), D (5.3 ± 4.6), 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 ± 00.0), D (5.3 ± 4.6), and TG (4.5 ± 5.3) and C had more %MPA during BWE (22.7 ± 9.6) than JG (17.4 ± 6.5). [Dancing]: P had more %VPA (5.3 ± 4.6) than BRISK (00.0 ± 00.0) (p < 0.05). [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, Neil P. Sharma, Sharon E. Taverno 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 = .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<.001), as well as higher estimated energy expenditure (0.087 vs. 0.079 kcal/kg/min, p<.001). Compared with the gym, children spent less time in management contexts (i.e., breaks and transitions; 15.9% vs. 30.2%, p<.001) and more time in free play (10.7% vs. 0.7%, p<.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.

2841 Board #124 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.
¹University of Massachusetts Boston, Boston, MA. ²CDM Group, Inc., Bethesda, MD. (Sponsor: Laurie Milliken, FACSM)
 (No relevant relationships reported)

PURPOSE: To objectively measure and compare the enjoyment of 5 physical activities designed for 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 facilitated by trained research assistants. The 6-point Visual Analog Scale (VAS), with 1 meaning 'like it very much' and 6 meaning 'don't like it at all', was used to assess

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 = 1.46 ± 0.78 , children's mean = 3.00 ± 1.58 , $U = 34.5$, $p = 0.007$). When comparing PA's performed by parents, parents enjoyed tag games (mean = 1.31 ± 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 ± 1.58 , $Z = -2.825$, $p = 0.005$).

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 In Health Parameters In Overweight Children

Carmen Silvia Grubert Campbell¹, Suliane Beatriz Rauber¹, Henrique Lima Ribeiro¹, Isabella Reis Praça¹, Joyce Bomfim Vicente¹, Geiziane Melo¹, Zelia Vargas dos Reis¹, Valeria Pedrosa¹, Pablo Cidelino¹, Daniel Fernandes Barbosa¹, Eric Vale¹, Alisson Luiz Aquino da Silva¹, Herbert Gustavo Simões².
¹Catholic University of Brasilia, Taguatinga, Brazil. ²Catholic University of Brasilia, Águas Claras, Brazil.

(No relevant relationships reported)

PURPOSE: To investigate the impact of a Health Educational Program for Children (HEPchild) 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 at the 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 < 3000 METs/week) after FOU in comparison to pre KIDS. On the other hand, the amount of sedentary children (< 600 METs/week) decreased by 15% and the insufficiently active (600 at 1500 METs per week) increased by 15%. The PAL leisure time increased significantly throughout the weekdays (26.0%) and the weekends (14.1%) after FOU comparing to pre KIDS. The SB showed a significant reduction in 177.14 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, tricipital and subscapular 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, triceps and subscapular 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.

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-Driscoll². 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 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-listed 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. Scale scores are reported (Mean \pm SE). Intent-to-treat analyses were conducted.

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 , $FU = 11.6 \pm 0.6$) and speed and agility (pre = 9.2 ± 0.4 , post = 10.8 ± 0.5 , $FU = 11.4 \pm 0.5$), $p < 0.05$. At FU all youth maintained improvements in upper-limb coordination (pre = 10.7 ± 0.5 , post = 12.2 ± 0.6 , $FU = 12.1 \pm 0.8$) balance (pre = 8.1 ± 0.3 , post = 9.3 ± 0.4 , $FU = 9.2 \pm 0.5$) and strength (pre = 8.0 ± 0.3 , post = 9.0 ± 0.4 , $FU = 9.0 \pm 0.5$), 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

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)

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.

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 \pm 0.9 years) 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 *a priori* at $p < 0.05$.

Results: At the end of the intervention, it was observed that both groups had significant improvement in motor competence [$F(1,54) = 0.465, p = 0.001$], 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 [$F(1,54) = 5.586, p = 0.022$] 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.

2845 Board #128 June 1 2:00 PM - 3:30 PM
The Effect of Education on Perceived Risk of Diabetes in Traditional-Age College Students
 Heather E. Webb, Shannon Strawn, Mikaela Boham, Liana Davis. *Texas A&M Corpus Christi, Corpus Christi, TX.*
(No relevant relationships reported)

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 a blood sample, 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:** RMANOVAs 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 revealed six participants at high risk for prediabetes and 12 with at least one risk factor for metabolic syndrome. RPS-DD risk and RPS-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 developing type II diabetes. 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.

2846 Board #129 June 1 2:00 PM - 3:30 PM
Associations between Chinese College Students' Social Cognitive Beliefs, Physical Activity, and Health: Sex Differences
 Jichao Liu¹, Nan Zeng¹, Kun Tao², Qingwen Peng², Xianxiong Li³, Shanying Xiong⁴, Zachary Pope¹, Zan Gao, FACSM¹.
¹University of Minnesota, Minneapolis, MN. ²Huaihua University, Huaihua, China. ³Hunan Normal University, Changsha, China. ⁴Shenzhen Polytechnic University, Shenzhen, China. (Sponsor: Zan Gao, FACSM)
(No relevant relationships reported)

PURPOSE: Use of a theoretical framework can offer implications for physical activity (PA) intervention. College students represent a population which might benefit from theoretically-grounded PA interventions. This study investigated the associations among Chinese college students' Social Cognitive Theory-based beliefs, PA levels, and relevant health outcomes while also examining if sex were present for any outcome. **METHODS:** In June of 2017, 220 college students (115 females; $M_{age} = 20.29 \pm 2.37$) 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 3-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 ($\beta = -0.21$, $p < 0.01$) but, as expected, that a lower body fat percentage was predictive of improved objective health ($\beta = -0.17$, $p < 0.05$). Finally, significant sex differences were observed for average MVPA per day, $F(1, 213) = 22.2$, $p < 0.01$, $\eta^2 = 0.09$, PA self-efficacy $F(1, 217) = 26.5$, $p < 0.01$, $\eta^2 = 0.11$, and PA enjoyment $F(1, 217) = 3.9$, $p = 0.05$, $\eta^2 = 0.02$, wherein 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.

2847 Board #130 June 1 2:00 PM - 3:30 PM
Use And Acceptance Of Sit-to-stand Workstations In The College Classroom
 Jeremy A. Steeves, Colby Beach. *Maryville College, Maryville, TN.* (Sponsor: David R. Bassett, FACSM)
(No relevant relationships reported)

PURPOSE: To evaluate the impact and acceptance of portable sit to stand workstations in a college class. **METHODS:** This 10-week pilot study used a non-randomized two-group pre-post comparison design. Half of the students ($n=7$) had access to sit to stand workstations (STS) during one course (two 75-min class meetings per week). The other half ($n=7$) retained usual sitting desks (SIT) in all classes. All participants completed questionnaires at baseline, at the end of week 2, and week 10, which captured participant characteristics including age, sex, classroom engagement, and focus. A 7-day log was used to capture classroom sitting and standing at these three time points. After week 10, STS participants were asked about the acceptability of the sit to stand workstations and changes in perceived classroom engagement and focused attention. Mann Whitney U tests compared STS and SIT groups for classroom sitting, and classroom focus. Within the STS group, paired t-tests compared classroom focus between the traditional seated position and the non-traditional standing position. In addition, changes in classroom posture in the class with the sit to stand workstation and acceptability of the sit to stand workstations are reported. **RESULTS:** At baseline, fourteen students (21.9 ± 1.9 yrs) reported sitting for 89.7% of all their classes (142.4 min/day). Despite no differences in overall classroom based sitting between the groups, the STS group trended towards increased classroom focus when standing compared to the SIT group (week 2: 3.7 ± 0.8 vs 2.8 ± 0.8 ; $p = 0.067$, and week 10: 4.1 ± 0.7 vs 3.4 ± 0.5 ; $p = 0.058$). When the STS group had access to the sit-to-stand workstations, sitting time decreased by almost 60% from 74 min/class at baseline to 43 and 44 min/class in weeks 2 and 10, respectively. Students reported that the sit to stand workstations were easy to use, enjoyed having the choice to sit or stand in class, and that engagement and focused attention was improved with the sit to stand workstations compared to traditional sitting. **CONCLUSION:** Providing college students with access to sit to stand workstations in some classes may reduce sitting, and help them focus.

2848 Board #131 June 1 2:00 PM - 3:30 PM
Examining the Relationships between Physical Activity Participation and Sleep Quality in Chinese College Students
 Nan Zeng¹, Kun Tao², Qingwen Peng², Shanying Xiong³, Xianxiong Li⁴, Zan Gao, 55455, FACSM¹. ¹University of Minnesota, Minneapolis, MN. ²Huaihua University, Huaihua, China. ³Shenzhen Polytechnic University, Shenzhen, China. ⁴Hunan Normal University, Changsha, China. (Sponsor: Zan Gao, FACSM)
(No relevant relationships reported)

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, $X_{age} = 20.29 \pm 2.37$, $X_{BMI} = 20.67 \pm 3.12$) were recruited from a university in South Central China. Participants wore a wrist accelerometer (ActiGraph GT9X Link) for 7 consecutive days. Participants' PA was defined by Troiano Adult (2008)'s cut points as follows: sedentary behavior (SB, 0-99 counts per minute [CPM]), light PA (LPA, 100-2019 CPM), moderate to vigorous PA (MVPA, 2020 and above CPM) (Troiano, 2008), while total sleep time (TST, mins/night) and sleep efficiency (SE%, the number of mins in bed/number of mins of sleep periods) were calculated from the same monitors. **Results:** Descriptive statistics indicated that participants spent 77.53% (SD = ± 10.03), 12.12% (SD = ± 2.68), 10.35% (SD = ± 2.73) of their time in SB, LPA, and MVPA, while TST and SE were 341.67 mins (SD = ± 80.65) and 84.12% (SD = ± 4.79), respectively. Correlation analyses revealed there was no significant relationship among SE, LPA, and MVPA (all $p > 0.05$). However, a significant positive relationship between SE and TST ($p < 0.01$, $r = .31$) was observed. Notably, there was an inverse relationship between TST and MVPA ($p < 0.05$, $r = -.16$), and between SE and SB ($p < 0.05$, $r = -.16$). Although multiple regression suggested the overall model was statistically significant [$F(3, 219) = 5.72$, $p < 0.05$, $\eta^2 = 0.12$] when age, gender, and BMI were controlled, SB did not appear to be an ideal predictor of SE. **Conclusion:** Accelerometry-determined daily PA was not related to sleep efficiency, suggesting higher PA participation does not necessarily improve sleep quality in the short-term. Notably, daily increases in MVPA may result in a reduction in TST. Nevertheless, decreased SB may lead to improvement in sleep efficiency. As low PA and low sleep quality are linked to adverse health outcomes, more long-term research with larger diverse samples examining how daily PA impact sleep is warranted.

2849 Board #132 June 1 2:00 PM - 3:30 PM
Research of the Perceived Exertion Scale of Physical Activity Intensity for Chinese Preschool Children
 Qu Sha, Luo Dong mei, Yao Tian cong. *Beijing Sport University, Beijing, China.*
 (No relevant relationships reported)

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 (PESPAl).

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 PESPAl. 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 PESPAl 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 PESPAl 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 PESPAl utilizes cartoon images for the items and contains 6 options. The PESPAl 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.

2850 Board #133 June 1 2:00 PM - 3:30 PM
Effect of Physical Activity Over 1-Week on Peak Expiratory Flow in Asthmatic Children
 Alexandra B. Ptacek, Gina M. Besenyi, Craig A. Harms, FACSM. *Kansas State University, Manhattan, KS.* (Sponsor: Craig A. Harms, FACSM)
 (No relevant relationships reported)

PURPOSE: Asthma is the most common chronic respiratory disease among children in the US, and may be a barrier to physical activity due to breathlessness and chest tightness. The purpose of this study was to determine if airway function was influenced by moderate to vigorous physical activity (MVPA) in asthmatic children over one week. It was hypothesized that as minutes of MVPA increased, peak expiratory flow (PEF) would also increase. **METHODS:** 45 children (6-13 yrs old), who were physician diagnosed with asthma, participated in a five-day asthma camp whose purpose was to improve child knowledge and management of their disease while providing a safe environment for normal summer camp activities. PEF as a measure of airway function was taken by a respiratory therapist for each child daily via a spirometer in the morning (0800). In asthmatic patients, PEF has been reported to correlate with forced expiratory volume in 1-sec (FEV_1). Objective MVPA was recorded daily with hip-worn Actigraph GT3X accelerometers from 0845-1125 and 1445-1625 at 5s epochs. Minutes of MVPA were calculated using validated cut-points. Pearson correlations were used to examine relationships between minutes of MVPA and PEF across the week and by age group (young (Y) 6-9 yrs; older (O) 10-13 yrs). Repeated measures ANOVA was used to determine differences in daily mean PEF percent change and minutes of MVPA, controlling for short-relief medication use. **RESULTS:** Data from 37 asthmatic children were analyzed (boys: 58.5%) and divided among age groups (Y=50%; O=50%). Over the week, MVPA was 73.3 ± 34.2 min/day. Pearson correlation coefficients were nonsignificant for PEF and minutes of MVPA across the week for total sample ($r = -0.11, p = 0.55$) and by age group (6-9 years, $r = 0.10, p = 0.72$; 10-13 years, $r = -0.28, p = 0.25$). PEF was not different ($p = 0.17$) from baseline across time. **CONCLUSIONS:** These results suggest that airway function is not influenced by MVPA in asthmatic children over the course of a weeklong asthma camp. Future research should incorporate a longer intervention period and a larger sample.

2851 Board #134 June 1 2:00 PM - 3:30 PM
Are Latino Preschool Children Meeting Recommendations Related To The 5-2-1-0 Message?
 Neil P. Sharma, Sharon E. Taverno Ross, Bethany B. Gibbs, Patricia I. Documét. *University of Pittsburgh, Pittsburgh, PA.*
 (Sponsor: Dr. Russell Pate, FACSM)
 (No relevant relationships reported)

PURPOSE: Almost 17% of Latino preschool children are obese, which is far higher than their racial/ethnic counterparts. To address the key behaviors associated with childhood obesity, the 5-2-1-0 message was developed (≥ 5 servings of fruits and vegetables [F/V], ≤ 2 hours of recreational screen time, ≥ 1 hour of physical activity [PA], and zero sugary drinks per day). In this study, we examined baseline data from ANDALE Pittsburgh, a culturally-tailored obesity prevention program, to determine whether or not Latino preschool children were meeting recommendations from the 5-2-1-0 message.

METHODS: N=51 parents (33.5 \pm 6.1 years) with preschool-aged children (3.5 \pm 1.2 years, 59% female) were recruited from community venues in Southwestern Pennsylvania. Screen time (parent survey; n=51), F/V and sugary beverage consumption (food screener; n=51), and PA (accelerometry; n=22) were assessed. For analysis, we used PA guidelines from the Institute of Medicine (IOM) recommendations for preschool children (≥ 15 min/hour of total daily physical activity). Sociodemographic and home factors related to the 5-2-1-0 message were assessed via parent survey. A trained researcher measured child height and weight to calculate body mass index and percentiles. We calculated descriptive statistics [mean (SD) and frequencies (n)] in SPSS version 25.0.

RESULTS: 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 ± 26 kcals/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.

2852 Board #135 June 1 2:00 PM - 3:30 PM
A Multi-level Analysis Of The Effects Of Epoch Length On Children'S Physical Activity Pattern
 Han Chen. *Valdosta State University, Valdosta, GA.*
 (No relevant relationships reported)

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

Purpose: Using the new generation ActiGraph GT3X+ accelerometer, the study examined the effects of different epoch lengths on children's moderate to vigorous physical activity (MVPA) generated by five different cut points while monitoring them during activity classes. The study also tested the moderating effects of physical activity (PA) level on the relationship between epoch length and MVPA.

Methods: The participants included both third ($n = 28$) and fourth grade ($n = 35$) students. Students in third grade participated in a Sports, Play, and Active Recreation for Kids (SPARK PE) class while the fourth graders were engaged in an active video game (AVG) class. Data were downloaded using 1s, 5s, 10s, 15s, 30s, and 60s epoch lengths. MVPA was determined by five different cut points. Multi-level analyses were conducted to test the effects of level 1 (i.e., epoch length) and level 2 (i.e., gender, body mass index [BMI], and class content) variables on MVPA. The study also examined the moderating effects of level 2 variables on the relationship between epoch length and MVPA.

Results: When lower cut points suggested by Freedson (2005), Evenson (2008), and Pulford (2011) were used, MVPA increased, followed by the increase of epoch lengths. This positive relationship between epoch length and MVPA was stronger when the PA level was higher. When MVPA was determined by higher cut points suggested by Puyau (2002) and Mattocks (2007), epoch length was found to negatively relate to MVPA, and this relationship was stronger when the PA level was lower.

Conclusions: Different epoch lengths generate various MVPA levels, and the relationship between epoch length and MVPA is moderated by PA levels.

2853 Board #136 June 1 2:00 PM - 3:30 PM
The Development And Testing Of A Direct Observation Protocol For Children'S Free-play Activity

Melanna F. Cox, Gregory J. Petrucci, Jr, Brittany R. Masteller, John R. Sirard. *University of Massachusetts Amherst, Amherst, MA.*

(No relevant relationships reported)

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), 28 children (age=8.4±1.5 years) participated in a 30-minute indoor free-play session. The participants were recorded using a GoPro camera and wore an accelerometer on the hip (AG-H) and non-dominant wrist (AG-W). Researchers coded videos for the main Whole-Body Movement and four modifiers: 1) Locomotion, 2) Limb Movement, 3) Activity Type, and 4) MET value. For intrarater 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 inter-rater 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=0.008), moderate (MPA; p<0.001), and moderate-to-vigorous PA (MVPA; p=0.017) and underestimated light, (LPA; p<0.001). The AG-W underestimated SED (p=0.03) and LPA (p<0.001) but overestimated MPA (p<0.001) and MVPA (p<0.001).

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

2854 Board #137 June 1 2:00 PM - 3:30 PM
Associations Of Physical Activity And Screen Time With Obesity In Chinese Children And Adolescents

Zheng Zhu¹, Shengxia Ma¹, Yang Bai², Yan Tang¹, Jie Zhuang¹, Yang Liu¹, Peijie Chen¹, Zhen-Bo Cao¹. ¹Shanghai University of Sport, Shanghai, China. ²University of Vermont, Burlington, VT.

(No relevant relationships reported)

Associations of Physical Activity and Screen Time with obesity in Chinese Children and Adolescents

Zheng Zhu^{1,2}, Shengxia Ma¹, Yang Bai², Yan Tang^{1,2}, Jie Zhuang^{1,2}, Yang Liu^{1,2}, Peijie Chen^{1,2}, Zhen-Bo Cao^{1,2}

1. Shanghai University of Sport, Shanghai, China

2. Shanghai Research Center for Physical Fitness and Health of Children and Adolescents, Shanghai, China

3. University of Vermont, Burlington, VT

PURPOSE: The objective of this study was to examine the associations of physical activity and screen time with obesity in Chinese children and adolescents.

METHODS: We conducted cross-sectional analyses of 33,399 participants (boys:48.9%, age:12.5±2.5 yr, weight:48.1±14.9 kg, height:154.6±13.8 cm, Body mass index:19.7±3.9 kg/m²) who completed height and weight measurement and physical activity and sedentary behavior questionnaire (including screen time and time spent in doing homework after school). Based on the criteria set by Working Group on Obesity in China, the participants were categorized into either obesity or not using the body mass index. The associations of physical activity and screen time with weight status were examined, through multiple logistic regressions, after controlling for gender, age and time spent in doing homework.

Results: The children and adolescents who did not meet the recommendation of at least 60 min/day of moderate to vigorous physical activity (MVPA) had 1.21 times the odds of being obese compared to those meeting the guideline (95% confidence interval [CI] of Odds Ratio: 1.10-1.33), after adjusting gender, age, time spent in doing homework and screen time. The children and adolescents who did not meet the screen time recommendation of ≤2h/day had 1.16 times the odds of being obese compared to those meeting guideline (95% CI of Odds Ratio: 1.07-1.26) after adjusting gender, age, time spent in doing homework and MVPA. In joint association analysis, children

and adolescents who did not meet physical activity nor screen time guidelines had 0.45 times higher odds of being obese than children and adolescents who met both guidelines (95% CI of Odds Ratio: 1.27-1.66).

CONCLUSION: The results demonstrated that MVPA and screen time are independently but also jointly associated with obesity in Chinese children and adolescents.

2855 Board #138 June 1 2:00 PM - 3:30 PM
Teaching Styles in Physical Education: The Effects on Physical Activity Levels of Middle School Students with Different Motivation Types

Yongju Hwang¹, Jooyeon Jin². ¹University of Wisconsin-La crosse, Onalaska, WI. ²University of Seoul, Seoul, Korea, Republic of.

(No relevant relationships reported)

PURPOSE: Self-determination theory (SDT) has been widely investigated as a powerful theoretical framework to understand and change an individual's physical activity behavior in different settings (Deci & Ryan, 1985; De Meyer et al., 2016). However, there is a limited understanding on how entire SDT explains objectively measured moderate to vigorous physical activity (MVPA) levels of adolescents in physical education lessons. To examine if physical educators' teaching style influences student needs that affect student motivation, which in turn predict objectively measured student MVPA levels (i.e., a serial mediator model).

METHODS: A total of 313 students from three middle schools in Wisconsin completed Learning Climate Questionnaire modified from Williams and Deci (1996), Psychological Need Scale and Need Frustration Scale adopted from Chen et al. (2015), and Physical Education Questionnaire modified from (Aelterman et al., 2012) to assess perceptions of autonomy-supportive teaching, experience of need satisfaction and need frustration, and motivational outcomes, respectively. After a week of the survey administration, participants' MVPA levels were recorded using a GT3X+ accelerometer for four consecutive physical education lessons. PROCESS, a regression-based computational procedure program designed for mediation analyses in SPSS, was used to examine the mediating relationships.

RESULTS: Bootstrapping with 10000 samples showed that autonomous teaching behavior significantly influence MVPA levels through relatedness satisfaction and intrinsic motivation (b = .79; 95% CI: .29 - 1.35), autonomous teaching behavior significantly influence MVPA levels through competence satisfaction and intrinsic motivation (b = 1.17; 95% CI: .69 - 1.77), and autonomous teaching behavior significantly influence MVPA levels through competence satisfaction and identified regulation (b = 1.33; 95% CI: .83 - 1.99). In addition, bootstrapping with 10000 samples revealed that controlling teaching behavior significantly affects MVPA levels through autonomy frustration and amotivation (b = -.49; 95% CI: -1.03 - -.08). **CONCLUSIONS:** The findings indicates that an autonomy-supportive teaching style may promote MVPA levels of middle school students during physical education lessons.

2856 Board #139 June 1 2:00 PM - 3:30 PM
Relationships of Physical Activity and Academic Achievement in the College Student Attending a Two-Year Institution

Gwendolyn Plucar, David Barrett. *Southwest Minnesota State University, Bloomington, MN.*

(No relevant relationships reported)

PURPOSE: Physical activity is directly related to a healthy body along with a healthy mind. The relationship between physical activity and academic activity has been studied for decades. Researchers have focused on the effects on K-12 students. Academic performance in college students has been linked with: cognition, sleep, mental health, self-efficacy, diet, and stress. Depression and anxiety tendencies tend to have the highest prevalence of mental health issues in college students. All factors that have been shown to improve with exercise. This study will determine a correlation between organized and leisurely forms of physical activity and academic achievement in college students.

METHODS: Three hundred ninety-nine students, enrolled in classes at Normandale Community College completed a wellness questionnaire. Student participation was voluntary and responses were anonymous. The survey asked students to self-report factors related to: age, GPA, physical activity, sleep, diet, and GRIT (Duckworth's 8-item GRIT scale, a validated measure of Growth, Resilience, Intuition, and Tenacity). Correlation and Regression models were assessed in version 20 of SPSS.

RESULTS: 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 all of the time * .197) + (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.

CONCLUSIONS: This study found statistically significant correlations with GRIT score, age related GRIT score, and breakfast frequency. Results related to physical activity may have been related to social desirability responses. GRIT related to age is likely related to the required academic achievement of Post-Secondary Education Option students. Gender identification was not included in the survey to protect anonymity. Gender identification may change the correlation factors that were found.

2857 Board #140 June 1 2:00 PM - 3:30 PM
Changes In Student Perceptions of Interdisciplinary Collaboration After Community Health Fair Volunteer Experiences
 Mary C. Stenson, Mark Glen, Nicole Lang, Julie Strelow.
College of St. Benedict/ St. John's University, Saint Joseph, MN.
 (No relevant relationships reported)

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 opportunity to introduce pre-healthcare students to interdisciplinary collaboration. A descriptive, mixed-methods design was used with an interdisciplinary convenience sample of pre-healthcare college students who identified as exercise science, Integrative Health Science, nursing, and nutrition majors. Surveys were conducted before and after the health fairs using a 7 item scale developed by Gallagher et al. (2010) and open-ended questions developed by the researchers that measured the impact of the collaborative experience. **RESULTS** A significant increase was observed in knowledge of community agencies that can provide optimum care ($\Delta 0.67$; $t=-4.51$; $p<0.000$), knowledge of the value of an interdisciplinary healthcare team ($\Delta 0.85$; $t=-7.17$; $p<0.000$), knowledge of strengths and skills of other disciplines ($\Delta 0.69$; $t=-5.95$; $p<0.000$), and experience working with healthcare teams ($\Delta 0.97$; $t=-5.43$; $p<0.000$). Students more strongly agreed that other members of the healthcare team are important to their work after the health fair experiences than before ($\Delta 0.15$; $t=-2.87$; $p<0.000$). No significant change was found in attitudes towards the importance of communication between team members ($\Delta 0.03$; $t=-1.00$; $p=0.32$) or learning from other professionals ($\Delta 0.08$; $t=-1.93$; $p=0.06$). In open ended responses students indicated that they were motivated to learn about other healthcare disciplines to improve patient/client care and they experienced challenges in applying the professional values they perceive as important. **CONCLUSION** Students increased their knowledge of the value of an interdisciplinary healthcare team. Students recognized the importance of interdisciplinary collaboration, but engaged in collaboration to varying degrees. The health fairs provided an intentional, foundational experience to support development as future healthcare professionals and effective members of interdisciplinary teams. Using skills in a real-world setting helped students recognize their strengths and areas where their interdisciplinary teamwork skills may need improvement.

2858 Board #141 June 1 2:00 PM - 3:30 PM
Who Are the Undergraduate Equestrians in the Intercollegiate Horseshows Association, and What Are Their Lifestyle Habits?
 Jessie Bitler, Helen Battisti, Shelby Yeager, Diane DellaValle.
Marywood University, Scranton, PA.
 (No relevant relationships reported)

Purpose: Given there is little available research on equestrian athletes, and none about the members of the Intercollegiate Horse Shows Association (IHSA), the purpose of this cross-sectional study was to describe demographic characteristics and lifestyle habits of undergraduate student members of the IHSA.
Method: Participants included 528 undergraduate student members from the eight zones of the IHSA (Age 20.30 ± 1.43 years, 96 % female, 91.7 % white). Participants completed an online survey including demographic characteristics, academics, years of riding experience, sleep, physical activity, fruit and vegetable intake, and alcohol (ETOH) and tobacco use. Body Mass Index (BMI) was calculated based on self-reported height and weight. Participants were divided into two groups (less experience and more experience) based on the sample median of 12 years of riding experience. Independent-samples *t* test and Chi-Square test of independence were used to assess differences between years of riding experience for characteristics and lifestyle habits. **Results:** Participants reported 11.7 ± 4.5 years of riding experience, 55.7 % did not own their own horse and 64.8 % rode English. Mean GPA of participants was 3.4 ± 0.4 and 46.4 % reported majoring in math, science and animal sciences. There were no significant differences found between riding experience groups and BMI (23.2 ± 3.7 kg/m²), alcohol consumption (34.3 reported none, 46.6 % reported < 1 serving ETOH per day), cigarette smoking (98.1 % non-smokers), fruit consumption (83.6 % reported 1-3 servings/day), vegetable consumption (82.8 % reported 1-3 servings/day), and hours of sleep per night (84.6 % reported 6-8 h/night). There were also no significant differences in physical activity within sport (44.1 % reported 30-60 min/day), vigorous physical activity outside of sport (59.2 % reported 0-30 min/day), and light activity outside of sport (64.8 % reported 15-60 min/day).

Conclusion: There were no differences between riding experience groups and demographics or lifestyle habits in this representative sample of undergraduate members of the IHSA. 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.

F-58 Free Communication/Poster - Physical Activity and Cancer
 Friday, June 1, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

2859 Board #142 June 1 2:00 PM - 3:30 PM
Mid-term Effectiveness Of An Unsupervised Exercise Prescription Program In Breast Cancer Survivors
 Gabriele Mascherini, Benedetta Tosi, Leonardo Osti, Giorgio Galanti.
University of Florence, Florence, Italy.
 (No relevant relationships reported)

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 ($T_0=27.3 \pm 4.2$; $T_5=26.1 \pm 3.9$ kg/m²; $p<0.001$); - waist circumference ($T_0=90.2 \pm 10.8$; $T_5=85.3 \pm 9.8$ cm; $p<0.001$); - extracellular water ($T_0=17.5 \pm 1.9$; $T_5=16.8 \pm 1.9$ L; $p<0.01$); - fat mass ($T_0=25.0 \pm 8.1$; $T_5=22.6 \pm 7.2$ kg; $p<0.001$). Physical fitness improvements: - 6 MWT ($T_0=518.6 \pm 133.0$; $T_5=584.8 \pm 97.2$ m; $p<0.001$); - Hand Grip ($T_0=24.3 \pm 4.8$; $T_5=26.5 \pm 4.5$ kg; $p<0.01$); - Chair Test ($T_0=14.5 \pm 3.8$; $T_5=18.3 \pm 4.3$ repetitions; $p<0.001$); - Sit and Reach ($T_0=2.6 \pm 9.3$; $T_5=8.5 \pm 7.1$ cm; $p<0.001$). Health Related Quality of Life improvements: - Physical Functioning ($T_0=72.7 \pm 24.6$; $T_5=83.7 \pm 17.1$ %; $p<0.001$); - General Health ($T_0=64.7 \pm 20.4$; $T_5=69.1 \pm 18.9$ %; $p<0.001$); - Social Functioning ($T_0=60.5 \pm 24.5$; $T_5=67.6 \pm 22.9$ %; $p<0.05$); - Mental Health ($T_0=63.4 \pm 14.8$; $T_5=67.3 \pm 12.5$ %; $p<0.05$). 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.

2860 Board #143 June 1 2:00 PM - 3:30 PM
The Effects of Smart Watch Intervention on Breast Cancer Survivors' Biomarkers and Health Outcomes
 Nan Zeng¹, Chunyuan Han², Ning Liao³, Zan Gao, FACSM¹.
¹University of Minnesota, Minneapolis, MN. ²South China University of Technology, Guangzhou, China. ³Guangdong People's General Hospital, Guangzhou, China. (Sponsor: Zan Gao, FACSM)
 (No relevant relationships reported)

PURPOSE: Adverse health outcomes are often seen among breast cancer survivors (BCS), with physical activity (PA) a possible solution in disease management. To date, little research has examined how smart watches might promote BCS' health-related outcomes. This study assessed the effectiveness of a smart watches PA intervention on biomarkers and functional fitness in Chinese BCS.
METHODS: Thirty-three BCS ($X_{age}^- = 44.7 \pm 7.1$, $X_{BMI}^- = 21.7 \pm 2.5$) were recruited from Southern region of China. All patients received a Xiaomi smart watch to track their PA behaviors (e.g., steps, calories burned, etc.). An individually-tailored exercise prescription (e.g., increasing step counts by $\geq 2,000$ steps/day to reach a daily step counts $\geq 9,000$ steps) was delivered to each patient based on their smart watch data collected via online server every month. Patients' biomarkers triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), blood glucose (BG), carcinoembryonic antigen (CA), and functional fitness: leg strength and endurance (LSE; 30-second chair stand test); upper body strength and endurance (UBSE; 30-second arm curl test); lower body flexibility (LBF; chair sit and reach test);

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-months.

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, significant 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 ($M_{diff} = -92.26$, $p < 0.01$, Cohen's $d = -1.26$) 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 Greterman. *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 compared time spent in SED, LIT, MOD, and VIG between weeks 1, 6, and 12 was used to analyze the data.

Results: Of the 47 recruited, 15 participants (age = 55.20±13.85) completed week 1 (Group A), 19 participants (age = 52.17±11.71) completed weeks 1 and 6 (Group B), and 12 participants (age = 53.08±11.01) completed weeks 1, 6 and 12 (Group C). Participants averaged > 17 hr·day⁻¹ of non-sleep activity monitor wear time with no significant differences in wear time ($p = 0.05$, $F = 4.48$). Minimal VIG PA resulted in combining MOD and VIG activity into one moderate-vigorous PA group (MVPA). Group C engaged in more PA compared to Groups A and B, but there were no statistically significant differences between Groups A and C ($p = 0.24$, $F = 1.47$) during week 1 or between groups B and C during both week 1 ($p = 0.54$, $F = 0.39$) and week 6 ($p = 0.33$, $F = 0.98$). For Group C, total PA based on wear time increased slightly from weeks 1 to 6 and decreased from weeks 6 to 12, but there were no statistically significant changes over all three time points ($p = 0.12$, $F = 1.83$). All three groups averaged more than 40 min·day⁻¹ of MVPA. Group C engaged in less SED time compared to Groups A and B, but there were no statistically significant differences between groups A and C ($p = 0.64$, $F = 0.22$) or between groups B and C ($p = 0.42$, $F = 0.67$). For Group C, SED time was lower at both week 6 and week 12 compared to week 1, but week 12 was slightly higher than week 6. There was a statistically significant difference in change in SED time from weeks 1 to 6 ($p = 0.03$, $t = 2.79$) and weeks 6 to 12 ($p = 0.03$, $t = -2.85$), but not weeks 1 to 12 ($p = 0.9997$, $t = 0.03$).

Conclusion: The fact that participants exceeded the 150 min·week⁻¹ CDC recommendation of PA and SED time declined from week 1 to week 12 is promising.

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, FACSM², Renwei Wang³, Jiaying Lang¹, Ruirui Xing³, Shuhao Quan³. ¹Tongji 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 Guolin 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±6.14; Cancer survival yr: 1.67±0.69) were recruited from the Shanghai Cancer Club. All the 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/CD(16+56)/CD19/CD4CD25 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 180 minutes per day. It was found that CD4⁺ increased significantly ($p < 0.01$), CD4⁺CD25⁺ declined significantly ($p < 0.05$) respectively after 24 weeks.

CD3⁺, CD8⁺, CD(16+56)⁺ and CD19⁺ showed no statistical difference before and after intervention. The change of CD8⁺CD28⁺ is moderately correlated with SCE duration per week ($r = 0.552$, $p < 0.01$).

CONCLUSIONS: SCE intervention improved the cellular immune function of lung cancer patients and is correlated with the duration of the practice.

2863 Board #146 June 1 2:00 PM - 3:30 PM
An Investigation Of Physical Activity And Cardiorespiratory Fitness In Childhood Cancer Survivors.
 David Mizrahi¹, Claire E. Wakefield¹, Joanna E. Fardell¹, David Simar¹, Ann Maguire², Gill Hubbard³, James McBride⁴, Penelope Field⁴, Richard J. Cohn⁴. 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, ≥5 years after diagnosis, from 11 Australian and New Zealand hospitals as well as from age-matched controls using the International Physical Activity Questionnaire. We compared moderate-vigorous physical activity 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 (6MWT), 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 vs 46.8 ml/kg/min, $p=0.31$; 47th vs 60th percentile, $p=0.41$) and 6MWT distance (737m vs 690m, $p=0.07$; 85th vs 78th 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.

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
Neuropathy And Fine-motor-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 Chambliss, FACSM, 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 persistent neuropathy, which interferes with general mobility and walking. Neuropathy 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±5.9 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). Neuropathy 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). Neuropathy 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, FACSM, 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 concern 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 a 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, FACSM¹. ¹*Penn State Cancer Institute, Hershey, PA.* ²*Penn State University, State College, PA.* (Sponsor: Kathryn Schmitz, FACSM)
 (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% (lung) 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.

	Total	Breast	Colorectal	Gynecologic	Lung	Prostate
n	585	144	107	131	81	122
Sufficiently active	47%	49%	42%	48%	35%	54%
BMI 20-25	20%	25%	22%	15%	26%	13%
At least 5 servings f/v	0%	0%	0%	0%	0%	0%
Not smoking	91%	93%	92%	94%	82%	93%
Average score	1.6	1.7	1.6	1.6	1.4	1.6

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 Baker¹, Patricia Fitzgerald¹, Kristofer Wisniewski¹, Jonathan Myers, FACSM². ¹*Saint Francis University, Loretto, PA.* ²*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 (59.3±15.2 years) free from malignancy at baseline who were followed for a mean of 12±6.9 years. Multivariate 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 5 and 8 for cancer incidence and cancer mortality, respectively. **CONCLUSIONS:** Higher CRF is associated with lower risk for cancer incidence and cancer mortality in women, suggesting the possible protective benefits for cancer prevention. Eliminating low CRF as a risk factor would potentially prevent considerable cancer morbidity and mortality and reduce the associated societal-economic burden. Achieving CRF of ≥5 METs could be cost-effective for public health and may play an important role in primary cancer prevention programs. Future large cohorts should ascertain these findings.

2869 Board #152 June 1 2:00 PM - 3:30 PM
The Effect of Radiation Therapy on Cancer Patients Participating in Structured Exercise
 Amber M. Huang¹, Cynthia Villalobos¹, Justin C. Brown², J. Mark VanNess¹, Jeremy P. McConnell¹, Paul D. Vosti³, Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²Harvard University, Cambridge, MA. ³St. Joseph's Medical Center, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)
 (No relevant relationships reported)

Radiation therapy was first attempted as a treatment for cancer in 1896. Since then, it has become a common modality, and the survival rate among diagnosed patients has increased drastically. While radiation can prolong life expectancy, it can be deleterious to the patients' health. Exercise has consistently demonstrated improvement in anthropometric, cardiometabolic, and functional capacities of cancer survivors, but data concerning the effect of radiation on exercise outcomes are limited. **PURPOSE:** To evaluate the effect of radiation therapy on exercise outcomes in cancer survivors. **METHODS:** Patients participated in a 10-week exercise intervention involving aerobic, resistance, and flexibility training. There were 59 patients who had never used radiation (NR), 63 who had complete radiotherapy (HR), 18 currently undergoing treatment (CR), and 17 who failed to report their status. We analyzed differences among the three radiation exposure groups (NR, HR, and CR) in baseline characteristics, exercise adherence, and improvement in several parameters of health and function using chi-square and multivariate tests; post-hoc analyses tested specific group differences. **RESULTS:** There were no baseline differences between groups in age, health history, body composition, cardiovascular parameters, fatigue, insomnia, or depression. Patients in the NR group performed better on the five times sit-to-stand test than HR patients ($p=0.013$) and better on sit-and-reach ($p=0.037$) and functional reach ($p=0.059$) than CR patients. There were no differences in program completion based on use of radiation ($p=0.404$). Although there were no baseline differences in the six-minute walk ($p=0.987$), CR patients improved more than HR patients ($p=0.038$) and NR patients ($p=0.051$). There were no baseline differences in systolic blood pressure ($p=0.957$) but CR patients experienced greater reductions than patients in the HR group ($p=0.011$) and NR group ($p=0.035$). **CONCLUSION:** Exercise may be an effective way to mitigate some of the health consequences associated with radiation therapy. In our sample, exercise improved blood pressure and six minute walk more in patients who were currently undergoing treatment; however, our low retention rate may create potential bias and fail to accurately characterize expected results.

2870 Board #153 June 1 2:00 PM - 3:30 PM
Effect of an Exercise Program on Fitness and Motivation Outcomes in Overweight Breast Cancer Survivors
 Rita Musanti¹, Damion Martins², Dean Padavan², Adam Kahn². ¹Rutgers, New Brunswick, NJ. ²Atlantic Sports Health Institute, Morristown, NJ.
 (No relevant relationships reported)

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: VO_2 max, grip, balance and body composition. Psychological needs and motivation were measured with Basic Psychological Needs for Exercise 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 VO_2 max. 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.

2871 Board #154 June 1 2:00 PM - 3:30 PM
Chemotherapy and the Exercising Cancer Survivor
 Samantha R. Gayla¹, Cynthia Villalobos¹, Justin C. Brown², J. Mark VanNess¹, Paul D. Vosti³, Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²Harvard University, Cambridge, MA. ³St. Joseph's Medical Center, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)
 (No relevant relationships reported)

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 measured 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 VO_2 max ($p=0.037$) and systolic blood pressure ($p=0.064$). **CONCLUSION:** Patients who had 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.

2872 Board #155 June 1 2:00 PM - 3:30 PM
Self-Reported Physical Activity at Breast Cancer Diagnosis is Associated with Greater Physical Activity During Chemotherapy
 Chad W. Wagoner, Allison M. Deal, Seul K. Choi, Jordan T. Lee, Hyman B. Muss, Kirsten A. Nyrop. University of North Carolina at Chapel Hill, Chapel Hill, NC.
 (No relevant relationships reported)

PURPOSE: Examine 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 ; $p < 0.0001$) and a history of self-reported vigorous physical activity (55% vs 45%; $p < 0.01$) at baseline exhibited greater weekly Fitbit step totals during chemotherapy. **CONCLUSIONS:** 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.

2873 Board #156 June 1 2:00 PM - 3:30 PM
Time-Course of Muscle Performance Recovery of Hodgkin's Lymphoma Survivors After a Resistance Exercise Session: A Preliminary Study
 Sandro N. Chaves, Filipe Dinato de Lima, Ritielli de Oliveira Valeriano, Ricardo Jacó de Oliveira. *University of Brasília, Brasília, Brazil.*
(No relevant relationships reported)

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 peak torque was assessed and the volunteers performed an exercise session composed by six sets of ten repetitions at 60°/s 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 (178.97 ± 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.

2874 Board #157 June 1 2:00 PM - 3:30 PM
Objectively Quantified Doses of Activity and Inactivity and Subjective Well-Being in Breast Cancer Survivors
 Amanda Hickey¹, Richard Viskochil², Patty Freedson, FACSM², Barry Braun, FACSM³. ¹Keene State College, Keene, NH. ²University of Massachusetts, Amherst, MA. ³Colorado State University, Fort Collins, CO.
(No relevant relationships reported)

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 wore an ActiGraph GT3X monitor on the right hip for 7 consecutive days and completed the EORTC QOL questionnaire and Piper Fatigue Scale prior to and during the final week of a supervised 12-wk 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.

	ST (%)	Light (%)	MVPA (%)	Piper Fatigue Score	EORTC QOL Score
Baseline	77.2 (6.41)	17.6 (4.95)	5.2 (3.94)	80.6 (40.40)	5.7 (0.69)
Post-Intervention	71.8* (8.38)	22.7* (6.75)	5.5 (3.29)	66.1* (31.87)	5.9* (0.96)

Note: Data are presented as mean (SD); * indicates significant change from baseline ($p < 0.05$)

By post-intervention these women replaced ST with light intensity activity. The EORTC score was significantly correlated with ST at baseline ($R^2 = 0.33$, $p = 0.05$), but this relationship was not significant at post-intervention. There were no significant relationships found between the Piper Fatigue Score and ST.

Discussion: These findings suggest participants did not reduce PA or increase ST during the exercise program. It has been reported that exercise training may lead to compensatory declines in habitual PA and/or increases in ST but our results do not support this. It is possible that as BC survivors increase purposeful exercise, they are able to substitute low levels of PA for ST. The relationship found between QOL and ST suggests that reductions in ST could be a potential target for interventions that aim to improve QOL in BC survivors.

2875 Board #158 June 1 2:00 PM - 3:30 PM
Effects of a Lifestyle Intervention on Select Social Cognitive Outcomes in Prostate Cancer Patients Undergoing Androgen Deprivation Therapy
 Brian C. Focht, FACSM¹, Alexander R. Lucas², Elizabeth Grainger¹, Christina Simpson¹, Ciaran M. Fairman¹, Jennifer M. Thomas-Ahner¹, Jessica Bowman¹, Victoria R. DeScenza¹, Zachary L. Chaplow¹, Steven K. Clinton¹. ¹The Ohio State University, Columbus, OH. ²Wake Forest University, Winston Salem, NC.
(No relevant relationships reported)

Social cognitive theory (SCT) variables are well-established determinants of lifestyle behavior change. Although exercise consistently improves clinically relevant outcomes in prostate cancer (PCa) patients undergoing androgen deprivation therapy (ADT), knowledge of the effects of lifestyle interventions promoting concomitant change in both exercise and dietary (EX+D) behavior upon key SCT outcomes remains limited. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D) intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX+D intervention on select SCT outcomes at the end of the intensive phase of the intervention. **METHODS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX+D ($n = 16$) or SC ($n = 16$) interventions. Measures of select SCT outcomes were obtained at baseline and 2-month follow-up assessments. **RESULTS:** Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant treatment main effect for ($p < 0.01$) for self-regulatory self-efficacy and satisfaction with physical function. Post hoc analysis revealed that the intensive phase of the EX+D intervention resulted in superior improvements in self-regulatory self-efficacy ($d = .55$) and stair climb ($d = 1.20$) performance relative to the SC intervention at 2 months. **CONCLUSIONS:** Findings from the IDEA-P trial suggest that the intensive phase of the EX+D intervention, implementing a GMCB approach designed to promote adoption and adherence to lifestyle behavior change, resulted in superior changes in select SCT outcomes relative to SC approach. These results underscore the utility of a GMCB-based EX+D intervention for promoting meaningful improvement in key SCT outcomes among PCa patients undergoing ADT. Supported by NIH/NCI Grant R03 CA16296901

2876 Board #159 June 1 2:00 PM - 3:30 PM
Changes in Quality of Life of Cancer Survivors Participating in a Group Exercise Program
 Sarah Greterman. *Concordia College, Moorhead, MN.*
(No relevant relationships reported)

Purpose: The purpose of this study was to evaluate the overall quality of life (QOL) of cancer survivors participating in the LIVESTRONG® at the YMCA 12-week group exercise program using the Functional Assessment Cancer Therapy – General (FACT-G).

Methods: Thirty-seven cancer survivors, representing a variety of cancer and treatment backgrounds, volunteered to complete the (FACT-G) QOL questionnaire at three different time points of the LIVESTRONG® at the YMCA Program: weeks 1, 6 (midpoint), and 12 (endpoint). The FACT-G includes questions related to social (SWB), emotional (EWB), functional (FWB), and physical well-being (PWB). Repeated measures ANOVA with mixed model framework was used to determine significance differences at weeks 1, 6, and 12. Post-hoc paired t-tests with Tukey-Kramer correction were conducted if significant differences were found.

Results: Of the 37 recruited, 7 participants (age = 55.20±13.85) completed week 1 (Group A), 12 participants (age = 52.17±11.71) completed weeks 1 and 6 (Group B), and 11 participants (age = 53.08±11.01) completed weeks 1, 6 and 12 (Group C). There were no statistically significant differences between total FACT-G score or between each subscale between Groups A and C or Groups B and C at the end of week 1, nor between Groups B and C at the end of week 6. For Group C, there were no statistically significant changes in three of the four subscales: SWB ($F = 0.09$, $p = 0.916$), EWB ($F = 1.14$, $p = 0.345$), or FWB ($F = 0.40$, $p = 0.679$) at all three time points. PWB was the only subscale to show statistically significant changes over the three time points ($F = 5.09$, $p = 0.02$). Changes in PWB were statistically significant between weeks 1 and 6 ($t = -3.14$, $p = 0.017$), but there was insufficient evidence to suggest any statistically significant differences between weeks 1 and 12 ($t = -2.05$, $p = 0.131$) or weeks 6 and 12 ($t = 0.28$, $p = 0.514$).

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.

2877 Board #160 June 1 2:00 PM - 3:30 PM
Age, Mobility Performance, and Physical Activity in Prostate Cancer Patients Undergoing Prolonged Androgen Deprivation Therapy

Victoria R. DeScenza¹, Brian C. Focht, FACSM¹, Alexander R. Lucas², Elizabeth Grainger¹, Christina Simpson¹, Ciaran M. Fairman¹, Jennifer M. Thomas-Ahner¹, Jessica Bowman¹, Zachary L. Chaplow¹, Steven K. Clinton¹. ¹The Ohio State University, Columbus, OH. ²Wake Forest University, Winston Salem, NC. (Sponsor: Brian C. Focht, FACSM)

(No relevant relationships reported)

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 PC 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) x 2 (Time) 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 ($d = .65$) or youngest ($d = .92$) age groups. However, the Age x 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.

2878 Board #161 June 1 2:00 PM - 3:30 PM
Aquatic Exercise Training Program Outcomes on Quality Of Life and Lower Limb Lymphedema: Pilot Study

Andrée Dionne¹, Tarik Azlag¹, Sandra Morales¹, Serge Goulet², Mario Leone³, Alain Steve Comtois¹. ¹University of Quebec in Montreal, Montreal, QC, Canada. ²University of Sherbrooke, Montreal, QC, Canada. ³University of Quebec in Chicoutimi, Chicoutimi, QC, Canada.

(No relevant relationships reported)

Lower limb lymphedema (LLL) has a negative impact on many aspects of daily living, including household chores, physical activity, and psychological well-being. Patients with LLL that are not properly managed may become progressively worse and lead to an increase impairment of physical functional capacity and decline in the quality of life. **PURPOSE:** To determine whether patients with LLL can benefit from water immersion exercise to improve quality of life and control-diminish limb volume. **METHODS:** A total of 7 female participants affected by bilateral (n=4) or unilateral (n=3) LLL were included in this pilot study. Patients had primary or secondary LLL as complications of melanoma or gynecological cancers. Water immersion interval training exercise was conducted over a 6-week period (12 sessions of 45 minutes) and consisted of yoga exercises, aqua-jogging, pedaling on a water stationary bike and muscular training on a step and a trampoline. Outcome measures were taken before (pre) and after (post) the exercise program using the quality of life for limb lymphedema questionnaire (LYMQOL), 6 min walk test, handgrip strength test, bioelectrical impedance spectroscopy (BIS) and lower limb circumferences. **RESULTS:** Pre vs post lower limb circumference volumes remained stable, while BIS measurements increased significantly ($R_{0-} = 204.8 \pm 58.5$ vs 220.9 ± 68.3 ohm, $p=0.04$) indicating a reduction in the extracellular fluid compartment. The distance covered in the 6 min walk test (458.4 ± 117.0 vs 520.0 ± 126.0 meter, $p=0.04$) and the sum of right and left handgrip strength (32.6 ± 5.6 vs 38.0 ± 10.8 kg, $p=0.003$) were significantly improved and so did the emotion score (2.1 ± 0.7 vs 1.6 ± 0.6 , $p=0.03$) and overall quality of life (7.09 ± 1.8 vs 8.1 ± 0.8 , $p=0.05$). **CONCLUSIONS:** Water immersion exercise training allowed patients with lower limb lymphedema to lower the extracellular fluid volume, increases physical fitness, and quality of life outcomes.

2879 Board #162 June 1 2:00 PM - 3:30 PM
The Importance of Adiposity to the Cancer Patient Initiating Exercise

Alexia Amo¹, Cynthia Villalobos¹, Justin C. Brown², Paul D. Vosti³, Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²Harvard University, Cambridge, MA. ³St. Joseph's Hospital, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)

(No relevant relationships reported)

Each year, more than 600,000 adults are diagnosed with an obesity-associated cancer. Maintenance of a healthy body weight may reduce the likelihood of developing these cancers, slow the deterioration of health, and lower the risk of recurrence. Exercise is a commonly prescribed method of weight management in cancer survivors, but data are limited regarding the individualized benefits experienced by obese versus non-obese patients. **PURPOSE:** To compare the effects of exercise on obese and non-obese cancer survivors. **METHODS:** We enrolled 157 patients in a 10-week exercise program. At baseline, we determined anthropometric and cardiovascular profiles, psychological wellbeing, and physical functioning. Follow-up data were collected on subjects who completed the program (n=58). Obesity was defined by a body mass index ≥ 30 kg/m². Cardiovascular variables were blood pressure and heart rate. Wellbeing was assessed with questionnaires evaluating fatigue, insomnia, and depression. Physical function was measured with 13 tests of strength, coordination, aerobic capacity, and flexibility. Independent-samples t tests compared baseline characteristics and changes in outcome measurements of obese and non-obese patients. **RESULTS:** At baseline, obese (40%) and non-obese (60%) patients were similar with the exception that obese patients performed poorer in the six-minute walk ($p < 0.001$) and timed up-and-go ($p=0.012$) while they were stronger in push ($p=0.017$) and pull ($p=0.040$) assessments. Retention rate did not differ by obesity status ($p=0.853$). From baseline to follow-up, patients improved in wellbeing and most functional tests, but there were no differences in improvement between obese and non-obese patients in any component of their cardiovascular profile, psychological health, or physical functioning ($p > 0.190$). **CONCLUSION:** Obese and non-obese cancer survivors have similar profiles at baseline and generally improve with exercise. Exercise may be more critical to obese patients, not due to cardiovascular, psychological, or functional changes, but because of the risk of recurrence associated with excess adiposity. Our findings reiterate the importance of exercise to the cancer survivor, regardless of body composition, but there is potential for bias owing to the high dropout rate found in our study.

2880 Board #163 June 1 2:00 PM - 3:30 PM
Cancer Stage Does Not Affect Fatigue or VO_{2peak} Improvements Following an Exercise-Based Cancer Rehabilitation Program

Daniel Y.K. Shackelford¹, Jessica M. Brown¹, Brent M. Peterson², Reid Hayward³. ¹Carroll University, Waukesha, WI. ²Biola University, La Mirada, CA. ³University of Northern Colorado, Greeley, CO.

(No relevant relationships reported)

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_{2peak}). 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_{2peak}. **METHODS:** A total of 384 cancer survivors (57 \pm 12 years of age) completed initial assessments of CRF and VO_{2peak} via the Piper 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_{2peak} were reassessed following the intervention. **RESULTS:** Collectively, pre-to-post assessments demonstrated significant overall improvements in CRF (-25%) and VO_{2peak} (11%) across all stages ($p < 0.01$). No significant differences in CRF ($p=0.92$) or VO_{2peak} ($p=0.44$) improvements occurred between the stages. When evaluating individual cancer stage CRF, significant improvements ($p < 0.01$) were observed with each stage (I, -32%; II, -27%; III, -29%; IV, -29%). Similarly, significant improvements in VO_{2peak} ($p < 0.01$) 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_{2peak}, but the effect of stage diagnosis on these improvements has been unclear. We observed no significant differences in improvement of CRF and VO_{2peak} 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.

F-59 Free Communication/Poster - Sedentary Behavior

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

2881 Board #164 June 1 2:00 PM - 3:30 PM
Recruitment Strategies for Cluster Randomized Controlled Trials Targeting Workplace Sedentary Behavior- a Retrospective Review
Sarah L. Mullane¹, Sarah A. Rydell², Miranda L. Larouche¹, Meynard John L. Toledo¹, Linda H. Feltes³, Brenna Vuong⁴, Noe C. Crespo⁵, Mark A. Pereira², Matthew P. Buman, FACSM¹. ¹Arizona State University, Phoenix, AZ. ²University of Minnesota, Minneapolis, MN. ³Minnesota Department of Health, Minneapolis, MN. ⁴Fairview Health Services, St Paul, MN. ⁵San Diego State University, San Diego, CA. (Sponsor: Matthew P. Buman, FACSM)
(No relevant relationships reported)

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] \times 100 were calculated. Mean (\pm 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, $52 \pm 16\%$ 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.

2882 Board #165 June 1 2:00 PM - 3:30 PM
Validation Of Two Physical Activity And Sedentary Behavior Questionnaires In Orthopedic Trauma Patients
William G. Veitch¹, Rachel E.D. Climie², Belinda J. Gabbe¹, David W. Dunstan², Neville Owen², Christina L. Ekegren¹. ¹Monash University, Melbourne, Australia. ²Baker Heart and Diabetes Institute, Melbourne, Australia.
(No relevant relationships reported)

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 orthopedic 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) 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.10.53hr/day). There was moderate concordance between IPAQ-reported and objectively-derived overall physical activity ($\rho=0.431$,

$p<0.001$), weak concordance between IPAQ-reported and objectively derived sitting time ($\rho=0.384$, $p<0.001$) and moderate concordance between AusDiab3-reported and objectively measured sitting time ($\rho=0.551$, $p<0.001$). **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 orthopedic trauma patients. Modifications could be made in order to more specifically address the activity characteristics of this population.

2883 Board #166 June 1 2:00 PM - 3:30 PM
Informing Workplace Sedentary Behavior Interventions Through Momentary Affective States And Email-based Prompts.
Meynard John L. Toledo, Sarah L. Mullane, Sayali S. Phatak, 85004, Marios Hadjimichael, Eric B. Hekler, Matthew P. Buman. Arizona State University, Phoenix, AZ. (Sponsor: Matthew P Buman, FACSM)
(No relevant relationships reported)

PURPOSE: The study aimed to (a) examine the effect of momentary affective states on workplace sedentary behavior (WSB); and (b) test the proximal effects of email-based prompts on WSB. **METHODS:** Office workers with sit-stand desks were recruited in a two-part 20-workday study. In part A, participants completed ecological momentary assessments (EMA; at 3 random times/day) of affective states. Each EMA response was matched with behavioral outcomes (i.e., time spent sedentary, standing, or moving preceding each EMA response). Part B involved a micro-randomized prompt-based trial. Prompt delivery was randomized to be sent (ST) or not sent (NST) to all participants (probability of 0.5), at eight decision points per day between 9am and 5pm. Half of the prompts encouraged standing and the other half encouraged moving. An activPAL device was used continuously through the 20 days to measure WSB. Multilevel models were used to examine the associations of workplace behaviors and affective states. General estimating equations were used to examine the likelihood of a response to a prompt (i.e., transition from sitting to standing/moving) over the preceding 5 and 30 min intervals. All models were adjusted for age, gender, race, and job type. **RESULTS:** Participants ($N = 18$; 56% females) who completed part A contributed 493 EMA responses (27.4 \pm 13.3 EMA responses/participant). When examining momentary relationships, individuals sat less ($b[SE]= -3.9[1.8]$, $p=.02$) and stood more ($b[SE]= 3.5[1.6]$, $p=.02$) in the hour following higher than usual energy and sat less ($b[SE]= -2.8[1.4]$, $p=.04$) and moved more ($b[SE]= 1.2[0.4]$, $p<.01$) following higher than usual intentions to stand/move. Among participants ($N = 15$; 67% female; age = 50.9 \pm 9.5yrs) who completed part B, 1147 decision points occurred when seated. Participants were 42% more likely to transition from sitting to standing within 5 mins when a prompt was sent (OR[95%CI] = 1.4[1.1, 1.8], $p<.01$). Stand prompts were 25% more likely to elicit a transition (OR[95%CI] = 1.6[1.2, 2.0], $p<.01$) than move prompts (OR[95%CI] = 1.3[1.0, 1.7], $p<.05$). **CONCLUSIONS:** Prompts may be an effective complementary strategy to encourage sit-stand desks use. Information regarding context (i.e., affective states and intentions) may complement these findings in developing just-in-time interventions.

2884 Board #167 June 1 2:00 PM - 3:30 PM
Impact of 3-Month Changes in Sedentary Time and Light-Intensity Physical Activity on Subjective Sleep Quality
Miranda L. Larouche¹, Meynard John L. Toledo¹, Sarah L. Mullane¹, Kristina Hasanaj¹, Sarah A. Rydell², Mark A. Pereira², Matthew P. Buman, FACSM¹. ¹Arizona State University, Phoenix, AZ. ²University of Minnesota, Minneapolis, MN. (Sponsor: Matthew Buman, FACSM)
(No relevant relationships reported)

Regular moderate-vigorous physical activity (MVPA) has been shown to improve sleep quality. However, little is known about whether reducing sedentary time (i.e., replacing sitting with standing) or increasing light-intensity physical activity (LPA) may also improve sleep. **PURPOSE:** To examine whether 3-month changes in objectively measured sedentary time and LPA are associated with subjective sleep quality. **METHODS:** Participants ($N=632$, 72.3% female, 71.2% white, 44.6 \pm 11.2 years of age) were recruited from 24 worksites in the Phoenix and Minneapolis regions to participate in the multi-component cluster randomized controlled trial 'Stand & Move at Work,' to reduce sitting and increase LPA in the workplace. Participants wore an activPAL accelerometer continuously for seven consecutive days to assess sedentary (i.e., sitting/lying down) and LPA (stepping at < 100 steps/min) behaviors. Daily logs were used to separate data into work and non-work hours and behaviors were standardized to 8hr workdays. The Pittsburgh Sleep Quality Index (PSQI) was administered concurrently with the activPAL at baseline and at 3 months to assess

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 333.1 ± 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 ($b[se] = -.009 [.20], p = .025$). 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 both 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. Deere. *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 time 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 sedentary, in addition to the percentage of type and 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 (VO_{2peak}) in young adults. **METHODS:** 146 participants (age 22.0 ± 3.7 years, BMI 25.0 ± 3.9 kg.m⁻², VO_{2peak} 43.9 ± 8.5 ml.kg.min⁻¹) volunteered for the study. Total minutes and bouts of sedentary behavior (<150 counts/minute) and MVPA ($\geq 2,690$ 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. VO_{2peak} was measured using an incremental treadmill test to exhaustion. Confirmatory factor analysis (CFA) was used to construct a model for MetS and individual indicator variables. Structural equation modeling (SEM) was used to determine the associations among sedentary behavior, VO_{2peak} , MVPA and MetS. Goodness-of-fit indices were used to assess model fit for CFA and standardized estimates with an alpha level of 0.05 were used for SEM models. **RESULTS:** The clustered score was a valid model of MetS ($\chi^2=12.9, p=.12$;

CFI=.93; RMSEA=.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 ($\beta=.24, p=.03$). This association was independent of MVPA ($\beta=.23, p=.04$) but mediated by relative VO_{2peak} ($\beta=.25, p=.29$). 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, $p < .05$) but not VO_{2peak} (β range .16 to .25, $p > .05$). **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.

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 reported using an 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 ($p = 0.216$). Post hoc analysis indicated that AVG-G and AVG-B elicited a higher mean (\pm SD) heart rate (108 ± 16 and 97 ± 15 BPM), percent of APHRM (58 ± 10 and $51 \pm 9\%$), and RPE (13 ± 2 and 12 ± 2) versus SED (72 ± 13 BPM, $39 \pm 8\%$ APHRM, 7 ± 1 RPE). Participant VG performance was lower during AVG-G and AVG-B (51.75 ± 28.07 and 68.84 ± 35.52 arbitrary units) versus SED (202.11 ± 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. Pulford¹, Adam Gavarkovs², Naron C. Boa Sorte Silva¹, Cassandra Bartol¹, P Karen Simmavong¹, Ashleigh De Cruz¹, Guangyong Zou¹, Robert J. Petrella, FACSM¹. 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. Individuals ($N = 118$; 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 network; apps; website). From V1 to 12 mo. (V2), participants only had access to eHealth technologies; from V2 to 18 mo. (V3), access included only publically available technologies. We examined *within* and *between* group differences in mean healthful eating (Starting the Conversation, STC; score 0-16, lower=better) using linear mixed models (LMM) adjusted for age, sex and site (covariates). Quantile

regression was used to examine *between* group differences at V1 in median sitting time (International Physical Activity Questionnaire; min/d, typical wk day), adjusted for baseline and covariates. A log-transformation was applied and changes in sitting time *within* HeS were examined via a LMM. **RESULTS:** By V1, HeS improved healthful eating more than WL [mean change in STC score (95% CI), p-value for difference: [HeS: -1.84 (-2.56, -1.13); WL: -0.35 (-1.03, 0.34); p=0.002] and maintained these improvements to V2 (p<0.001) and V3 (p=0.002). By V1, HeS decreased sitting time more than WL [difference between groups in median change (95% CI), p-value: -66.16 (-117.68, -14.64) min/d; p=0.01] and maintained decreased sitting time in the long-term (V2: p=0.002; V3: p=0.04).

CONCLUSION: Compared to usual care, HeS improved healthful eating and decreased sitting time in at-risk adults over 6 months, with strong potential for long-term sustainability.

2889 Board #172 June 1 2:00 PM - 3:30 PM
Reproducibility Of Free-living Physical Activity/ sedentary Behaviors In College Undergraduates

Justin M. Moreng, Jesse A. Goodrich, Jeffrey C. Higdon, Marissa Holliday, Miguel A. Rueda, Sourav Podder, Theresa D. Hernandez, Matthew B. McQueen, Kenneth P. Wright Jr., William C. Byrnes, FACSM. *University of Colorado- Boulder, Boulder, CO.* (Sponsor: William C. Byrnes, FACSM)
(No relevant relationships reported)

PURPOSE: To determine the reproducibility of free-living physical activity/sedentary behaviors in college undergraduates. **METHODS:** Twice during an academic semester, 20 college students wore activPAL and Actiwatch monitors for seven consecutive days. Subjects were instructed to wear the devices at all times. These devices were worn according to manufacturer's instructions. Sleep and non-wear time were determined via the Actiwatch; waking physical activity and inactivity parameters were determined with the activPAL. The weekly means of these parameters were compared via paired t-tests and used to determine the typical error (TE) and coefficient of variation (CV). **RESULTS:** For the following waking day parameters, there were no significant differences between weeks one and two, so the average of both weeks are reported as the mean ± SD together with the TE and CV: total number of steps (9647.0 ± 4614.2, 1744.3, 18.2%), minutes spent stepping (104.0 ± 47.9, 16.5, 15.5%), sedentary minutes (737.2 ± 138.2, 53.7, 7.5%), MET-hours (25.0 ± 3.2, 1.3, 5.2%), minutes spent standing (163.2 ± 87.9, 34.4, 21.1%), minutes of light intensity activity (1.5-2.99 METs; 192.2 ± 99.1, 37.9, 19.4%), number of breaks from sitting/lying (48.1 ± 15.9, 5.2, 11.1%), the number of breaks per sitting/lying hour (4.1 ± 1.7, 0.6, 14.4%), the minutes of sitting/lying bouts that last at least 30 (475.5 ± 163.3, 52.5, 11.1%) and 60 minutes (271.4 ± 166.8, 59.7, 21.2%), percent of day spent sedentary (73.4 ± 11.5, 0.04, 6.2%), percent of day spent in light intensity (19.1 ± 9.5, 0.04, 19.0%), and percent of day spent in moderate-to-vigorous activity (≥3 METs; 7.6 ± 3.6, 0.01, 17.4%). In contrast, total time spent in moderate-to-vigorous intensity activity (≥3 METs) was significantly different between weeks one (78.9 ± 39.6) and two (70.8 ± 33.9; p<0.05). In addition, the number of minutes meeting the ACSM physical activity guidelines were also significantly different between weeks one (27.7 ± 32.2) and two (20.2 ± 22.9; p<0.05). **CONCLUSION:** For college students, waking physical activity 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 lifestyle requirements demanded of a full-time college undergraduate.

2890 Board #173 June 1 2:00 PM - 3:30 PM
The Effect Of A Sit And Resistance Training Program On Sedentary Behavior

Danielle D. Wadsworth, David Pascoe, FACSM, James McDonald, Mynor Rodriguez Hernandez. *Auburn University, Auburn, AL.*
(No relevant relationships reported)

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 iDXA, VO_{2max}, and an 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.

2891 Board #174 June 1 2:00 PM - 3:30 PM
Accelerometer-determined Physical Activity and Sedentary Behavior among Majority-minority Sample of Adults: The Houston Train Study

Ashleigh M. Johnson¹, Kelley Pettee Gabriel, FACSM¹, Deborah Salvo¹, Erin E. Dooley¹, Casey P. Durand², Gregory Knell², Samantha J. Kreis¹, Harold W. Kohl, III, FACSM¹.
¹The University of Texas Health Science Center at Houston (UTHealth) School of Public Health in Austin, Austin, TX.
²The University of Texas Health Science Center at Houston (UTHealth) School of Public Health in Houston, Houston, TX.
(No relevant relationships reported)

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.

PURPOSE: To describe and examine differences in accelerometer-determined PA and sedentary behavior among TRAIN participants at baseline, by race/ethnic groups 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. Freedson cut-points 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. Kruskal-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<0.05). 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<0.05). Race/ethnicity differences were further stratified by sex. Among Hispanics, VM estimates were higher among men (461.5) than women (390.9) (p<0.05), which was also reflected in MVPA (min/d). In blacks, MVPA was higher among men (21.3) than women (11.3) (p<0.05). 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.

2892 Board #175 June 1 2:00 PM - 3:30 PM
The Effectiveness of Standing on a Balance Board for Increasing Energy Expenditure while Performing Sedentary Work

Megan C. Nelson, Madeline P. Casanova, Katie Eason, Elizabeth Biancosino, Chantal A. Vella, FACSM. *University of Idaho, Moscow, ID.*
(No relevant relationships reported)

It is estimated that occupational energy expenditure has decreased by 100 kcal·d⁻¹. Analogous to sitting, too much standing that is static with little movement poses health risks. Innovative technologies such as balance boards have been developed for use within an office setting to replace sitting and encourage movement while standing, yet little is known whether physiological benefits exist or if productivity is affected.

PURPOSE: To investigate differences in energy expenditure (EE), heart rate (HR), productivity, fatigue, and pain while performing desk work while sitting (SIT), standing (STAND), and standing on a balance board (BOARD).

METHODS: Thirty healthy adults (60% female; age 39.7 ± 11.8 y; BMI 26.7 ± 5.0 kg·m⁻²) employed in sedentary-based jobs volunteered for this randomized crossover trial. Participants performed typing work in three different positions: SIT, STAND, and BOARD; each condition lasting 30 min. Oxygen consumption (VO₂) was measured via indirect calorimetry and EE was calculated using respiratory quotient and corresponding caloric equivalent values. Productivity was quantified by measuring words typed per min, accuracy, and typing mistakes. Overall feelings of fatigue and

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: VO_2 was significantly different among all conditions regardless of current standing desk use (SIT 3.35 ± 0.53 ; STAND 3.77 ± 0.48 ; BOARD $3.92 \pm 0.54 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $p < 0.001$). EE ($\text{kcal} \cdot \text{min}^{-1}$) 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 ($67 \pm 9 \text{ bpm}$), HR was higher in STAND ($76 \pm 11 \text{ bpm}$) and BOARD ($76 \pm 11 \text{ bpm}$, $p < 0.001$). 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.

2893 Board #176 June 1 2:00 PM - 3:30 PM
Intervention Targeting Reductions In Sedentary Time In Older Cancer Survivors: Characteristics Of Responders Versus Non-responders

Elizabeth Harding, Amy Tarnower, Charles Wiggins, Emily Williams, Matthew Schwartz, David Medrano, Anita Y. Kinney, Cindy K. Blair. *University of New Mexico, ALBUQUERQUE, NM.*

(No relevant relationships reported)

PURPOSE

We conducted a 16-week randomized controlled trial among older cancer survivors to disrupt sedentary time with short bouts of standing and stepping using prompts from a Jawbone UP2 tracker and smartphone app. Technical support was provided via 5 telephone calls. Primary analyses revealed limited change between intervention and control groups regarding reduction and breaks in sedentary time, and time spent stepping. The purpose of this secondary analysis is to provide insight as to the characteristics and behaviors of the participants that improved during the intervention (responders) versus those who did not improve (non-responders).

METHODS

Sedentary behavior and physical activity were measured in 26 older cancer survivors (mean age 69 ± 3.1 years), using an ActivPAL activity monitor for 7 days pre- and post-intervention. The intervention group was divided into non-responders ($n=12$) and responders ($n=14$) based on improvement defined as: a decrease in daily sedentary time of 30 minutes or more, or an increase in daily light-intensity activity (LPA) of 30 minutes or more, or an increase in moderate-intensity physical activity (MPA) of 10 minutes or more. Independent sample t-tests were used to evaluate differences between groups regarding baseline demographic factors (age, sex, BMI), health characteristics (pain interference, fatigue, self-reported physical function, physical performance), sedentary behavior [sedentary minutes, breaks from sitting], and physical activity (LPA, MPA).

RESULTS

There were no significant differences in demographic factors (p -values 0.13 to 0.89) or baseline health characteristics (p -values 0.44 to 0.75) between responders and non-responders. Responders had more sedentary minutes/hour (42.4 ± 4.3 vs. 36.1 ± 8.1 ; $p=0.03$) and less LPA minutes/hour (standing + stepping: 14.3 ± 3.4 vs. 20.3 ± 7.8 ; $p=0.03$) at baseline compared to non-responders.

CONCLUSION

These findings suggest that the greatest effect was observed in older cancer survivors who stood to benefit most from the intervention. Additional behavioral change techniques are needed to achieve more improvement.

FUNDING: American Cancer Society Institutional Research Grant and University of New Mexico Comprehensive Cancer Center Pilot Award.

2894 Board #177 June 1 2:00 PM - 3:30 PM
Effects of a 16-Week Treadmill Exercise on Physical Activity and Sedentary Time in Older Women

Joshua R. Sparks, Charity B. Breneman, Ryan R. Porter, Steven N. Blair, FACSM, Xuewen F. Wang. *University of South Carolina- Columbia, Columbia, SC.* (Sponsor: Steven N. Blair, FACSM)

(No relevant relationships reported)

Aging is often accompanied by a decrease in physical activity (PA) and increase in sedentary time. Low PA and excessive sedentary time have been linked to adverse health outcomes. Less is known about whether exercise training influences sedentary time and PA in various intensities, and whether body weight and cardiorespiratory fitness (CRF) play a role in any of the associations. **PURPOSE:** To examine the influence of a 16-week treadmill walking protocol on time spent being sedentary and time spent performing light PA (LPA) and moderate-to-vigorous PA (MVPA), in older women, and to examine the influence of body weight and CRF. **METHODS:** Older

women ($n=61$; age= 65.5 ± 4.3 years) participated in a 16-week moderate-intensity treadmill walking program (35-65 minutes/session, 3 days/week). Women wore a SenseWear Mini Armband consecutively for 14 days, except during water activities, at baseline and at the end of intervention. The software provided by the manufacturer was used to estimate the metabolic equivalents (METs), and to classify PA into LPA (1.5 to ≤ 3.0 METs) and MVPA (> 3.0 METs). Sedentary time was calculated by subtracting time being asleep from time with METs < 1.5 . Body weight and CRF (by a graded exercise test) were measured at baseline and end-intervention. Repeated measure analyses were used to compare between baseline and end-intervention in the time being sedentary and performing PA. Body weight and CRF were used as time-varying covariates. **RESULTS:** Time being sedentary significantly reduced from baseline to end-intervention by approximately 38 minutes ($p < 0.001$). Contrary to sedentary time, LPA significantly increased by approximately 17 minutes ($p < 0.002$), and MVPA significantly increased by 20 minutes ($p < 0.0001$). Body weight was associated positively with sedentary time ($p=0.007$), and negatively with LPA ($p=0.001$) across the intervention, but not with MVPA ($p=0.24$). CRF was associated negatively with sedentary time ($p=0.002$), and positively with both LPA ($p=0.04$) and MVPA ($p < 0.0001$) across the intervention. **CONCLUSION:** A 16-week moderate-intensity treadmill-based intervention decreased sedentary time, and increased time spent performing LPA and MVPA. Interestingly, MVPA time was associated with CRF, but not body weight.

2895 Board #178 June 1 2:00 PM - 3:30 PM
Accelerometer-Assessed Physical Activity And Sedentary Time Profiles Of Kidney Transplant Recipients

Jeff K. Vallance¹, Steven T. Johnson¹, Kevin Wen², Ngan N. Lam², Stephanie Thompson², Terry Boyle³, Soroush Shojai².
¹Athabasca University, Athabasca, AB, Canada. ²University of Alberta, Edmonton, AB, Canada. ³University of South Australia, Adelaide, Australia.

(No relevant relationships reported)

Physical activity may improve quality of life among kidney transplant recipients. Studies that have examined physical activity and sedentary time prevalence among kidney transplant recipients have used self-reported assessment tools, which may result in biased reporting. A better understanding of physical activity and sedentary patterns among transplant recipients is needed for the optimal design of targeted interventions. **PURPOSE:** To objectively assess physical activity and sedentary time profiles among kidney transplant recipients, and examine possible demographic and clinical correlates of physical activity and sedentary time. **METHODS:** Transplant recipients (diagnosed between 1993-2016) were recruited from the Northern Alberta Renal Program's Nephrology Information System database. Participants ($N=133$; 11% response rate) wore an Actigraph® GT3X+ accelerometer on their hip during waking hours for seven consecutive days. Commonly accepted activity count cutoffs (Freedson) were used to differentiate between sedentary, light, and moderate-to-vigorous intensity physical activity (MVPA). Accelerometer data were processed in 60-second epochs. **RESULTS:** Participants' average age was 58.4 years ($SD=14.7$), 57% were female, and the average duration since transplant was 27.2 months ($SD=21.5$). Participants wore their accelerometer for 6.5 days ($SD=6.5$). Participants recorded 9.4 ($SD=4.1$) hours per day of total sedentary time and averaged 3.7 bouts ($SD=1.7$) of sedentary time per day accumulated in at least 30-minute bouts, for a total of 2.9 hours ($SD=1.5$). For active behaviors, participants recorded 20.7 minutes of total MVPA per day and 5.7 minutes per day of MVPA accumulated in at least 10-minute bouts. Participants < 60 years of age reported significantly more minutes of MVPA than participants ≥ 60 years of age (Mean $\Delta=15.8$ min/day, CI: 9.7 to 22, $p < .001$). MVPA and sedentary time were not significantly associated with gender, BMI, or months since transplant. **CONCLUSION:** Accelerometer assessment of daily activity patterns indicated kidney transplant recipients showed high volumes of sedentary time, and low volumes of health-enhancing physical activity. Further research on effective interventions to favorably change this ratio and improve health outcomes of these patients is needed.

2896 Board #179 June 1 2:00 PM - 3:30 PM
Comparison Of Actipal And Actigraph On Detecting Sitting Vs. Standing In Three Classroom Postures

Saori Braun, Marquell Johnson, Jeffrey Janot, Sarah Reischel, Joshua Stewart, Chelsea Alger, Bo Casper. *University of Wisconsin-Eau Claire, Eau Claire, WI.* (Sponsor: Don Bredle, FACSM)

(No relevant relationships reported)

PURPOSE: In the premise of reducing sedentary behavior as a preventive means to minimizing the risk of developing chronic diseases, efforts have been put forth to modify workplace and classroom setting to be more activity-permissive. In order to monitor postural changes and their impact on health, appropriate selection of monitoring devices becomes critical. The purpose of the study, therefore, was to

examine 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 standardization of the analyses, the first and the last five minutes 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 38.34 ± 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 ($p < .001$, $p = .020$, and $p < .001$, 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 Activpal 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 (1,219) 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 ($r\geq 0.95$, $p<0.001$). Bland-Altman plots showed no pattern of error and limits of agreement (hr/day) that decreased from 10PM (-1.1, 3.3), to hybrid (-1.3, 1.8), to diary (-0.8, 0.5). Differences from criterion steps/day were highest using the 10PM method (329, 11%) and similar for the hybrid or diary methods (39, 1%). Steps were highly correlated comparing all alternative methods to criterion ($r\geq 0.96$, $p<0.001$). **CONCLUSIONS:** Using a standard 10PM bedtime resulted in the highest error in sedentary time and steps, though correlations to the criterion were ≥ 0.95 for all methods after normalizing to wear time. In this population, using participant diaries is preferred to accurately quantify absolute sedentary time, though all methods were acceptable with wear time normalization.

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. ¹*University of Montevallo, Montevallo, AL.* ²*Kent 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. is 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* ($n = 131$, 474 ± 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 ($\beta = 0.157$, $p = 0.002$), negatively associated with age ($\beta = -0.128$, $p = 0.015$), and not related to physical activity ($\beta = 0.091$, $p = 0.086$) or sex ($\beta = 0.023$, $p = 0.638$). Analysis of variance revealed that the *high* cell phone use group (521 ± 266 min/d sitting) participated in significantly more ($p = 0.006$) sedentary behavior than *low* users (442 ± 214 min/d) with no differences ($p \geq 0.1$) 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.

2899 Board #182 June 1 2:00 PM - 3:30 PM
Impact Of Sit-stand Workstation Progressions On Stress, Focus, And Productivity In University Staff Members

Mark A. Schafer, K. Jason Crandall, T. Scott Lyons, FACSM, Kolbi Edens, Lydia Blankenship, Nuha Shaker, Robert Vondy. *Western Kentucky University, Bowling Green, KY.* (Sponsor: Scott Lyons, FACSM)
(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine the impact of utilizing sit-stand workstations (Ergotron) throughout the workday on stress, focus, and productivity when following sit-stand progression protocols for 10 weeks. **METHODS:** Participants ($N=60$) were randomly assigned to one of three groups. Group 1 and 2 followed a prescribed protocol to progress up to 30 and 20 minutes of standing per hour, respectively. The protocol consisted of reminder emails delivered to participants each hour to reinforce prescribed standing times. Group 3 was instructed to sit and stand according to their preference throughout the day. Stress, focus, and productivity during standing and sitting time were measured using the visual analogue scale (VAS) at the end of each day. Data were analyzed using mixed-design-repeated measures ANOVA with significance set at $p < 0.05$. **RESULTS:** For each group, stress was significantly lower and focus and productivity were significantly higher standing compared to sitting ($p = 0.01$) over the 10 weeks. **CONCLUSIONS:** The results indicate that there is an increase in focus and productivity, along with reductions in stress, when standing compared to sitting throughout the workday. Furthermore, there was no influence of standing time progression throughout the 10 weeks or total standing time per hour. Future investigations should examine the long-term utilization and compliance of the sit-stand workstations and the potential impact on overall health.

2900 Board #183 June 1 2:00 PM - 3:30 PM
The Physical And Psychological Effects Of Standing Desks In Office Workers

Hannah E. Dohm, Dale D. Brown, FACSM, Kristen M. Lagally, FACSM, Kelly R. Laurson. *Illinois State University, Normal, IL.*
 (Sponsor: Drs. Dale D. Brown and Kristen M. Lagally, FACSM)
(No relevant relationships reported)

The present study demonstrates differences between energy expenditure in typical office workers and whether or not sit-stand desk options are beneficial. **PURPOSE:** The purpose of the study was to determine differences in energy expenditure between sitting and standing in typically sedentary office workers. A secondary purpose of this study was to determine mindset differences with regards to job boredom, job stress, and job satisfaction. **METHODS:** Participants ($N = 26$, 4 males and 22 females) were from two moderately sized communities in the Midwest that had standing desk options available to them. Data was collected using BodyMedia SenseWear armbands for energy expenditure and self-reported Likert-scale surveys for psychological data. Data was collected during four sessions; two sitting sessions where participants were asked to not use their standing desk option, and two standing sessions where participants were allowed to stand as they desired. Data was analyzed using paired-samples *t*-tests to determine mean differences between energy expenditure and survey data. **RESULTS:** Results of the *t*-test for energy expenditure indicated the standing condition expended an average of 7.25 kcal more per hour than the sitting condition ($t(24) -3.352$, $p = 0.003$). No differences were found between average total survey data

or specific question survey results (all $p > 0.05$). **CONCLUSIONS:** The results of this study suggest there is a statistically significant increase in energy expenditure when utilizing a standing desk option at the typical office workstation. Participants expressed improvements in mindset, but this difference was not statistically significant. Overall, individuals that participate in standing throughout the day rather than strictly sitting can increase energy expenditure while at their normal workstation, potentially resulting in increased weight loss and decreased negative health risk factors for typically sedentary office workers.

2901 Board #184 June 1 2:00 PM - 3:30 PM
Effects Of Isotemporal Substitution Of Sedentary Time (total And Prolonged Bouts) On Mental Wellbeing

Jacob Meyer¹, Laura Ellingson, FACSM¹, Matthew Buman, FACSM², Robin Shook³, Gregory Hand, FACSM⁴, Steven Blair, FACSM⁵. ¹Iowa State University, Ames, IA. ²Arizona State University, Tempe, AZ. ³Children's Mercy Hospital, Kansas City, MO. ⁴West Virginia University, Morgantown, WV. ⁵University of South Carolina, Columbia, SC. (Sponsor: Steven Blair, FACSM) (No relevant relationships reported)

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 mins), 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. Minutes spent sedentary, in light activity or MVPA, and sleeping were assessed with the SWA. Isotemporal substitution was performed separately for replacing one hour of a) total sedentary time and b) time in prolonged bouts with one hour of shorter sedentary bouts, light activity (1.5-3.0 METs), MVPA (> 3.0 METs) or sleep, on mood and stress at baseline and changes across one year.

RESULTS: At baseline: substituting 60 mins into MVPA from total sedentary time (standardized beta [95% CI]: -0.107 [-0.199, -0.014]) or time in prolonged bouts (-0.119 [-0.212, -0.025]) improved mood, as did swapping prolonged for shorter bouts (-0.106 [-0.211, 0.000]). Substituting time in prolonged bouts with sleep decreased current stress (-0.132 [-0.255, -0.009]) and improved mood (-0.136 [-0.257, -0.015]). When predicting changes in wellbeing at one year: substituting total sedentary time with light activity improved the change in mood at one year (-0.141 [-0.280, -0.002]), while substituting prolonged bouts with light activity non-significantly improved changes in mood (-0.138 [-0.282, 0.006]).

CONCLUSIONS: These results suggest that replacing one hour of sedentary time (especially that accumulated in prolonged bouts) with either more sleep or light activity could be effective for improving current and future mental wellbeing in healthy young adults. Longitudinal studies including objective 24-hour monitoring such as this are instrumental for informing future interventions targeting this set of behaviors.

2902 Board #185 June 1 2:00 PM - 3:30 PM
Racial and Ethnic Differences in Time Spent Sitting - The Booster Break Study

Matthew D. Leatherwood¹, Raheem J. Paxton¹, John C. Higginbotham¹, Wendell C. Taylor². ¹The University of Alabama, Tuscaloosa, AL. ²The University of Texas Health Science Center, Houston, TX. (No relevant relationships reported)

PURPOSE: To examine the racial and ethnic differences among various types of sedentary behavior (SB) in a sample of sedentary office workers.

METHODS: Study participants were recruited from five worksites in a large metropolitan city in the United States (N = 149, 67% minority, 83% female) All participants sat for at least 5-hours during a typical workday. SB was measured using a 7-item modified version of the Sedentary Behavior Questionnaire (SBQ) and the two-item sedentary behavior questions assessed in the International Physical Activity Questionnaire. Racial differences were examined with descriptive statistics as regression models. Statistical significance was determined at $p < 0.05$ with a two-sided test. **RESULTS:** Sedentary behavior ranged from a median of 0 minutes/day for viewing movies or videos to 60 min/day for watching television and riding in or driving a vehicle. Total median time spent sitting during the weekday was 480 min/day, whereas total time spent sitting during the weekend was 270 min/day. Our adjusted models indicated statistically significant racial and ethnic differences for sitting while talking on the phone ($p < 0.001$), watching television ($p = 0.042$), riding in or driving a vehicle ($p = 0.027$), total sitting time during the weekdays ($p = 0.008$), and weekend ($p = 0.012$). Median scores were higher among Blacks than Whites for both sitting and

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 curbe sedentary behavior. Supported by NIH Grants K01CA158000, R03NR010291, and CA016672

2903 Board #186 June 1 2:00 PM - 3:30 PM
Changes In Leisure Sedentary Behavior Across Retirement Transition: Finnish Retirement And Aging Study (FIREA)

Tuija Leskinen¹, Anna Pulakka¹, Olli Heinonen¹, Jaana Pentti¹, Mika Kivimäki², Jussi Vahtera¹, Sari Stenholm¹. ¹University of Turku, Turku, Finland. ²University of Helsinki, Helsinki, Finland.

(No relevant relationships reported)

Retirement is a major life transition and it may influence health behaviors and time use. **PURPOSE:** To examine changes in leisure sedentary behavior across retirement transition. In addition, we examined which and how pre-retirement characteristics predicted these changes. **METHODS:** The study population consisted of 1,354 participants from the Finnish Retirement and Aging Study (FIREA). Repeated postal survey including questions on sedentary behavior domains (television viewing, computer use at home, sitting in a vehicle and other sitting) were conducted once a year across retirement transition, covering on average three study waves. **RESULTS:** Total sedentary time increased by 67 (95% CI 58-75) minutes/day during retirement transition and continued to increase by 27 minutes/day two years after retirement transition (period*time interaction $p < .0001$). Of the domain-specific sedentary behaviors, television viewing time increased by 25 (95% CI 21-29), computer use at home by 19 (95% CI 16-22), and other sitting time by 36 (95% CI 31-41) minutes/day, while time sitting in a vehicle decreased by 6 (95% CI 3-10) minutes/day during retirement transition. Women (69 vs. 50 minutes/day, sex*time interaction $p = 0.04$) and persons who had high occupational sitting time, sleep difficulties, mental disorders or poor self-reported health before retirement were most likely to increase in sedentary behavior during retirement transition. **CONCLUSIONS:** Total leisure-related sedentary time and especially television viewing time increased across retirement transition. As both total sedentary behavior and television viewing are associated with adverse health outcomes and mortality among older adults, more attention should be paid to reducing time spent on sedentary behaviors among recently retired adults. Supported by Academy of Finland Grants 286294 and 294154, Finnish Ministry of Education and Culture and Juho Vainio Foundation.

2904 Board #187 June 1 2:00 PM - 3:30 PM
Objectively-measured And Self-reported Sedentary Behavior And Its Association With Mental Wellbeing In College Students

Keith M. Thraen-Borowski¹, Alex J. Hofstetter¹, Elizabeth G. Mills¹, Mackenzie R. Anderson¹, Rachel A. Valente¹, Laura D. Ellingson², Jacob D. Meyer². ¹Loras College, Dubuque, IA. ²Iowa State University, Ames, IA. (No relevant relationships reported)

Sedentary behavior (SB) is an emerging health risk. While behavior patterns are often established during young adulthood, little is known regarding the accumulation of SB in this population and its association with mental wellbeing.

Purpose: To describe SB patterns in college-aged men and women and to compare objectively-measured SB with self-reported SB and their associations with mental wellbeing.

Methods: Participants were recruited as part of a larger study evaluating feedback mechanisms for lessening SB. Baseline assessments of objectively-measured SB were collected with an inclinometer (activPAL), worn for seven days. Participants subsequently self-reported sedentary time (IPAQ), health-related quality of life (SF-36), and mood (POMS). Descriptive statistics and Pearson's correlation coefficients were used to characterize SB and the cross-sectional relationship between SB and mental wellbeing constructs, including fatigue, pain, anxiety, depression, anger, vigor, and confusion.

Results: Thirty-five participants (age = 19.4 ± 1.1 (mean ± SD); 64% male) wore the activPAL for 6.9 ± 0.5 days. Per the activPAL, subjects accumulated 602.65 ± 82.4 min/day of sedentary time, with 343.5 ± 77.3 min/day accumulated in bouts of > 30 minutes. They had 48.8 ± 12.8 breaks in SB per day, averaging 5.1 ± 1.4 min/break. Per the IPAQ, SB was significantly lower at 406.59 ± 117.94 min/day ($p < 0.01$). Further, objectively-measured total SB was not significantly correlated with self-reported SB ($r = -0.04$, $p = 0.81$), though bouts of SB in > 30 min was ($r = 0.36$, $p = 0.04$). There were no significant differences in objectively-measured SB, number of breaks in

SB, or average break rate by gender or BMI category ($p > 0.05$ for all). SB (objectively-measured or self-reported) was not significantly associated with any of the mental wellbeing outcomes ($p > 0.05$ for all).

Conclusions: College-aged men and women engage in large amounts of SB. The discrepancy between self-report and objective measures suggests they may be unaware of this important health behavior, and may be especially unaware of incidental SB accumulated in shorter bouts. Though SB was unrelated to mental wellbeing in this young healthy population, the development of sedentary habits during young adulthood may be problematic for future health outcomes.

2905 Board #188 June 1 2:00 PM - 3:30 PM
Determinants Of Sedentary Behavior In Adults: Who Is At Risk Of High Sedentary Time?

Esmée A. Bakker¹, Duck-chul Lee, FACSM², Maria TE Hopman, FACSM¹, André LM Verbeek¹, Dick HJ Thijssen³, Thijs MH Eijsvogels¹. ¹Radboud university medical centre, Nijmegen, Netherlands. ²Iowa State University, Nijmegen, IA. ³Liverpool John Moores University, Liverpool, United Kingdom. (Sponsor: Prof. Dr. Maria Hopman, FACSM)

(No relevant relationships reported)

Sedentaryness 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 (0.99 per year [0.98-0.99]; 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/m² [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 (0.73 [0.56-0.96]). 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/m² [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.

2906 Board #189 June 1 2:00 PM - 3:30 PM
Sedentary Time and Cumulative Risk of Preserved and Reduced Ejection Fraction Heart Failure: MESA

Brandi S. Rariden¹, Michael R. Richardson¹, Tammie M. Johnson¹, Clinton A. Brawner, FACSM², Sherry O. Pinkstaff¹, James R. Churilla, FACSM¹. ¹University of North Florida, Jacksonville, FL. ²Henry Ford Hospital, Detroit, MI. (Sponsor: James R. Churilla, FACSM)

(No relevant relationships reported)

Purpose: Examine the relationship between self-reported sedentary time and cumulative risk of preserved ejection fraction heart failure (HFpEF) and reduced ejection fraction heart failure (HFrEF) using a diverse cohort of U.S. adults 45-84 years of age. **Methods:** Using data from the Multi-Ethnic Study of Atherosclerosis (MESA), we identified 6,814 subjects (52.9% female). All were free of baseline cardiovascular disease. Cox regression was used to calculate the hazard ratio (HR) associated with baseline sedentary time and risk of HFpEF and HFrEF. Weekly self-reported sedentary time was dichotomized based on the 75th percentile (1,890 min/wk). **Results:** During ~11.2 years of follow-up there were 178 first incident HF diagnoses; 74 HFpEF, 69 HFrEF and 35 with unknown EF. In the age adjusted model, sedentary time $> 1,890$ min/wk was a significant predictor of HFpEF (HR 1.75, $p = 0.03$), but not HFrEF (HR 1.36, $p = 0.24$). The relationship with HFpEF remained significant in separate fully adjusted models including body mass index (HR 1.87, $p = 0.02$) or waist circumference (HR 1.86, $p = 0.02$) while the relationship with HFrEF did not reach statistical significance. These models were also adjusted for physical activity (MET-min-wk⁻¹). **Conclusion:** Sedentary time $> 1,890$ min/wk (~ 4.5 h/d) is an independent predictor of HFpEF, but not HFrEF.

2907 Board #190 June 1 2:00 PM - 3:30 PM
Sitting Is The New Smoking And Teens Report Doing A Lot Of It

Sarah G. Sanders, Betty J. Skipper, Karen Scherzinger, Elizabeth Yakes Jimenez, Alberta S. Kong. University of New Mexico, Albuquerque, NM.

(No relevant relationships reported)

Purpose: Sedentary time has been independently associated with poor chronic disease outcomes in adults, regardless of physical activity level. Thus intervening to decrease sedentary time in adolescents could have important long-term health implications. The aim of this analysis is to assess differences in sedentary time and activities of teens by weight status and sociodemographic factors at baseline of a cluster-randomized, longitudinal study of an intervention for adolescent obesity prevention and management (ACTION PAC). **Methods:** 9th and 10th grade students ($n = 834$) from 8 public high schools in the Southwest completed a physical activity recall during 3 consecutive days (1 weekend day; 2 weekdays) for 30-minute blocks from 5 AM to midnight at baseline. Metabolic equivalents (METs) were assigned based on reported activity and intensity; time blocks with METs ≤ 1.5 were considered sedentary. Electronics-related activities were aggregated as screen-time. Height and weight were collected using standardized methods and sociodemographic information was collected via questionnaire. A multilevel linear regression model was constructed to examine the association of sedentary activities and BMI category (SAS 9.4, PROC MIXED); sex, race/ethnicity, parental education, and household income were assessed as covariates. **Results:** On average, participants were sedentary for 71% of their waking time; 52 participants (6%) reported entire days spent in sedentary activities. Participants in all categories spent most of their sedentary time sitting in class (7.2 blocks/d), followed by screen time (3.7 blocks/d) and car time (2.0 blocks/d). Participants with BMI ≥ 95 th percentile reported more screen time relative to the group with a BMI < 85 th percentile (4.3 vs. 3.7 blocks/d, $p = 0.048$); however, this was attenuated when participant sex was added to the model ($p = 0.08$). Males reported higher mean screen time than females (4.3 vs. 3.2 blocks/d, $p < 0.0001$), with the largest difference in video gaming (1.2 vs 0.2 blocks/d, $p < 0.0001$). **Conclusions:** Teens report large amounts of sedentary time, with no significant differences by weight status. Decreasing sedentary time within the school day and replacing screen time with active endeavors may be an important focus of interventions. Supported by NIH Grant R01HL118734

2908 Board #191 June 1 2:00 PM - 3:30 PM
"Health-enhancing" Breaks From Sitting- Variations By Gender, Age, Adiposity And Diabetes Status

Jennifer Blankenship¹, Elisabeth Winkler², Genevieve Healy², Neville Owen³, David Dunstan³. ¹University of Colorado Anschutz Medical Campus, Aurora, CO. ²The University of Queensland, Brisbane, Australia. ³Baker Heart and Diabetes Institute, Melbourne, Australia.

(No relevant relationships reported)

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 ≥ 4 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 \pm 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 HEB; and, that the sociodemographic patterning of HEBs and total breaks were not identical, especially with respect to gender. Notably, while the ADA recommends adults with diabetes break up their sitting time, this population, along with those who were obese, performed the fewest HEBs.

F-60 Free Communication/Poster - Ergogenic Aids IV - Food, Herbal Supplements and Performance

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

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 E. Noreen, Jaclyn Turet, Daniel Mallozzi. *Gettysburg College, Gettysburg, PA.*
(No relevant relationships reported)

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/d of CQ; or 3.2 g/d of a maltodextrin placebo (PL). Subjects consumed half of the daily dose in the morning and half in 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= -1.1±0.7 kg, PL= -1.0±1.9 kg, p=0.96), fat free mass (CQ= +0.8±0.7 kg, PL= +0.7±1.5 kg, p=0.89), body fat % (CQ= -1.2±0.7 % body fat, PL= -1.1±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= +3.30±5.6 lbs, p=0.08), or 1000 m rowing test (CQ= -3.0±6.0s, PL= -3.9±9.3s, 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)

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. **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 reported increased soreness at 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 and p=0.007, respectively) post-EIMD 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 (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 (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 power at 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.

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 prefectural 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/mg) 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. Willems¹, Tim Berendsen², Mehmet A. Sahin³, Stephen D. Myers¹, Sam D. Blacker¹, Matthew D. Cook¹. ¹University of Chichester, Chichester, United Kingdom. ²Maastricht University, Maastricht, Netherlands. ³Haccettepe University, Ankara, Turkey.
(No relevant relationships reported)

Blackcurrant is high in anthocyanin content. We have shown enhanced whole-body fat oxidation and increased time trial performance during cycling, in addition to increased femoral artery diameter during an sustained submaximal isometric contraction of the *m. quadriceps* with intake of New Zealand blackcurrant (NZBC) extract in normobaric normoxia (Cook et al., 2015, 2017). The effect of blackcurrant on metabolic and physiological responses and performance during cycling in normobaric hypoxia are not known. **PURPOSE:** To examine the effect of NZBC extract on intensity-dependent physiological and metabolic responses and 16.1-km cycling time trial in trained cyclists in normobaric hypoxia. **METHODS:** The study used a double-blind randomized cross-over design. Eleven healthy men from cycling and triathlon clubs with at least 3 yrs experience and cycling 8-10 hr·wk⁻¹ (age: 38±11 yrs, height: 179±4 cm, body mass: 76±8 kg, $\dot{V}O_{2max}$: 47±5 mL·kg⁻¹·min⁻¹, maximum power: 398±38 W, mean±SD) ingested NZBC extract (600 mg·day⁻¹ containing 220 mg anthocyanins) or placebo (PL) for 7 days (washout 14 days). Participants performed bouts of 10 min at 45, 55 and 65% $\dot{V}O_{2max}$, using indirect calorimetry and blood sampling, followed by a 16.1 km time-trial on a SRM ergometer (SRM International, Germany). Participants were familiarized for the time-trial. All testing took place in a temperature controlled (15°C) normobaric hypoxic chamber set at an altitude of ~2500 m (15% FiO₂) (TIS Services, Medstead, UK) in morning sessions. Data was analysed using paired t-tests. **RESULTS:** At each intensity, NZBC extract had no effect on metabolic and physiological responses (e.g. at 65% $\dot{V}O_{2max}$, heart rate - PL: 133±12, NZBC: 132±12 beats·min⁻¹); fat oxidation - PL: 0.24±0.12, NZBC: 0.20±0.16 g·min⁻¹; carbohydrate oxidation - PL: 2.34±0.42, NZBC: 2.48±0.35 g·min⁻¹; lactate - PL: 1.37±0.45, NZBC: 1.56±0.57 mmol·L⁻¹). No improvements in 16.1 km time-trial performance were observed (PL: 1685±92, NZBC: 1685±99 sec). **CONCLUSION:** Seven day intake of New Zealand blackcurrant extract does not change whole-body fat oxidation and 16.1

km time-trial performance during cycling in normobaric hypoxia. Supplements were provided by Health Currency Ltd (UK). Blackcurrants New Zealand Inc (NZ) provided funding for conference attendance.

2913 Board #196 June 1 3:30 PM - 5:00 PM

Effects Of Montmorency Tart Cherry (L. Prunus Cerasus) Consumption On Nitric Oxide Biomarkers And Exercise Performance.

Karen M. Keane¹, Stephen J. Bailey², Anni Vanhatalo, FACSM³, Andrew M. Jones, FACSM³, Glyn Howatson, FACSM¹.

¹Northumbria University, Newcastle Upon Tyne, United Kingdom. ²Loughborough University, Loughborough, United Kingdom. ³University of Exeter, Exeter, United Kingdom.

(Sponsor: Professor Glyn Howatson, FACSM)

(No relevant relationships reported)

Montmorency 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 Montmorency tart cherry juice (MC) on plasma nitrite concentration ($[NO_2^-]$), 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 \pm SD age; 28 ± 7 years, stature 1.83 ± 0.06 m, body mass 78.0 ± 8.5 kg and VO_{2peak} 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 1.5 h post ingestion 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 $[NO_2^-]$ 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 nitrite 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. These data reveal a practical, non-pharmacological, dietary intervention that may have implications for enhancing vascular health and exercise performance in trained cyclists.

2914 Board #197 June 1 3:30 PM - 5:00 PM

Effects Of Blackcurrant Extract On Peripheral Blood Flow And Muscular Endurance

Matthew J. Barnes¹, Blake G. Perry², Roger D. Hurst³, Dominic Lomiwes³. ¹Massey University, Palmerston North, New Zealand. ²Massey University, Wellington, New Zealand. ³Plant and Food Research, Palmerston North, New Zealand.

(No relevant relationships reported)

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 performance.

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 participants were blinded to the treatments. Participants sat at rest and measures of forearm blood flow (FBF), using venous occlusion plethysmography, heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP) were made prior to and every 30 min after treatment ingestion, for 2 h. After 2 h participants completed intermittent isometric handgrip exercise to volitional fatigue. Differences within and between trials for all criterion measures were analysed using two-way repeated measures ANOVA.

RESULTS: A treatment effect ($p = 0.014$), time effect ($p = 0.05$) and a treatment x time interaction ($p = 0.005$) were observed for FBF. FBF decreased over the 2 h period with PP only (90 min = $-35.8 \pm 28.8\%$, $p = 0.047$; 120 min = $-39.4 \pm 29.1\%$, $p = 0.028$), no change was observed with BC. HR, SBP and DBP changed over time

(all $p < 0.001$) however no difference between treatments was found. The number of repetitions completed during hand grip exercise did not differ between treatments (BC = 73.6 ± 28.8 repetitions vs PP = 77.2 ± 44.5 repetitions, $p = 0.68$). **CONCLUSIONS:** New Zealand blackcurrant extract maintains peripheral blood flow during a period of prolonged sitting, however this effect does not alter fatiguing hand grip performance.

2915 Board #198 June 1 3:30 PM - 5:00 PM

Effects Of Acute Golden Root Extract (rhodiola Rosea) Supplementation On Anaerobic Exercise Capacity

Christopher G. Ballmann, Shelby Maze, Abby Wells, Mallory Marshall, John Petrella, FACSM, Rebecca Rogers. Samford University, Birmingham, AL. (Sponsor: John Petrella, FACSM)

(No relevant relationships reported)

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 \pm 0.63 , height = 66.3 in \pm 1.8 , weight = 152.8 lbs \pm 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 (gluten-free cornstarch) for 3 days. Participants also took an additional 500 mg dose of corresponding treatment 30 minutes prior to testing of each trial. During each exercise trial, participants completed 3x 15 second Wingate cycle tests separated by 2 minute recovery periods. Each exercise trial was separated by a 1 week washout period. **RESULTS:** Over the 3x 15 second Wingate cycle tests, mean watts ($p = 0.01$), mean anaerobic capacity ($p = 0.025$), and total work ($p = 0.018$) were higher in the GRE treatment trial versus placebo. However, mean anaerobic power ($p = 0.185$), mean peak watts ($p = 0.078$), and fatigue index ($p = 0.186$) were unaffected regardless of treatment. **CONCLUSIONS:** This study suggests that acute GRE supplementation improves repeated Wingate performance suggesting a role for GRE as an ergogenic aid.

2916 Board #199 June 1 3:30 PM - 5:00 PM

Nutritional Analysis of Ginger (ZingibreOfficinale) Drink: Potentials for Sport Performance

Muhammed A. Muhammed¹, Olufunmilola L. Dominic¹, Iliasu Y. Seidina¹, Emmanuel O. Sarpong², Adetayo E. Talabi¹. ¹University of Ilorin, Ilorin, Nigeria. ²University of Education, Winneba, Winneba, Ghana.

(No relevant relationships reported)

PURPOSE: Sport and energy drinks for performance enhancement is a common practice among athletes. These supplements reportedly increases health risks including: 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 drink and ascertain their potentials for enhancing sport performance. **METHODS:** Experimental research design was adopted to analyse two versions of ginger drinks prepared using ginger rhizomes (Botanical Identification: UIL/001/1083) 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 energy value 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 sport performance. Ginger drink containing 1CS had increased pH/100ml; 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 athletes.

2917 Board #200 June 1 3:30 PM - 5:00 PM
The Effect of Curcumin on Inflammation and Exercise Induced Muscle Damage in Healthy Adults

Alexa Gerchman¹, Angela Hillman², Erin O'Hara¹. ¹Marywood University, Scranton, PA. ²Ohio University, Athens, OH.
 (No relevant relationships reported)

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 creatine 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 limit 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.

2918 Board #201 June 1 3:30 PM - 5:00 PM
The Effects of Blueberry Supplementation on Exercise-Induced Muscle Damage

Lyndsay J. Lee, Paul C. Miller, FACSM, Takudzwa A. Madzima. *Elon University, Elon, NC.*
 (No relevant relationships reported)

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 appropriate blueberry dosage. **PURPOSE:** To examine the effect of blueberry supplementation (BB) at a dose relative to LM on delayed onset muscle soreness (DOMS) and recovery. **METHODS:** Fourteen recreationally active women (age: 21±1yr; body fat: 24.8±4.5%) participated in this double blind, matched-pairs study. Participants were matched by LM and randomly assigned to either a BB or a placebo (PLA) group. Leg strength was assessed via one-repetition maximum (1RM) on a leg press. Participants consumed a daily dose of freeze-dried BB powder (1.6g BB/kg_{LM}) or a PLA (1.6g PLA/kg_{LM}) for 7 days prior to induction of DOMS. Participants completed 6 sets of 10 repetitions at 70% 1RM on the leg press to induce DOMS. Perceived soreness (questionnaire), pressure-pain threshold (dolorimeter), and average power (AP; Biodex™) of the right thigh muscles were assessed immediately before (PRE) and after (POST), 24, 48, and 72h post induction of DOMS. Repeated measures ANOVAs were used for analyses. Significance was set at p<0.05. **RESULTS:** There were no group x time interactions for perceived soreness, pressure-pain threshold, and AP, however, significant time effects were observed for these variables. When comparing pre to post 24hr (p<0.001), 48hr (p=0.001), and 72hr (p=0.011) perceived soreness of the thigh muscles significantly increased. Pressure-pain threshold of the thigh muscles decreased significantly from pre to post 24hr (p=0.023), 48hr (p=0.001), and 72hr (p=0.024). Isokinetic leg extension AP decreased from pre to post 24hr (BB: 83±17 to 76±22Nm; PLA: 85±21 to 79±26Nm; p=0.02). **CONCLUSION:** Consumption of BB for 7 days prior to DOMS induction on a leg press does not affect rating of perceived soreness, pain threshold, nor attenuate decreases in performance compared to a PLA in recreationally active women.

2919 Board #202 June 1 3:30 PM - 5:00 PM
The Effects Of Rhodiola Rosea Supplementation On Time To Fatigue And Recovery After Exercise In Rats

Gerseli Angeli¹, Turibio Barros Neto¹, Donald Kirkendall, FACSM². ¹São Paulo Federal University, São Paulo, Brazil. ²Duke University, Durham, NC. (Sponsor: Donald Kirkendall, FACSM)
 (No relevant relationships reported)

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 (intra-gastric administration). The training protocol consisted in a swimming time of approximately 2h/day 5 days/week. The animals were also submitted to a time to 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 (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.

2920 Board #203 June 1 3:30 PM - 5:00 PM
Curcuma Longa Extract Reduces Muscle Soreness And Myoglobin Following A Half-marathon: A Double-blind, Placebo-controlled, Randomized

João Felipe Mota¹, Flávia Rasmussen Faria¹, Aline Corado Gomes¹, Kennia Rocha Rezende¹, Gustavo Duarte Pimentel¹, Camila Lemos Pinto², Marcelo Saldanha Aoki³. ¹Federal University of Goiás, Goiânia, Brazil. ²University of Alberta, Edmonton, AB, Canada. ³University of São Paulo, Sao Paulo, Brazil.
 (No relevant relationships reported)

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 ng/mL, 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.

2921 Board #204 June 1 3:30 PM - 5:00 PM
Grain Fermented Beverage Treatment Induces Mitochondrial Biogenesis in C2C12 Myotubes
 Tsubasa Shibaguchi¹, Atsushi Tsuji², Yuya Yamazaki², Keizo Matsui³, Kazumi Masuda¹. ¹Kanazawa University, Kanazawa City, Japan. ²Industrial Research Institute of Ishikawa, Kanazawa City, Japan. ³Fukumitsuya Sake Brewery, Kanazawa City, Japan.
 (No relevant relationships reported)

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 grain 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 glycogen 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 myotubes 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.

F-61 Free Communication/Poster - Ergogenic Aids V - Food, Herbal Supplements & Health

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

2922 Board #205 June 1 3:30 PM - 5:00 PM
A Comparison of Commercially-Available Echinacea Supplements based off Product Label Information
 David S. Senchina. Drake University, Des Moines, IA.
 (No relevant relationships reported)

Echinacea is one of the most popular herbal supplements among athletes, purportedly for preventing or treating upper respiratory infections. **PURPOSE:** To compare the compositions of commercially available Echinacea supplements based off product label information. **METHODS:** Approximately 250 distinct capsules/tablets and tinctures were identified from online vendors or stores in central Iowa; of these, only 76 capsule/tablet supplements and 17 tinctures provided sufficient product information for comparison (species, type of plant material, extraction method, standardization, and amount). Hierarchical clustering analysis ("phenetics") with Ward's linkage was used to generate dendrograms representing major groups ("clades") of supplements. **RESULTS:** Across the 93 included supplements, the most common species was *E. purpurea* (83%), the most common tissue was aboveground parts (62%), and 20% claimed some form of standardization (most used echinacoside). Twenty percent of supplements combined species, and 22% combined plant material types. Within the capsule/tablet category, 68% used raw plant material (versus extraction). Hierarchical clustering analysis revealed that plant material type explained the largest amount of variation: separate dendrograms for both the capsules/tablet and tincture categories depicted two major clades based on whether the supplement was made from aboveground or belowground parts. **DISCUSSION:** Based on label comparisons, Echinacea supplements differed tremendously in composition. Many studies have indicated that products made from belowground parts and *E. angustifolia* may elicit stronger immunomodulatory outcomes than those from aboveground parts and *E. purpurea*, respectively, suggesting that many current commercially-available supplements may not contain the optimal components. Variation in supplement composition likely explains heterogeneous clinical outcomes in athletes.

2923 Board #206 June 1 3:30 PM - 5:00 PM
Effects of Microencapsulated Diindolylmethane on Resting and Exercise Metabolism in Overweight and Obese College Aged Men
 David Bellar¹, Amber Sharp¹, Lawrence Judge². ¹University of Louisiana at Lafayette, Lafayette, LA. ²Ball State University, Muncie, IN.
 (No relevant relationships reported)

DIM is present in cruciferous vegetables and further produced after ingestion of crucifers. DIM has been studied for numerous potential health benefits. **PURPOSE:** The present investigation sought to evaluate the effects of DIM on resting and exercise metabolism, fasted glucose, blood lipids and estrogen metabolites after 7 days of supplementation. **METHODS:** The present investigation was a double-blind, cross-over design. Eight overweight college aged males volunteered to participate (Age: 22±2.9yrs; height: 180.9±7.4; BF%: 34.6±5.8). Participants were given DIM (150mg) or placebo twice daily for seven days before returning to the lab, providing blood and urine samples for analysis, undergoing a resting metabolic rate (RMR) assessment and exercising for 20 minutes at a moderate intensity (50% V_{O2} peak). Prior to crossing over to the other treatment, subjects had a 7 day washout period. **RESULTS:** Paired samples T-test did not reveal differences for total cholesterol ($t=0.49$, $p=0.32$ DIM 149mg/dL±19.2, placebo 161mg/dL±16.7), triglycerides ($t=0.29$, $p=0.38$ DIM 137.6mg/dL±31.2, placebo 149mg/dL±19.5), Fasted Glucose ($t=0.03$, $p=0.55$ DIM 101.8mg/dL±6.9, placebo 101.6mg/dL±2.9), RMR ($t=0.37$, $p=0.35$ DIM 2756.4 kcal/24hr±226.6, placebo 2796.6 kcal/24hr±161.4). Additionally, there were no significant differences found for exercise respiratory exchange ratio (RER), glucose or lactate between treatments ($t<0.86$, $p>0.36$). Urine sample were analyzed for 2-hydroxyestrone (2OHE1) and 16 α -hydroxyestrone (16 α -OH-E1) levels using a commercially available immunoassay. Analysis of results did not reveal differences for 2OHE1 ($F=0.23$, $p=0.63$ DIM 4.58 ng/ml±4.28 vs placebo 3.80 ng/ml±3.18) or 16 α -OH-E1 ($F=0.001$, $p=0.93$ DIM 13.34 ng/ml±14.24 placebo 13.87 ng/ml±12.83). When examined as a ratio 2OHE1/16 α -OH-E1 Anova did reveal a significant increase associated with DIM ingestion ($F=2.28$, $p=0.04$, $ES=0.67$). **CONCLUSION:** Based upon the data from the present study supplemental DIM does not appear to alter metabolism at rest or exercise in overweight young men. The higher 2OHE1 to 16-OH-E1 warrants further investigation as this ratio has been associated with positive health outcomes.

2924 Board #207 June 1 3:30 PM - 5:00 PM
Curcumin Supplementation Decreases Homocysteine and Increases HDL in Young, Obese Men
 Marilyn S. Campbell¹, An Ouyang¹, Richard J. Charnigo¹, Philip M. Westgate¹, I. M. Krishnakumar², Bradley S. Fleenor³. ¹University of Kentucky, Lexington, KY. ²Akay Flavours & Aromatics Pvt., Ltd., Cochin, India. ³Ball State University, Muncie, IN.
Reported Relationships: M.S. Campbell: Contracted Research - Including Principle Investigator; Akay Flavours and Aromatics, Ltd..

Obesity increases cardiovascular disease risk and is associated with generalized metabolic dysfunction that may contribute to vascular endothelial dysfunction. Curcumin, an active component of the Asian-Indian spice turmeric, is known to improve vascular function in various populations, but the effects of this constituent are largely unknown in young, obese individuals. **PURPOSE:** To determine if 12 weeks of curcumin supplementation in young, apparently-healthy obese men would improve resting serum homocysteine, cholesterol, glucose, and insulin values that would be associated with improvements in endothelial function. **METHODS:** Twenty-two young (26.27 ± 4.18 years), obese (BMI = 33.20 ± 3.42 kg/m²) men were matched based on BMI and randomized into the intervention (curcumin formulated with fenugreek soluble dietary fiber) or placebo (fenugreek soluble fiber only) group for 12 weeks. Pre- and post-intervention blood was collected by venipuncture, and endothelial function was assessed with the Endo-PAT 2000 via the reactive hyperemia index (RHI). Enzyme-linked immunosorbent assays were used to assess homocysteine, high-density lipoprotein (HDL), low-density lipoprotein (LDL)/very low-density lipoprotein (VLDL), glucose, and insulin. A multilevel linear regression model with random effects and an unstructured covariance matrix was employed to analyze treatment effect over the 12-week study with the Kenward and Rogers degrees of freedom method. **RESULTS:** Compared with placebo, the 12-week curcumin intervention reduced homocysteine levels (-26.7 v. +17.6, $P = 0.038$, group by time interaction) and increased HDL levels (+15.2 v. -17.4, $P = 0.047$, group by time interaction). The changes from baseline to 12 weeks in low-density lipoprotein (LDL)/very low-density lipoprotein (VLDL), glucose, and insulin were not significantly different between groups ($P > 0.05$). There was also no significant difference between groups on the change in RHI from baseline to 12 weeks (-0.06 v. -1.18, $P = 0.667$). **CONCLUSION:** Enhanced bioavailable curcumin may be an effective strategy to improve homocysteine and HDL levels in young apparently-healthy obese men that, in turn, may reduce future CVD risk.

2925 Board #208 June 1 3:30 PM - 5:00 PM
Bitter Melon Intake Versus Exercise For Postprandial Glucose Among Patients With Type 2 Diabetes
 Tongyu Ma, Chong-Do Lee, FACSM. *Arizona State University, Phoenix, AZ.*
(No relevant relationships reported)

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 ± 0.7 mmol/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 mmol/L, $P=.56$) and 2-h postprandial glucose iAUC (12.6 ± 4.8 vs. 10.7 ± 3.6 mmol/L·h, $P=0.38$) between the bitter melon and walking 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 mmol/L, $P=0.086$), at 60 minutes (14.5 ± 2.8 vs. 13.6 ± 2.7 mmol/L, $P=0.56$), 90 minutes (14.7 ± 3.7 vs. 14.4 ± 3.3 mmol/L, $P=0.88$), or 120 minutes (13.5 ± 4.6 vs. 13.4 ± 3.9 mmol/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.

2926 Board #209 June 1 3:30 PM - 5:00 PM
Curcumin Supplementation Mitigates NASH Development and Progression in Female Wistar Rats
 Mary Moore¹, Rory Cunningham¹, Angelique N. Moore², James C. Healy², Michael D. Roberts², Scott Rector, FACSM¹, Jeffrey S. Martin². ¹*The University of Missouri & Truman VA, Columbia, MO.* ²*Auburn University, Auburn, AL.* (Sponsor: Scott Rector, FACSM)
(No relevant relationships reported)

PURPOSE: Nonalcoholic steatohepatitis (NASH) is independently associated with mortality risk and currently there are no proven pharmacological therapies for treatment. Limited existing evidence suggests that curcumin, a naturally occurring plant polyphenolic compound known to exert anti-inflammatory and antioxidant effects, may have beneficial effects on attenuating NASH development. Here we sought to determine whether curcumin supplementation could be used in both the prevention and treatment of NASH with fibrosis.

METHODS: Female Wistar rats (N=48) were fed a 'western diet' (WD) high in fat (43% kcal) and cholesterol, and administered CC14 injections (0.5 mL/kg) at weeks 1, 2, 4 and 6 to induce a NASH with fibrosis phenotype. Rats were randomized to 4 groups (n=12/group): Fed WD for 8 weeks (WD8), fed WD enriched with curcumin (WD8+C; 0.2% curcumin, BCM-95, Dolcas Biotech), fed WD for 12 weeks (WD12) or fed WD for 8 weeks followed by 4 weeks WD+C (WD12+C).

RESULTS: Dietary curcumin supplementation (WD+8C) significantly attenuated ($p<0.05$) histological liver inflammation, molecular markers of fibrosis (Col1a1 mRNA) and serum markers of liver injury (AST) compared with WD8. In addition, curcumin supplementation (WD12+C) also partially reversed WD+CC14 induced NASH, including reduced ($p<0.05$) hepatocellular inflammation, steatosis and NAFLD Activity Scores (NAS) compared with WD12. Furthermore, 4 weeks of curcumin supplementation also reduced molecular markers of hepatic fibrosis (Col1a1 mRNA) and inflammation (TNF- α , FABP4, SPP1 mRNA), as well as serum measures of macrophage infiltration (CCL5, IL-17a) and liver injury (AST, ALP). These witnessed changes were independent of differences in body mass or adiposity and were not related to changes in markers of hepatic total macrophages/Kupffer cells (F480, CD68).

CONCLUSIONS: Here we report that curcumin supplementation was partially effective at both preventing and also treating NASH in WD+CC14 challenged Wistar rats. These beneficial effects were more prominent in the reversal of NASH with

fibrosis and was particularly effective in attenuating hepatocellular inflammation. Further study is warranted to examine the anti-inflammatory properties of curcumin in the treatment of NASH.

2927 Board #210 June 1 3:30 PM - 5:00 PM
Effects of Aerobic Training and Pomegranate Juice on Oxidative Stress Markers in Women with Type-II Diabetes
 Majid S. Koozehchian¹, Ahmad Abdi², Javad Mehrabani³, Maryam Kaveh B⁴, Amin Daneshfar², Gholamali Owlia⁶, Jeff Chandler¹. ¹*Jacksonville State University, Jacksonville, AL.* ²*Azad University, Amol, Iran, Islamic Republic of.* ³*University of Guilan, Rasht, Iran, Islamic Republic of.* ⁴*Karnataka College of Pharmacy, Bangalore, India.* ⁵*University of Canterbury, Christchurch, New Zealand.* ⁶*Texas Southern University, Houston, TX.*
(No relevant relationships reported)

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, placebo-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] n=7, supplement [SUP] n=9, aerobic training [AT] n=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-weeks 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 ($p=0.001$). 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.

2928 Board #211 June 1 3:30 PM - 5:00 PM
Allyl Isothiocyanate Enhances Brain Neuronal Plasticity Proteins Via Inhibition Of Inflammation Proteins
 Vijaya Juturu¹, Berrak Caglayan², Ertugrul Kilic², Arman Dalay², Mehmet Tuzcu³, Fusun Erten³, Mehmet Yalcin Gunal², Serdar Altunay², Cemal Orhan³, Kazım Sahin³. ¹*OmniActive Health Technologies Inc, Morristown, NJ.* ²*Istanbul Medipol University, Istanbul, Turkey.* ³*Firat University, Elazig, Turkey.*
Reported Relationships: V. Juturu: Salary; Employee.

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, NCAM, Nrf2 and BDNF. Moreover, expressions of inflammation-related proteins; NF- κ B, 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

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

Friday, 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. Bataineh¹, Ayesha S. Al Dhaheri². ¹Hashemite University, Zarqa, Jordan. ²United 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-s mouth rinse with a solution of either 7.5% carbohydrate (CHO), placebo (PLA), or a 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) ($\eta^2 = 0.430$). 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) ($\eta^2 = 0.354$). Subsequent trial energy intake (Kcal) was lower for CHO (577.5 ± 50.5) versus PLA (622.8 ± 78.3, p < 0.0001), and CON (615.2 ± 69.4, p < 0.0001) ($\eta^2 = 0.530$). 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 Collomp¹, Corinne Buisson², Nicolas Gravis¹, Soraya Belgherbi¹, Zakaria Laby³, Manh-Cuong Do³, Olivier Gagey³, Sophie Dufay⁴, Nancy Vibarel-Rebot¹, Michel Audran².
¹University of Orleans, Orléans, France. ²AFLD, Chatenay-Malabry, France. ³University of Paris Sud, Orsay, France. ⁴AGEPS, 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. Lean 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, total 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 fTest 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 Kirk¹, David A. Gable¹, Jason D. Stone¹, Anthony J. Anzalone¹, Stephanie M. Turner¹, Andy T. Asko¹, Joel A. Luedke², Andrew Jagim³, Margaret T. Jones, FACSM⁴, Jonathan M. Oliver¹. ¹Texas Christian University, Fort Worth, TX. ²University of Wisconsin - La Crosse, La Crosse, TX. ³Lindenwood University, St. Charles, MO. ⁴George 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; \times/\div 90% confidence limits; 1.5; \times/\div 1.2 fold), a period of significant contact. Further, the attenuation relative to placebo was likely maintained at T3 (1.3; \times/\div 1.2 fold), T4 (1.3; \times/\div 1.2 fold), T5 (1.3; \times/\div 1.3 fold), and T6 (1.2; \times/\div 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, FACSM¹, Brianna Jackson², Brian Szekely³, Trevor Schramm⁴, Brandon S. Shaw⁵, Ina Shaw⁵. ¹the University of Nebraska at Kearney, Kearney, NE. ²AT Sill University, Mesa, AZ. ³Georgia Southern University, Statesboro, GA. ⁴Southern College of Optometry, Memphis, TN. ⁵University 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 project 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 ±

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 ± 15.0 sec) or second (79.8 ± 13.8 sec, 80.0 ± 14.2 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 stimulants, the present 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.

2933 Board #216 June 1 3:30 PM - 5:00 PM

Acute Effects Of A Multi-ingredient Pre-workout Supplement On 5-km Running Performance In Recreationally-trained Athletes

Taylor Musgier¹, Nora Johnston², Andrew Jagim³, Clayton Camic⁴. ¹University of Wisconsin-La Crosse, La Crosse, WI. ²University of Northern Colorado, Greeley, CO. ³Lindenwood University, St. Charles, MO. ⁴Northern Illinois University, DeKalb, IL. (Sponsor: John Porcari, FACSM)
(No relevant relationships reported)

PURPOSE: The purpose of the present study was to examine the effects of an acute dose of a multi-ingredient, thermogenic, pre-workout supplement on 5-km running performance and subjective measures of fatigue.

METHODS: Twenty aerobically-trained, college-aged males (n = 10, mean ± SD = 80.8 ± 6.1 kg) and females (n = 10, 64.5 ± 6.6 kg) completed two 5-km running races for time. During the first session, the subjects were randomly assigned to ingest the supplement or placebo 30 minutes prior to running a 5-km race as fast as possible. The supplement contained multiple ingredients including caffeine anhydrous (150 mg), beta alanine (1.6 g), arginine AKG (1.0 g), as well as tyrosine, L-carnitine, green coffee bean extract, and velvet bean extract at unspecified quantities. The placebo was a non-caloric mix that was matched for flavor and consistency. Subjects also completed a 5-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 (supplement 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 ± 0.6).

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.

2934 Board #217 June 1 3:30 PM - 5:00 PM

Effects of Multi-Ingredient Ergogenic Supplement Consumption on Performance Adaptations to High-Volume Resistance Training

Michael Wong, Dean Directo, Adam Osmond, Edward Jo. *Cal Poly Pomona, Pomona, CA.*
(No relevant relationships reported)

Consumption of various nutritive supplements in isolation have shown to enhance resistance training (RT) adaptations. What remains unclear is the efficacy by which consumption of a multi-ingredient ergogenic supplement (MIES) comprised of branched-chain amino acids, beta-alanine, creatine, glutamine, and black pepper fruit extract facilitates improvements in skeletal muscle performance during RT. **PURPOSE:** To investigate the effects of a MIES containing the above ingredients on performance adaptations to high-volume periodized RT. **METHODS:** Thirty-nine recreationally trained males and females were recruited for this randomized, double-blind, placebo-controlled investigation. Subjects were assigned to either a placebo (PLA) (n=16) or experimental MIES group (MIES) (n=23) in a randomized, counterbalanced manner. All 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 2 (group) x 2 (time) repeated measures analysis of variance (ANOVA) was used to detect main effects and/or interaction. A Tukey's post hoc test was used for pairwise comparisons. Significance was set at $p < 0.05$. **RESULTS:** 1RM for each exercise improved pre-post training in both MIES (Back Squat= +26.0%, $p < 0.001$; Bench Press= +20.4%, $p < 0.001$; Deadlift= +26.3%, $p < 0.001$) and PLA (Back Squat= +27.1%, $p < 0.001$; Bench Press= +15.6%, $p < 0.001$; Deadlift= +18.4%, $p < 0.001$), but no group x time interactions were found. There was also a significant improvement pre-post training for all dynamic lower body power output measures in both groups with no significant group x time interaction. There were no between-group differences for average daily training volume each week and across the entire training period. **CONCLUSION:** Supplementation of the experimental MIES in conjunction with high-volume RT failed to improve RT-induced performance adaptations when compared to a placebo group.

2935 Board #218 June 1 3:30 PM - 5:00 PM

The Effects Of A Multi-ingredient Ergogenic Supplement On Body Composition Following High-volume Resistance Training

Dean Directo, Michael Wong, Adam Osmond, Edward Jo. *Cal Poly Pomona, Pomona, CA.*
(No relevant relationships reported)

In addition to resistance training (RT) methodology, nutrient intake remains a critical factor for the support of skeletal muscle metabolism, performance, and adaptation. Despite the traditional debate regarding the ideal type, timing, and quality of nutrients for recovery and/or performance, the consumption of exogenous substances like branched-chain amino acids (BCAA), beta-alanine, creatine, glutamine and various plant-based compounds, like piperine have previously shown to support performance, recovery, or metabolic adaptations in skeletal muscle. This has largely enabled the use of multi-ingredient ergogenic supplements (MIES) that incorporate a single blend of these substances with the intent of obtaining a synergistic ergogenic effect. What remains unclear is the efficacy by which a MIES blend of such ingredients facilitates the adaptive changes in body composition during a high-volume RT regimen.

PURPOSE: To investigate the effects of a proprietary MIES comprised of BCAA, beta-alanine, creatine hydrochloride, glutamine, and black pepper fruit extract on body composition during 6 weeks of high-volume RT. **METHODS:** Male and female subjects completed a 6 week RT program 3 days a week with 48 hours of rest between each session. EXP (n=16) and Placebo (PLA) (n=23) groups consumed one serving of the experimental MIES or placebo, respectively immediately post-workout and before sleep on training days, and two servings during rest days. Body composition was measured pre- and post-training via Dual Energy X-Ray Absorptiometry. **RESULTS:** EXP (+1.7 ± 0.3 kg, $p < 0.001$) and PLA (+1.5 ± 0.2 kg, $p < 0.001$) demonstrated an increase in total body mass. EXP demonstrated a greater increase in lean mass than PLA (EXP= 2.1 ± 0.3 kg vs. PLA= 1.1 ± 0.3 kg) ($p = 0.03$). Fat mass was significantly greater in EXP (-0.4 ± 0.2 kg vs. PLA= +0.4 ± 0.2 kg) ($p = 0.02$). EXP exhibited a decrease in body fat percentage (1.2 ± 0.3 % units) ($p = 0.01$) while PLA showed no change. Post-training body fat percentage was lower in EXP than PLA. There were no between-group differences for average daily training volume each week. **CONCLUSION:** Supplementation of MIES comprised of BCAA, beta-alanine, creatine hydrochloride, glutamine, and black pepper fruit extract may enhance body composition changes during high-volume RT.

2936 Board #219 June 1 3:30 PM - 5:00 PM

Cannabis Use Habits In Relation To Timing Of Physical Activity

Jonathon K. Lisano, Kristina T. Phillips, Jeremy D. Smith, Laura K. Stewart. *University of Northern Colorado, Greeley, CO.*
(No relevant relationships reported)

PURPOSE: To describe cannabis use in individuals who use the drug relative to when they participate in physical activity (PA). **METHODS:** Physically active individuals (N=72; males n= 42; females n= 30; average age of 27 years), recruited using the snowball technique, completed a series of self-report questions through Qualtrics designed to describe participants use of cannabis products in relation to their PA. Cannabis use questions were based on the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU). **RESULTS:** Respondents reported 417 ± 451 minutes of PA per week, with 74.5% of respondents using cannabis in conjunction with PA at least 1-time per week. Cannabis use was reported in combination with a total of 28 different physical activities. The physical activities most commonly reported included hiking, running, resistance training, yoga, and cycling. Half of participants (51%) reported using cannabis within 1-hour of beginning PA, and 45% reported using most often within 1-hour after finishing PA. Only 4% of respondents reported using cannabis most often during PA. Almost half (47%) of participants that reported using cannabis products before PA were using the *Cannabis Sativa* strain, while 39% of respondents that reported using cannabis

after PA used the *Cannabis Indica* strain. Common perceptions of the effects of cannabis use if used before PA included improved focus, "getting into the zone," pain prevention, and increased pleasure. The most frequent reasons for using cannabis products after PA were to relax, aid in recovery, and stimulate appetite. The majority of participants (69%) reported feeling that cannabis products had a positive effect on their performance. Fewer respondents (29%) felt like there was no effect of cannabis on their performance and only 2% of respondents felt that cannabis use had a negative effect on their PA performance. **CONCLUSION:** Findings from this study showed that cannabis is used before, during and after a wide variety of activities. Participants most often used *Cannabis Sativa* before PA and *Cannabis Indica* after PA. Almost all respondents felt that using cannabis products did not negatively affect their performance.

2937 Board #220 June 1 3:30 PM - 5:00 PM
An Examination of Supplement Use in Volunteer Firefighters

Melitz Ramirez¹, Brittany S. Hollerbach, 66502¹, Sara A. Jahnke², Christopher M. Kaipust³, Katie M. Heinrich¹. ¹Kansas State University, Manhattan, KS. ²National Development and Research Institutes, Leawood, KS. ³University of Texas Houston, Houston, TX.
 (No relevant relationships reported)

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 usage than other tactical athlete 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.

2938 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)

Pharmacoepidemiological research has reported prevalent use of analgesics in several populations, while experimental research has reported the ability of analgesics to inhibit reparative processes in skeletal muscle. Use could be of particular detriment to athletes. **PURPOSES:** To examine prevalence of use analgesics for exercise-associated pain (EAP), patterns and behaviors associated with use, and predictors of use in a sample of Division I male and female athletes. **METHODS:** A valid and reliable 16-item self-report questionnaire previously used to examine analgesic use in recreationally-active college students was modified to include items pertaining to phase of competitive season, injury status, and number of weekly conditioning sessions (C) and team practice sessions (P). Athletes were verbally invited to participate during training sessions. Analgesic use EAP was the primary outcome variable. Secondary outcome variables included patterns of use (weekly, daily frequencies) and behaviors associated with use (likeliness to follow label instructions), with behavioral items rated on a 5-point Likert scale. Descriptive statistics and frequencies were calculated for all items, and logistic regression was used to evaluate the ability of 3 variables (sex, C, P) to predict use. **RESULTS:** Males (n=28) and females (n=41) across a range of sports participated. The majority (97.1%) were in- or post-season, performing 3.9±1.9 C and

5.5±1.4 P sessions weekly. Twenty-nine percent reported being injured and under care of a health professional. Seventy-four percent (73.9%) reported analgesic use for EAP. Thirty-six percent (36.2%) reported use of a combination of analgesics, and 29% used ibuprofen. Most reported use 2 or 3 days per week (33.3%) and 1 or 2 times per day (62.3%). Thirty-five percent self-determined use, and 31.9% reported a combination of self-determined and directed use. Thirty-four percent (34.7%) reported being *very likely* or *extremely likely* to follow label instructions. No individual variables were revealed as significant predictors of analgesic use (sex, p=0.89; C, p=0.33, P, p=0.16). The omnibus test was also non-significant (p=0.28). **CONCLUSION:** Analgesic use is prevalent in collegiate athletes; however, data seem to indicate conservative use and tendency to follow label instructions.

2939 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 Zdzieblik², Michael Schunck¹, Daniel König². ¹Collagen Research Institute, Kiel, Germany. ²University of Freiburg, Freiburg, Germany.
 (No relevant relationships reported)

It is generally accepted that the combination of resistance exercise and protein supplementation increases fat free mass (FFM) and leads to a reduction in fat mass (FM). However, the question of the optimal type and amount of protein is still under discussion. It was recently demonstrated that bioactive collagen peptide (BCP) intake significantly improves the body composition of sarcopenic men (Zdzieblik et al.(2015) *Br J Nutr*) **PURPOSE** To determine the efficacy of a collagen peptide supplementation in combination with resistance training on the body composition in untrained subjects. **METHODS** The effect of post-exercise supplementation of specific BCP (BODYBALANCE®) on FFM and FM was tested on 182 untrained women and men aged 46 ± 9 years. The study participants underwent 60 minutes of resistance training three times per week, and were daily treated with 15g BCP or a placebo over a period of 12 weeks. Changes in FFM and FM were measured by DEXA scans and by BIA at the beginning of the study and after 12 weeks. Changes between the study groups in FFM and FM were tested using the unpaired Student's T-test. The studies were conducted with the approval of the Ethics Committee of the Medical Faculty of the University of Freiburg, Germany. All participants gave written informed consent. **RESULTS** The results revealed a significant (p=0.002) increase in FFM after BCP compared to placebo. FFM gain was more than doubled (2.00 ± 0.25 kg) than in individuals who only did the training exercise (0.99 ± 0.19 kg). In addition, FM was significantly (p=0.035) reduced after BCP supplementation by -3.0 ± 0.37 kg compared to placebo (-2.0 ± 0.32 kg). Moreover, study participants who received BCP showed a significant increase in muscle strength of 5.4% compared to placebo treatment. **CONCLUSIONS** Bioactive collagen peptides appear to offer an interesting option for optimized sports nutrition. The results demonstrated that the intake of BCP supports the effect of resistance training, as indicated by a more improved body composition and an increase in muscle strength.

2940 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 Botatinha¹, Ayane S. Resende¹, Marilia C. Seelaender¹, Ricardo A. Fack¹, José C R Neto¹, Ronaldo V T dos Santos², Antonio H. Lancha Junior¹. ¹University of São Paulo, São Paulo, Brazil. ²Federal University of São Paulo, São Paulo, Brazil.
 (No relevant relationships reported)

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=4;37.3±5.8 yr,89.2±14.5Kg,time trial 4:04 hrs ±23min) or placebo (PL=4 36.3±8.5 yr,81.8±9.5Kg, time trial 4:53hrs±75min) in a double-blind design. PR was supplemented with sachet containing *Lactobacillus Acidophilus* and *Bifidobacterium Lactis*(10x10⁹UFC/d) during 30 days while PL received sachet with maltodextrin(5g/d). 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(7thafter)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, Neutrophils and Monocytes presented a significant increase AR (Leu: PR=13.28±2.63,PL=14.26±4.20mm³; Neu:PR=11.20±2.94,PL=12.62±4.27 mm³;

Mono: PR=1.02±0.30, PL=0.95±0.24mm³) when compared to other moments (**Leu:** Baseline: PR=6.47±1.41, PL=5.58±0.56; BM: PR=5.60±0.94, PL=6.01±0.60; 7th after: PR=5.55±0.59, PL=5.57±0.14; **Neu:** Baseline: PR=3.13±1.01, PL=3.27±0.72; BM: PR=3.19±0.97, PL=3.66±0.84; 7th after: PR=2.89±0.39, PL=3.13±0.30mm³); **Mono:** Baseline PR=0.61±0.16, PL=0.52±0.18; BM: PR=0.47±0.03, PL=0.50±0.12; 7th after: PR=0.50±0.09, PL=0.48±0.11 mm³) in both groups with no differences between groups. Regarding lymphocytes cells at the baseline, the probiotic group has presented higher levels when compared to the placebo group (PR=2.53±0.45; PL=1.46±0.21 mm³). In addition, AR, PR has exhibited a significant decrease in the lymphocytes count when compared to the baseline (AR: PR=1.03±0.42 mm³), as well as PL (PL=1.20±0.22 mm³). **CONCLUSION:** Thirty days of *Lactobacillus Acidophilus* and *Bifidobacterium Lactis* (10x10⁹ UFC) supplementation have no difference when compared to placebo in leukocytes, neutrophils, monocytes and lymphocytes. **Support** by CNPq, CAPES/PROEX.

2941 Board #224 June 1 3:30 PM - 5:00 PM
Short-Term Medium Chain Triglyceride Consumption Does Not Affect Executive Cognitive Function in Healthy Adults.
 Laura Q. Jimenez¹, Jay Feldman², Brian Arwari². ¹Longwood University, Farmville, VA. ²University of Miami, Coral Gables, FL.
 (No relevant relationships reported)

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 ($M_{MCT}(SD)=91(11)\%$, $M_{CON}=93(8)\%$; $p=0.36$) or reaction time ($M_{MCT}(SD)=412(60)$ ms, $M_{CON}=417(53)$ ms; $p=0.71$). Further separating the data into sub-sections, including the interference scores between congruent and deviant response accuracies ($M_{MCT}(SD)=12(13)\%$, $M_{CON}=17(20)\%$; $p=0.22$), and the interference scores between congruent and deviant reaction times ($M_{MCT}(SD)=-36(37)$ ms, $M_{CON}=-46(39)$ 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 trial, 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.

2942 Board #225 June 1 3:30 PM - 5:00 PM
28-Days Hydrogen-Rich Water Supplementation Affects Exercise Capacity in Mid-Age Overweight Women
 Sergej M. Ostojic, Darinka Korovljev, Valdemar Stajer, Dejan Javorac. University of Novi Sad, Novi Sad, Serbia.
 (No relevant relationships reported)

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 (HRW) 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, VO_{2max} 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 (VO_{2max}) 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 (IWQoL), 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 VO_{2max} 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 ($P < 0.05$). IWQoL scores and hematological markers were not affected by either intervention ($P > 0.05$). **CONCLUSION:** 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 (114-451-710), the University of Novi Sad Faculty of Sport and PE (2017 Annual Award) and HRW Natural Health Products Inc, New Westminster, BC, Canada. Clinical trial registration www.clinicaltrials.gov, ID number NCT02832219.

2943 Board #226 June 1 3:30 PM - 5:00 PM
Single versus Split Dose of Iron Optimizes Haemoglobin Mass Gains at 2,106m Altitude
 Rebecca Hall¹, Peter Peeling², Walter T. P. McCluskey¹, Dan Bergland³, Trent Stellingwerff, FACSM¹. ¹Canadian Sports Institute Pacific, Vancouver & Victoria, BC, Canada. ²University of Western Australia, Crawley, Australia. ³Hypo2 High Performance Center, Flagstaff, AZ. (Sponsor: Dr Trent Stellingwerff, FACSM)
 (No relevant relationships reported)

Purpose: To determine if a split daily 200mg elemental iron dose (2x100mg) is superior to a single daily iron dose (1x200mg) for optimal haemoglobin mass (Hbmass) gains at altitude, while minimizing gastro-intestinal (GI) discomfort.

Methods: Twenty-six elite male and female runners attended a 3.1±0.3week training camp at 2,106m altitude in Flagstaff, AZ. A two-group design, randomized and stratified to baseline Hbmass, sex and ferritin, was implemented as: 1) split dose of 2 x 100mg daily (AM & PM; SPLIT) vs; 2) single dosing of 1 x 200mg daily (PM only, SINGLE) elemental iron (ferrous fumarate). Two participants were excluded (baseline ferritins <30µmL; n=24 for final analysis). Hbmass measures (via the carbon monoxide rebreathing technique) and venepuncture draws were completed upon immediate (± 2 days) arrival and departure of the camp for ferritin, hepcidin and erythroferrone (ERFE) analysis. Validated food frequency (FFQ), GI, menstrual blood loss (MBL) and training questionnaires were implemented throughout the camp. Univariate analysis was used to compare Hbmass outcomes; accounting for the covariates of dietary iron intake, menstrual blood losses and training volume. The alpha-level was set at $p < 0.05$. Data are reported as means ± standard deviation.

Results: Both groups significantly increased Hbmass post-camp, but SINGLE was significantly higher than SPLIT (SINGLE: 867.3±47.9g, SPLIT: 828.9±48.9g, $p=0.048$). GI scores were worse (greater) in SINGLE for weeks 1 & 2 combined (SINGLE: 18.0±6.7 points, SPLIT: 11.3±6.9 points, $p=0.025$), however, GI tolerance improved in SINGLE, and the between group difference was no longer apparent by week 3 ($p=0.335$). ERFE significantly decreased in both groups (~28.5%), however, no between group differences existed ($p > 0.05$). Hepcidin showed a tendency to decline (~33.5%), with no difference between groups ($p > 0.05$). There were no between group differences in FFQ, MBL or average daily training outcomes ($p > 0.05$).

Conclusion: A single nightly 200mg dose of elemental iron (ferrous fumarate) was superior to a split dose for optimizing changes in Hbmass at 2,106m altitude in elite runners over a 3.1±0.3week training camp. Observed differences may be due to a greater acute hepcidin response in the SPLIT group, however, more research is required to explore the mechanism.

2944 Board #227 June 1 3:30 PM - 5:00 PM
Antioxidant Supplementation Attenuates Muscle Performance Adaptations In Young Women: A Randomized Placebo-controlled Trial
 Maurilio T. Dutra¹, Sávio Alex¹, Alyson F. Silva¹, Nathalia B. Sales¹, Marco A. Dourado¹, Andrew Fonseca¹, Filipe D. Lima¹, Lee E. Brown, FACSM², Martim Bottaro¹. ¹University of Brasilia, Brasilia, Brazil. ²California State University at Fullerton, Fullerton, CA. (Sponsor: Lee E. Brown, FACSM)
 (No relevant relationships reported)

Strength training (ST) is widely known to promote acute and chronic adaptations that result in increased muscle performance and hypertrophy. It has been argued that antioxidant supplementation could affect these adaptations by neutralizing oxidative stress. However, chronic interventions analyzing the effects of ST combined with antioxidant vitamins are scarce, and available results are ambiguous. **PURPOSE:** To investigate the effects of ST combined with vitamin C and E supplementation on muscle performance and thickness. **METHODS:** This was a double-blinded placebo-controlled randomized study. Forty-two untrained women (23.8 ± 2.7 years, 58.7 ±

11.0 kg, 1.63 ± 0.1 m) were allocated into three groups: 1) vitamins (VG, n=15), 2) placebo (PG, n=12), or 3) control (CG, n=15). Participants of VG and PG underwent a periodized ST program, twice a week, for 10 weeks. VG supplemented with vitamin C (1g/day) and E (400IU/day) while PG consumed placebo pills. At the beginning and end of the training period, knee extensor peak torque (PT) and total work (TW) were measured on an isokinetic dynamometer and quadriceps femoris muscle thickness (MT) was assessed by ultrasound. Mixed factor ANOVA analyzed data. **RESULTS:** A significant group*time interaction for PT (F = 13.4, P = .000), TW (F = 6.0, P = .005) and MT (F = 4.0, P = .03) was observed. Both VG (37.2 ± 5.4 vs 40.3 ± 5.6 mm) and PG (39.7 ± 5.2 vs 42.5 ± 5.6 mm) increased MT after the intervention (P < .05) with no differences between groups. Also, both VG (146.0 ± 29.1 vs 170.1 ± 30.3 N.m) and PG (158.9 ± 22.4 vs 182.7 ± 23.2) increased PT after training (P < .05). However, a significant group effect (F = 5.2, P = .01) showed that only PG presented a significant difference vs CG (P = .01). In addition, both VG (2068.3 ± 401.2 vs 2295.5 ± 426.8 J) and PG (2165.1 ± 369.5 vs 2480.8 ± 241.3 J) increased TW after the intervention (P < .05). However, a significant group effect (F = 5.1, P = .01) showed that only PG presented a significant difference vs CG (P = .01). **CONCLUSION:** Chronic antioxidant supplementation may attenuate muscle performance improvement, but not muscle growth, in untrained young women after 10 weeks of ST.

athletes, aged 19-22 years with vitamin D deficiency (25(OH)D; 12.3±2.78 ng/ml), participated in this study. They were randomly assigned to receive 5,000 IU/day of vitamin D₃ capsule (N=13) or placebo (N=12) during 4 weeks of winter training. Blood samples were collected two times (pre- and post-tests) to analyze serum 25(OH)D concentration. Saliva samples were collected three times (1st, 2nd, and 4th week) to analyze the salivary immunoglobulin A (SIgA) and lactoferrin concentrations. URTI symptoms were reported daily during 4 weeks of training. Repeated measures ANOVAs were performed and significant level was set at p<.05. **RESULTS:** The serum 25(OH)D concentration increased by 255.6% in supplementation group, but this level did not change in placebo group (F=247.50, p<.001). SIgA (F=23.00, p<.001) significantly increased in both groups during the study period, but salivary lactoferrin level (F=5.79, p=.011) increased only in placebo group at the 2nd week of training. URTI symptoms significantly decreased only in supplementation group (F=5.456, p=.005) throughout the study. **CONCLUSIONS:** The present study found that high dose of vitamin D₃ supplementation (5,000 IU/day) increased the serum 25(OH)D concentration to sufficient level (40.1±6.79 ng/ml), and decreased URTI symptoms during winter training. Our findings suggest that vitamin D₃ supplementation during winter training may provide potential benefits for preventing URTI in male taekwondo athletes with vitamin D deficient.

2945 Board #228 June 1 3:30 PM - 5:00 PM
Vitamin D Supplementation Improves Health Related Quality of Life in Children with Sickle Cell Disease
 Kelly A. Dougherty¹, Chiara Bertolaso², Joan I. Schall³, Kim Smith-Whitley⁴, Virginia A. Stallings⁴. ¹Stoll University, Galloway, NJ. ²University Hospital Umberto I, Sapienza University, Rome, Italy. ³The Children's Hospital of Philadelphia, Philadelphia, PA. ⁴The Children's Hospital of Philadelphia and University of Pennsylvania, Philadelphia, PA. (No relevant relationships reported)

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 (n=21) and without (n=23) type SS sickle cell disease (SCD-SS). **METHODS:** Subjects were randomized to oral daily doses (4000 vs. 7000 IU) of cholecalciferol (vit D₃) and evaluated at 6 and 12 weeks for changes in vit D status (serum 25 hydroxyvitamin D (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 scores indicate 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±17.5ng/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 (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 ± 7.1 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 (57.8 ± 3.3 vs. 57.5 ± 3.7) or peer relationships (56.0 ± 7.3 vs. 56.1 ± 9.2), but significant (both 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 ± 6.4). **CONCLUSIONS:** Daily high-dose vitamin D supplementation for African American children with and without SCD-SS improved HRQL. Supported by K12 (KL2RR024132), K23 (K23HL114637), (UL1TR000003), CHOP RAG Pilot Grant, GI Research and Education Fund, and Nutrition Center.

2946 Board #229 June 1 3:30 PM - 5:00 PM
Vitamin D₃ Supplementation on Immune Functions and Upper Respiratory Tract Infection in Male Taekwondo Athletes
 Hyun Chul Jung¹, Myong Won Seo², Sukho Lee³, Sung Woo Kim², Jong Kook Song². ¹University of Louisiana at Monroe, Monroe, LA. ²Kyung Hee University, Yong-In, Korea, Republic of. ³Texas A&M University-San Antonio, San-Antonio, TX. (No relevant relationships reported)

Vitamin D plays an important role for immune functions. Insufficient serum 25(OH)D concentration during winter season may be associated with increased risk of upper respiratory tract infection (URTI) in athletes. **PURPOSE:** This study was aimed to determine the effects of vitamin D₃ supplementation on immune functions and URTI in male taekwondo athletes. **METHODS:** Twenty-five male taekwondo (TKD)

2947 Board #230 June 1 3:30 PM - 5:00 PM
Impact of a Carbohydrate Mouth Rinse on Muscle and Functional Power in Older Adults.
 Logan E. Chaffin¹, Kayla Holder¹, Chioma Ichoku¹, Gabriel K. Harris², Srikant Vallabhajosula¹, Stephen Bailey, FACSM¹. ¹Elon University, Elon, NC. ²North Carolina State University, Raleigh, NC. (Sponsor: Dr. Stephen Bailey, FACSM) (No relevant relationships reported)

People over the age of 70 have decreased muscular power and reduced functional ability. Carbohydrate mouth rinse (MR) has been effective at producing an increase in power-like activities in young healthy athletic populations. **PURPOSE:** The purpose of this study is to assess the effect of a carbohydrate MR on functional measures of power in an older population. **METHODS:** Twelve subjects (5 males, 7 females; Age= 77±3 years) completed 2 experimental sessions under different MR conditions (Placebo (PLAC), 6.4% glucose (CHO)). Subjects completed the timed-up and go (TUG) and hand grip tests immediately after and 10 minutes after application of the MR. During the sit-to-stand phase of the TUG subjects initiated movement with both feet placed on force platforms. **RESULTS:** No differences were found in the TUG as a result of the MR condition immediately (PLAC=9.16±0.34 sec, CHO=9.26±0.33 sec) after or 10 minutes (PLAC=8.98±0.36 sec, CHO=9.11±0.34 sec) after MR. Similar results were found for the hand grip test immediately (PLAC=68.8±5.5 lbs, CHO=68.8±5.7 lbs) after and 10 minutes (PLAC=69.4±5.9 lbs, CHO=73.8±5.8 lbs) after MR. In contrast, impulse (PLAC=352±36 Ns, CHO=409±39 Ns; p=0.01) and power (PLAC=85±9 N-m sec⁻¹, CHO=99±10 N-m sec⁻¹; p=0.02) generated during sit-to-stand were greater immediately after CHO MR as compared to PLAC MR. This result did not persist 10 minutes after MR. **CONCLUSIONS:** CHO MR improved impulse and power during the sit-to-stand phase of the TUG; however, functional performance of the TUG and hand grip was not changed as a result of MR. These results suggest that CHO MR transiently increases muscle power in normal subjects above 70 years of age.

F-63 Free Communication/Poster - Military Physiology
 Friday, June 1, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

2948 Board #231 June 1 3:30 PM - 5:00 PM
Greater Fitness is Associated with Reduced Injury Risk in Specialized Military Men
 Lisa M. Hernandez¹, Stephanie D. Coffin¹, Marcus K. Taylor, FACSM². ¹Leidos, San Diego, CA. ²Naval Health Research Center, San Diego, CA. (Sponsor: Marcus K. Taylor, PhD, FACSM) (No relevant relationships reported)

Recent literature has shown that cardiorespiratory fitness (CRF) and strength deficits are associated with greater musculoskeletal injury (MSKI) risk. When combined, the Functional Movement Screen (FMS) and lower quarter Y-Balance test (YBT) are powerful indicators of MSKI risk in athletes and military personnel. As the premier combat force for countering explosive hazards, U.S. Navy Explosive Ordnance Disposal (EOD) operators must perform optimally in the most austere environments. To safeguard health and mission success, it is critical to assess factors that influence MSKI risk in this elite group.

PURPOSE: To assess the relationships between measures of fitness and injury risk in EOD operators.

METHODS: Fifty-one active duty men (age 35.6 ± 1.0 yr) were evaluated for body fat percentage (BF%) using 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 \pm 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) = $99.0 \pm 1.0\%$ and right composite (RC) = $98.6 \pm 1.0\%$. 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 high 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 TT ($r = .37$ -.46, $p < .01$). 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

Tunde K. Szivak¹, Elaine C. Lee², Cathy Saenz³, Brian C. Focht, FACSM³, Jeff S. Volek, FACSM³, Carl M. Maresh, FACSM³, William J. Kraemer, FACSM³. ¹Merrimack College, North Andover, MA. ²University of Connecticut, Storrs, CT. ³The Ohio State University, Columbus, OH.
(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: 3530.64 ± 2146.54 pmol·L⁻¹, low fit: 4907.16 ± 3020.85 pmol·L⁻¹) and NPY (high fit: 169.3 ± 85.89 pg·mL⁻¹, low fit: 123.02 ± 88.86 pg·mL⁻¹) 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 Performing Physically Demanding Occupational Tasks

Maria C. Canino, Bruce S. Cohen, Stephen A. Foulis, Peter N. Frykman, Jan E. Redmond, Edward J. Zambarski, Marilyn A. Sharp. U.S. Army Research Institute of Environmental Medicine, Natick, MA.
(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

SBC, 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) as fast as possible (min). For the CD, subjects 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⁻¹). During MUF subjects wore PPE and a weapon to perform a series of combat rushes covering 100m as fast as possible (min). The MUF course cycled between one prone and two kneeling positions, each 6.6 m apart. Univariate ANCOVA (height and body mass as covariates) were used to compare differences in performances on the three tasks between TRs and ADs. **RESULTS:** 94% of TRs and 99% of ADs performed the three tasks to the minimal acceptable performance standards. ADs performed significantly faster than TRs on SBC (AD: 1.73 ± 0.29 min, TR: 2.09 ± 0.46 min; $p < 0.01$) and CD (AD: 1.14 ± 0.28 m·s⁻¹, TR: 0.80 ± 0.30 m·s⁻¹; $p < 0.01$) with no differences in MUF performance (AD: 2.24 ± 0.15 min, TR: 2.27 ± 0.22 min; $p = 0.09$). **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 Occupation Stressor on Physiological Strain Index and Blood Pressure

Cody E. Morris¹, Lee J. Winchester¹, Andrew J. Hussey¹, Ariel S. Tomes¹, Wesley A. Neal¹, Damon M. Wilcoxon¹, MiRanda N. Anderson¹, William J. Bradshaw¹, Dana N. Lucas¹, Harish Chander², Scott W. Arnett¹. ¹Western Kentucky University, Bowling Green, KY. ²Mississippi State University, Mississippi State, MS. (Sponsor: Scott Lyons, FACSM)
(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 strain 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 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. 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.

2952 Board #235 June 1 3:30 PM - 5:00 PM

Effect of a Simulated Tactical Occupation Stressor on Perceived Exertion and Blood Lactate

Wesley A. Neal¹, Cody E. Morris¹, Lee J. Winchester¹, Andrew J. Hussey¹, Ariel S. Tomes¹, Damon M. Wilcoxon¹, MiRanda N. Anderson¹, Dana N. Lucas¹, Harish Chander², Scott W. Arnett¹. ¹Western Kentucky University, Bowling Green, KY. ²Mississippi State University, Mississippi State, MS. (Sponsor: Scott Lyons, FACSM)
(No relevant relationships reported)

PURPOSE: Findings by Marcora et al. (2009) and Zering et al. (2016) suggest that perceived exertion can be elevated during an exercise bout of a familiar intensity if it is

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). 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 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. A repeated-measures ANOVA showed that there was a significantly different blood lactate when comparing conditions ($p < 0.0005$).

CONCLUSIONS: Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly elevates 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 Immune System Markers of Physiological Stress and Inflammation

Ariel S. Tomes¹, Cody E. Morris¹, Lee Winchester¹, Andrew J. Hussey¹, Wesley A. Neal¹, Damon M. Wilcoxon¹, MiRanda N. Anderson¹, William J. Bradshaw¹, Dana N. Lucas¹, Harish Chander², Scott W. Arnett¹. ¹Western Kentucky University, Bowling Green, KY. ²Mississippi State University, Mississippi State, MS. (Sponsor: Scott Lyons, FACSM)
 (No relevant relationships reported)

PURPOSE: Walker et al., 2015 reported that increases in immune system markers [interleukin-6 (IL-6), C-reactive protein (CRP)] occur simultaneously with each increase in core temperature. A substantial physiological and psychological disturbance experienced by firefighters could potentially lead to a depression in immune system function. The purpose of this study was to evaluate specific immune system markers 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. Salivary cortisol (CORT) was measured at baseline, following initial 3 min workload, and following completion of total workload. CRP was evaluated at baseline and one hour following the completion of each workload.

RESULTS: A repeated-measures ANOVA showed that there was a significantly different blood lactate when comparing conditions ($p < 0.0005$). Both Conditions 2 and 4 exhibited a significantly higher BL ($p < 0.05$) than Conditions 1 and 3. There were not shown to be any significant differences ($p > 0.05$) as a result of the SFSC between Conditions 2 and 4 or any differences between Conditions 1 and 3 in regards to BL. Neither CORT ($p = 0.116$) or CRP ($p = 0.700$) was shown to be significantly different across conditions or from baseline.

CONCLUSIONS: Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly elevates BL above what would be expected by the exercise alone. This illustrates the significant increase in exercise intensity while wearing the simulated PPE. However, the degree of exercise employed was not enough (with or without the weighted vest) to elicit any substantial changes in inflammatory markers.

2954 Board #237 June 1 3:30 PM - 5:00 PM
Effect of a Simulated Tactical Occupation Stressor on Reaction Time

Andrew J. Hussey¹, Cody E. Morris¹, Lee J. Winchester¹, Ariel S. Tomes¹, Wesley A. Neal¹, Damon M. Wilcoxon¹, MiRanda N. Anderson¹, William J. Bradshaw¹, Dana N. Lucas¹, Harish Chander², Scott W. Arnett¹. ¹Western Kentucky University, Bowling Green, KY. ²Mississippi State University, Mississippi State, MS. (Sponsor: Scott Lyons, FACSM)
 (No relevant relationships reported)

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 the 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.

2955 Board #238 June 1 3:30 PM - 5:00 PM
Heart Rate Reserve: An Objective Measure of Soldiers' Physical Exertion During Field Operations

Leif Hasselquist, Clifford L. Hancock, Carolyn K. Bensenl. *Natick Soldier Research, Development, and Engineering Center, Natick, MA.*
 (No relevant relationships reported)

Physiological monitoring can be accomplished in a military field environment using wearable technologies, but information is limited on physical exertion measures that are most useful for military applications, such as mission planning and protective equipment evaluations.

PURPOSE: Determine sensitivity of percentage heart rate reserve (%HRR) to variations in carried load using experimenter- and self-paced military tasks.
METHODS: 38 Army male soldiers [M (SD): Age = 24.2 (4.1); Wt. = 80.7 kg (12.5); Ht. = 1.76 m (.07); $\dot{V}O_{2peak}$ = 50.3 ml/kg/min (5.4)] volunteered for a 6-session study conducted under an IRB-approved protocol. Wearing a heart rate monitor, they executed 3 trials (1 trial/session) of an experimenter-paced, 4.83-km foot march (FM) at a 4.83 km·h⁻¹ speed and 3 trials (1 trial/session) of a self-paced, maximum effort run of an obstacle course (OC) carrying a different military load (randomized) on each trial (FM: 8.8, 47.2, 50.7 kg; OC: 8.8, 28.1, 31.5 kg). Maximum heart rate (MHR) was obtained in the final 20 s of $\dot{V}O_{2peak}$ testing. Resting HR (RHR) was recorded in the final 20 s of a 5-min period of sitting prior to trial initiation. The highest HR in a trial (MHR_{trial}) was also identified. %HRR was calculated: $[(MHR_{trial} - RHR)/(MHR - RHR)] \times 100$. Separate repeated measures ANOVAs (Subjects x Load) were applied to FM and OC %HRR and completion time.

RESULTS: On the FM, completion time was not significantly affected by load, $F(1.15, 42.6) = 2.68, p = .105, \eta^2 = .067, [M$ (SD) in min: 59.68 (1.06), 59.37 (1.08), 60.52 (3.74) for loads 1-3], but %HRR increased significantly with each load increase, $F(1.66, 61.44) = 112.17, p < .001, \eta^2 = .752 [M$ (SD) in %: 54.15 (10.45), 76.15 (11.53), 82.32 (8.10) for loads 1-3]. On the OC, completion time increased significantly with each load increase, $F(2, 74) = 132.25, p < .001, \eta^2 = .781 [M$ (SD) in min: 4.34 (0.61), 5.58 (1.05), 6.23 (1.11) for loads 1, 2, & 3], but %HRR did not show a significant load effect, $F(1.51, 55.95) = 1.03, p = .347, \eta^2 = .027 [M$ (SD) in %: 91.02 (5.23), 91.97 (5.13), 91.18 (6.02) for loads 1-3].

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.

2956 Board #239 June 1 3:30 PM - 5:00 PM

Effect of Long-term Elite Military Training and Operations on Hormonal Profile

Andrew E. Jensen¹, Laura J. Arrington², Lorraine P. Turcotte, FACSM¹, Karen R. Kelly³. ¹University of Southern California, Los Angeles, CA. ²Leidos, Inc., San Diego, CA. ³Naval Health Research Center, San Diego, CA.

(No relevant relationships reported)

Chronic exposure to multifactorial stress, such as that endured by elite military operators, may lead to overtraining 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⁻¹, 13.5 ± 0.9 nmol · L⁻¹, 28.2 ± 1.2 pmol · L⁻¹, 94.2 ± 6.4 nmol · L⁻¹, 441.3 ± 26.4 nmol · L⁻¹, 3.5 ± 0.7 mIU · L⁻¹, 150 ± 9.0 ng · dL⁻¹, and 7.8 ± 0.2 µg · dL⁻¹, respectively. There was a significant positive correlation between TT and cortisol (R² = 0.07; y = 0.0093x + 9.4364; 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 nmol · 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 (367.4 ± 39.1 vs 497.2 ± 33.2 nmol · L⁻¹; P < 0.05) and T3 (121.1 ± 5.4 vs. 164.0 ± 14.3 ng · dL⁻¹; P < 0.01). **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.

2957 Board #240 June 1 3:30 PM - 5:00 PM

Psychological Hardiness And Success On The Occupational Physical Assessment Test In Army Combat Arms Recruits

Bruce Cohen, Stephen Foulis, Maria Canino, Jan Redmond, Edward Zambraski, Marilyn Sharp. *USARIEEM, Natick, MA.*

(No relevant relationships reported)

In January 2017, the U.S. Army employed the Occupational Physical Assessment Test (OPAT) to determine the physical readiness of recruits (RCs) prior to initial entry training (IET). The OPAT consists of the standing long jump (SLJ), seated power throw (SPT), strength deadlift (SDL), and interval aerobic run (IAR). Recruits who meet the top OPAT level (i.e., black) qualify for heavy physically demanding jobs, such as combat arms (i.e., infantry, artillery, etc). Psychological readiness, measured by hardiness, has been shown to predict recruit success. **PURPOSE:** To examine the relationship between psychological hardiness and physical readiness (OPAT) in combat arms RCs. **METHODS:** Within the first week of IET, 945 U.S. Army male combat arms RCs performed the OPAT and completed the Dispositional Resilience Scale - Military (DRS-II-M) questionnaire, a validated 24-item, 5-point Likert scale (1 = definitely false to 5 = definitely true) measure. DRS-II-M provides three positive (control, commitment and challenge) and three negative (alienation, powerlessness and rigidity) hardiness dimensions. RCs were divided into two groups; those who achieved the OPAT black level (n=636) (SLJ ≥ 160 cm, seated power throw ≥ 450 cm, SDL ≥ 160 lb, and IAR ≥ 43 shuttles) versus those who did not (n=309). Two-tailed independent sample t-tests were used to compare hardiness across groups. **RESULTS:** RCs achieving black level scored significantly higher than those who did not on positive hardiness dimensions summed averages (SA) (12.65 ± 1.29 vs 12.43 ± 1.47; p = 0.015) and significantly lower on negative hardiness SA (6.35 ± 1.39 vs 6.63 ± 1.43; p = 0.004). Within the individual measure dimensions, black-level RCs scored higher on challenge (4.15 ± 0.58 vs 4.05 ± 0.62; p = 0.013) and control (4.35 ± 0.47 vs 4.25 ± 0.51; p = 0.003) averaged factors (AF) of positive hardiness and lower on alienation (1.53 ± 0.68 vs 1.63 ± 0.69; p = 0.033) and powerlessness (1.57 ± 0.62 vs 1.70 ± 0.66; p = 0.003) AF of negative hardiness. **CONCLUSIONS:** RCs who score high on the OPAT also have increased hardiness suggesting they will be successful in meeting the

psychological and physical demands of combat arms jobs. *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.*

2958 Board #241 June 1 3:30 PM - 5:00 PM
Evaluation Of Occupational Heat Strain Under Dry And Humid Conditions With Equivalent WBGT

Jeffrey B. Powell, Yongsuk Seo, Amanda Strauch, Raymond Roberge, Jung-Hyun Kim. *NIOSH/CDC/NPPTL, Pittsburgh, PA.*

(Sponsor: Dr. Edward Sinkule, FACSM)

(No relevant relationships reported)

PURPOSE

American Conference of Governmental Industrial Hygienist's (ACGIH) Threshold Limit Value (TLV), based on Wet Bulb Globe Temperature (WBGT), is a commonly used tool to prevent occupational heat stress (core body temperature (T_c) elevation within +1°C or ≤ 38 °C). This study examined the hypothesis that a level of heat stress would be equivalent to different combinations of ambient temperature and relative humidity should it be matched to the equivalent in terms of WBGT.

METHODS

All subjects provided informed consent approved by the NIOSH IRB. Eight healthy men (Age: 23±2 yrs.) wearing a cotton work coverall with a hardhat and work gloves underwent four cycles of an intermittent work-rest (15 min each, total 2 hours) under two ambient conditions characterized as either dry (45.5°C, 15% RH) (DRY) or humid (31°C, 84% RH) (HUM), but both equivalent to 30°C WBGT. The work was performed via a cycling exercise at a fixed rate of 350 watts metabolic heat production while the rest was given as sitting on a chair and removing gloves and headgear, with hydration *ad lib*. T_c, skin temperature (T_{sk}), Thermal sensation (TS), and Rating of Perceived Exertion (RPE) were measured during exercise.

RESULTS

Measurement of T_c, TS, and RPE were not significantly different between DRY and HUM conditions. There was also no difference in T_c elevation (DRY: 0.8±0.4°C, HUM: 0.7±0.3°C) within the upper limit of TLV. However, T_{sk} was significantly higher in DRY condition than HUM during exercise (p≤0.05). The average amount of water intake was not significantly different between DRY (1187.5±258.8 ml) and HUMID (901.5±323.6 ml) throughout trials (P>0.05).

		Baseline	1st Exercise	2nd Exercise	3rd Exercise	4th Exercise
T _c (°C)	DRY	37.0 ± 0.4	37.0 ± 0.3	37.2 ± 0.2	37.4 ± 0.3	37.7 ± 0.3
	HUM	36.9 ± 0.4	37.1 ± 0.4	37.2 ± 0.4	37.4 ± 0.4	37.7 ± 0.4
T _{sk} (°C)	DRY	34.5 ± 0.7	36.1 ± 0.3	36.4 ± 0.4	36.3 ± 0.6	36.3 ± 0.7
	HUM	33.9 ± 0.5	35.3 ± 0.3	35.4 ± 0.5	35.3 ± 0.5	35.2 ± 0.5
TS	DRY	7.1 ± 0.2	9.2 ± 0.6	9.8 ± 0.7	9.8 ± 0.5	10.0 ± 0.8
	HUM	7.4 ± 0.5	9.1 ± 0.7	9.4 ± 0.9	9.6 ± 0.9	9.6 ± 0.9
RPE	DRY	6.1 ± 0.4	9.4 ± 1.2	10.1 ± 1.5	10.4 ± 1.8	10.5 ± 1.7
	HUM	6.1 ± 0.4	9.3 ± 1.3	10.1 ± 1.7	10.1 ± 1.8	9.9 ± 1.6

CONCLUSION

These data demonstrated that a level of heat stress is similar under different ambient temperature and RH when matched the same in WBGT. However, it is speculated that a prolonged working time (e.g. 4 to 8 hour work shift) would likely surpass the upper limit of ACGIH's TLV.

2959 Board #242 June 1 3:30 PM - 5:00 PM

Combat Exposure Blunts Sympathetic Response to Acute Exercise Stress in Explosive Ordnance Disposal Personnel

Marcus K. Taylor, FACSM, Shiloah A. Kviatkovsky, Lisa M. Hernández. *Naval Health Research Center, San Diego, CA.*

(No relevant relationships reported)

Electrodermal activity (EDA) is a valid proxy of sympathetic nervous system activity during exercise and thus possesses the translational potential for studying the effects of acute and chronic stress. **PURPOSE:** To evaluate the effect of combat exposure (CE) on the EDA response to acute exercise stress in chronically stressed military men. **METHODS:** Thirty-six healthy military men (mean age: 37.0±6.9 yr) completed a graded exercise test to assess maximal oxygen consumption (VO_{2max}). EDA was recorded at baseline and during exercise (25, 50, 75, 100% VO_{2max}) and recovery. A tertile split of CE levels established three exposure groups: low CE (n=12), medium CE (n=12), and high CE (n=12). A 3 (group) × 6 (stage) repeated-measures analysis of variance evaluated EDA changes across stages of exercise, as well as between CE

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%) ($p<0.001$, $\eta^2_p=0.28$). An interaction between CE and exercise workload was observed ($p=0.022$, $\eta^2_p=0.13$). 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.

2960 Board #243 June 1 3:30 PM - 5:00 PM
Factors Impacting Field March Performance of U.S. Service Academy Cadets

Todd A. Crowder¹, Scott K. Rapuano². ¹US Military Academy, West Point, NY. ²3rd Infantry Division, Fort Stewart, GA.
 (No relevant relationships reported)

Field march performance (FMP) is an important skill of ground combat forces. Aerobic ability, "GRIT", overall 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 of at least ~500 feet. Specific multiple regression & frequency distribution analysis involved investigating the 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 $R^2 = .62$. Threshold measures appear present; 12:30 or faster 2MR (13 vs 0 subjects) and 2:38 or faster on an indoor obstacle course test (IOCT; 15 vs 2 subjects) reside in the Top 10% fastest FMP group. Body mass (adjusted $R^2 = -.02$) and pull-ups (adjusted $R^2 = .02$; a questionable surrogate for strength) did not impact FMP. Descriptive data:

Group n = ()	HT in	BM lbs	PU Reps	SU Reps	Pullups Reps	2MR Secs	2MR-YR Secs	APFT Pts	APFT-YR Pts	FMP Min	IOCT Day Secs	IOCT-YR Secs
ALL (230)	71 (2.8)	180 (22.6)	74.1 (12.1)	69.5 (11.5)	11.2 (4.2)	821.4 (60.1)	793 (51.9)	270.6 (31.0)	316 (32)	122.5 (14)	216.4 (30.7)	NA*
Top 10% FMP (23)	70.6 (2.7)	178.6 (20.6)	74.4 (11.1)	75.5 (9.0)	12.0 (4.1)	781.2 (47.3)	752 (42.1)	290.8 (26.4)	335 (29.4)	100.9 (5.1)	199.7 (26.5)	156.3 (14.4)
Bottom 10% FMP (23)	70.6 (2.3)	177.6 (15.9)	65.5 (8.3)	62.0 (9.1)	8.7 (3.2)	879.2 (64.9)	841.1 (48.7)	241.3 (24.1)	291.5 (25.1)	149.7 (8.8)	241.6 (36.4)	181 (15.6)

*Data unavailable, institutional data reveals mean IOCT time of ~180 secs. **DISCUSSION:** With 35-lb load, body mass & pull-ups did not influence FMP, whereas aerobic ability was the most potent factor. A postulated "GRIT" factor, attaining a performance badge on the IOCT (<2:38 min:sec); although a high incidence of success attainment (15/23 top 10% vs 2/23 bottom 10%), did not increase the variance in a two-factor regression model. **CONCLUSIONS:** In the present study, more robust strength measures were unfortunately not attained and future research should examine these and other physiological parameters. For soldiers desiring success on an 8.5 mile FMP with a 35-lb load, achieving & maintaining a career 2MR of at least 12:30 appears to enhance FMP and lead to a more enhanced physical profile related to military school selection criteria.

2961 Board #244 June 1 3:30 PM - 5:00 PM
Change in Measures of Moral Function Following Acute Bouts of Marine Corps Martial Arts Training

Jacob A. Siedlik¹, John P. Vardiman², Jake A. Deckert³, Trent J. Herda³, Joseph P. Weir, FACSM³, Aaron W. Clopton³, Philip M. Gallagher³. ¹Creighton University, Omaha, NE. ²Kansas State University, Manhattan, KS. ³University of Kansas, Lawrence, KS.
 (No relevant relationships reported)

The Marine Corps Martial Arts Program (MCMAP) is designed to be delivered in an environment characterized by periods of intense physical activity and psychological stress. The purpose of the program is to prepare Marines for the stress and complex ethical decisions encountered in the modern-day battlefield. However, how multifactorial stressors effect ethical decision-making processes is not well understood. **PURPOSE:** To quantify changes in ethical decision-making following MCMAP training. **METHODS:** Fifty-five, active duty, newly enlisted U.S. Marines (Males: $n =$

37; age = 19 ± 1 yr; height = 176 ± 7 cm; mass = 74 ± 7 kg; Females: $n = 18$; age = 20 ± 2 yr; height = 164 ± 6 cm; mass = 61 ± 6 kg) volunteered for this investigation. Nine cohorts were recruited over a 2-year period with each cohort observed 3 times with 3 weeks between each visit. Serial blood samples for cortisol, norepinephrine (NE), and epinephrine (EPI) were collected before training and during the recovery period (Immediate Post (IP), 15, 30, 45 and 60min). Endocrine measures were quantified using summary measures and analyzed with RMANOVAs. To quantify moral function, the Moral Functioning Continuum (MFC) was adapted from the Continuum of Injurious Acts. The MFC represents a hierarchy from less severe to more severe aggressive actions. The subjects responded on a continuum as to whether they consider acts in hypothetical situations as legitimate or appropriate with scores assessed before training, IP, 30, and 60 min. Moral function variables were analyzed using a multilevel regression models. **RESULTS:** There were no significant differences observed for the summary or baseline endocrine measures. Moral Intention exhibited an acute response to training with significantly impaired decision making observed immediately post training. Moreover, both Moral Intention and Moral Judgment worsened over the visits suggesting a chronic impairment related to time in training. **CONCLUSION:** We have identified a functional change in ethical decision-making following acute bouts of 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.

2962 Board #245 June 1 3:30 PM - 5:00 PM
Prediction of Lower Extremity Musculoskeletal Injuries for Naval Special Warfare Operators: A Machine Learning Approach

Kim Beals, Karen A. Keenan, Nicholas J. Kissel, Lucas Mentch, Wuxin Yang, Bradley C. Nindl, FACSM, Qi Mi. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Bradley C Nindl, FACSM)
 (No relevant relationships reported)

Lower 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:** LE MSI rate was 13/285 or 4.5%. Each cluster of feature sets from 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 MSKI. Alternative high prediction models also can be created using this modeling framework on different variable sets. Supported by ONR N00014-11-1-0929

2963 Board #246 June 1 3:30 PM - 5:00 PM
Abdominal Circumference Measurements in a US Navy Active Duty Population

Katherine M. Wilson¹, Douglas M. Jones¹, Matthew P. Mandel¹, Rebecca S. Weller², Melissa D. Laird³, Jay H. Heaney³. ¹Leidos, San Diego, CA. ²Innovative Employee Solutions, San Diego, CA. ³NHRC, San Diego, CA.
 (No relevant relationships reported)

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). There are four sites most commonly measured for AC; iliac crest (IC), mid-abdominal (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.

2964 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

Douglas M. Jones¹, Katherine M. Wilson¹, Eric Duckworth¹, Magnus Perkins², Melissa Laird³, Jay H. Heaney³. ¹Leidos Inc., San Diego, CA. ²USS Nimitz, Bremerton, WA. ³Naval Health Research Center, San Diego, CA.

(No relevant relationships reported)

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 aboard an aircraft carrier deployed in the Persian Gulf.

METHODS: Eight military personnel (age: 22 ± 2 yrs, ht: 165 ± 6 cm, wt: 71.8 ± 11.9 kg) assigned to shipboard scullery work (designated PHEL V) had their metabolic rate predicted based on established PHEL guidance. They then performed routine scullery work for the duration of their shift while measurements of oxygen consumption (VO_2), heart rate (HR), and core temperature (T_{core}) were collected for 3-4 hours. Measurements were collected again during a second shift to determine consistency of metabolic rates. Predicted and measured VO_2 recordings, converted to watts (W), were then compared to determine accuracy of existing PHEL curve assignments.

RESULTS: VO_2 measurements between the first and second shifts were not different (229 ± 33 vs 225 ± 31 W; $p = .72$), suggesting that duties performed were consistent. However, the predicted metabolic rates of the current PHEL assignments were significantly higher than those actually measured (240 ± 22 vs 227 ± 28 W; $p = .03$). Mean T_{core} of scullery personnel during both shifts was $37.4 \pm 0.2^\circ\text{C}$, with the highest T_{core} recorded at 38.3°C . Mean HR was 96 ± 12 bpm, equivalent to $49 \pm 6\%$ of age-adjusted maxHR.

CONCLUSION: Findings from this limited data set identify a discrepancy between current PHEL curve assignments and measured metabolic rates in scullery personnel, likely resulting from task automation. Further work on this issue is warranted, as discrepancies between predicted and actual work rates could alter workspace allowable stay times and reduce the frequency of required workspace heat stress monitoring.

2965 Board #248 June 1 3:30 PM - 5:00 PM

Fitness and Body Composition Characteristics of Special Weapons and Tactics Team Members of Law Enforcement

Rafael A. Alamilla¹, Javier D. Romero¹, Kong Tu¹, Christina N. Cooper², Gary W. Berwick III¹, Matthew C. Jackson¹, Guillermo Escalante¹, Nicole C. Dabbs¹, Jason Ng¹. ¹California State University, San Bernardino, San Bernardino, CA. ²California State University, Long Beach, San Bernardino, CA. (Sponsor: Bryan Haddock, FACSM)

(No relevant relationships reported)

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.

PURPOSE: To examine the fitness and body composition characteristics of SWAT members. **METHODS:** Fourteen healthy men (mean \pm SD; age = 33.1 ± 5.7 y, 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) a 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_{2max}); 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 $18.7 \pm 4.7\%$, a BMD of 1.3 ± 0.1 g·cm⁻², 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⁻¹, respectively. VO_{2max} was 47.9 ± 5.5 ml·kg⁻¹·min⁻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

2966 Board #249 June 1 3:30 PM - 5:00 PM

Body Composition Indices to Classify Activity Level in Air Force Men and Women

Guy D. Leahy¹, Todd A. Crowder², Jerry L. Mayhew³. ¹Kirtland Air Force Base, Kirtland AFB, NM. ²United States Military Academy, West Point, NY. ³Truman State University, Kirksville, MO.

(No relevant relationships reported)

The search continues for a simple, accurate means of classifying the best body build and/or composition of active duty military personnel. Various branches of the military consider body composition assessment an integral part of determining combat readiness. Heretofore, branches of the military have relied on a tape measure test to estimate body fat (%fat), which has not proven entirely successful. Recent interest has increased in body composition ratios to discern proportions of muscle and fat to identify personnel with greater military-task performance potential. **PURPOSE:** To evaluate the ability of selected body composition ratios to differentiate among activity level groups of active duty Air Force personnel. **METHODS:** Air Force men ($n = 604$) and women ($n = 343$) were evaluated for body composition using air displacement plethysmography (BodPod®, Life Measurement) to identify fat mass (FM), fat-free mass (FFM) and %fat. Participants were stratified into 4 age groups, determined by decade, with individuals <20 yrs ($n = 13$) combined with the 20-29 yr-old group and into 4 activity groups (sedentary, low active, active, and very active). Height and weight were used to calculate BMI = kg/m². Fat-free mass index (FFMI) and fat mass index (FMI) were determined by evaluating each component relative to height (m²). Body type was estimated from the ratio of FFMI:FMI. **RESULTS:** An activity category x age group (4×4) MANOVA was performed on each sex. In men, BMI, FMI, and %fat were significantly different ($p < 0.001$) among activity groups and age groups, with no significant interactions. In women, BMI, FMI, and %fat were significantly different ($p < 0.007$) among activity groups. Among age groups, FFMI, %fat, and body type were significantly different. No interactions were significant. Discriminant analysis identified FM as the best discriminator of activity group in each sex, but the success rate of each category was $<10\%$. **CONCLUSION:** Body composition indices do not appear to offer a simple solution to identifying military

personnel with the proper proportion of FFM to FM commensurate with active duty status in either sex. Additional research may need to concentrate on the relationship between body composition indices and physical performance tasks.

2967 Board #250 June 1 3:30 PM - 5:00 PM

Morphological Characteristics Associated with Successful and Non-Successful Performance on Occupationally Specific, Operationally Relevant Physical Tasks

Neal Baumgartner¹, Matthew F. Gruse¹, William F. Wilson². ¹US Air Force Exercise Science Unit, San Antonio, TX. ²US Air Force Personnel Center Analysis Branch, San Antonio, TX.

(No relevant relationships reported)

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. **PURPOSE:** 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. **METHODS:** A bona fide occupational requirements physical demand analysis was conducted for six Battlefield Airmen career fields. Analysis identified operationally-required critical physical tasks, which provided the basis for developing physical task simulations (PTSs). 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 PTSs 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 176.7 cm - 167.8 cm, body mass 82.3 kg - 70.8 kg, body mass index 26.3 kg/m² - 25.1 kg/m², fat-free mass 69.6 kg - 55.2 kg, fat mass 12.7 kg - 15.7 kg, and relative body fat 15.2% - 22.2%) across nearly all PTSs. Number of PTSs significance ($p < .01$) reached equals: stature 14 of 14 PTSs, body mass 13, body mass index 10, fat-free mass 14, fat mass 10, and relative body fat 11. **CONCLUSION:** The study showed that significant differences in morphology 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.

2968 Board #251 June 1 3:30 PM - 5:00 PM

Validity of Critical Velocity Regression Equation to Estimate Weighted Sprint Performance

Nathan D. Dicks¹, Tammy V. Joe¹, Kyle J. Hackney¹, Robert W. Pettitt, FACSM². ¹North Dakota State University, Fargo, ND. ²Rocky Mountain University of Health Professions, Provo, UT. (Sponsor: Robert W. Pettitt, FACSM)

(No relevant relationships reported)

The maximal aerobic steady-state has been estimated for running using the critical velocity (CV) concept. The CV metric has been associated with occupational and combat-specific performance measures. Tactical professionals are often burdened with load carriage that takes the form of duty gear, equipment, weapons, body armor, and protective gear. Thus, a model of high-intensity interval training (HIIT) prescribed using the CV concept to specifically increase CV would be of considerable use for improving tactical performance. **PURPOSE:** We investigated the validity of a recently developed equation for predicting sprinting times of various tactical loads based upon performance of a running 3-min all-out exercise test (3MT). **METHODS:** 13 recreationally trained participants completed the running 3MT to determine CV and finite running capacity for running velocities exceeding CV (D'). Two subsequent counterbalanced loaded sprints of 800 and 1000 m distances with 20 and 15% of their body mass, respectively, were evaluated. Estimated times (t , sec) for running 800 and 1000 m with a tactical load was derived using $t = (D - D')/CV$, where the CV was adjusted for added load using the following regression equation: original CV + $(-0.0638 \times \%load) + 0.6982$, D was 800 or 1000 m, and whole percentage load was ~15 or 20% of the participant's body mass. **RESULTS:** From the 3MT, CV (3.80 ± 0.5 m/s⁻¹) and D' (200 ± 49.88 m) values were determined. The typical error of predicting actual time for the 800 and 1000 m loaded sprints was 5.6 and 10.1 s, with corresponding ICCs of 0.95 and 0.87, and coefficient of variations of 2.9 and 4.3%. The regression model (188.7 ± 25.4 s) underestimated actual (195.2 ± 22.4 s) sprint times for the 800 m distance with ~20% load carriage ($t = 2.96$, $p = 0.01$). Similarly, estimated (229.5 ± 27.1 s) underestimated actual (244.9 ± 24.2 s) sprint times for the 1000 m distance with ~15% load carriage ($t = 3.95$, $p < 0.01$). The effect size differences between estimate and actual sprint times were small (0.27) and moderate (0.60) for 800 and 1000 m, respectively. **CONCLUSION:** The adjustment to CV

through the regression equation yields small to moderate overestimates of maximal loaded sprint times for distances of 800 and 1000 m. Whether such errors remain pervasive for prescribing HIIT is unclear and is a research problem worth exploring.

F-64 Free Communication/Poster - Occupational/Firefighter Physiology

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

2969 Board #252 June 1 3:30 PM - 5:00 PM

Effects of Wrist Cooling on Recovery from Exercise-Induced Heat Stress with Firefighter Personal Protective Equipment

Monique D. Dudar, Ronald Caruso, Emily Schlicht, Kelsey Denby, Aless A. Matias, Stephen J. Ives. *Skidmore College, Saratoga Springs, NY.*

(No relevant relationships reported)

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_{co}), 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_{co} . During exercise, HR (145 ± 22 vs. 148 ± 19 bpm), T_{co} (37.8 ± 0.3 vs. 37.8 ± 0.3 °C), TS (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 ± 41 vs. 43 ± 41 sec) and time to complete recovery (519 ± 275 vs. 624 ± 289 sec) and were not significantly different with the band active (both, $p > 0.05$, control vs. cool). During recovery, there was no significant differences in T_{co} or HR ($p > 0.05$). At recovery, T_{co} (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 ± 0.6), 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: DhamaUSA.

2970 Board #253 June 1 3:30 PM - 5:00 PM

Longitudinal Changes in Dynamic Balance Ability Among Firefighter Recruits: A Multivariate Analysis Perspective

David J. Cornell¹, Stacy L. Gnacinski², Kyle T. Ebersole¹. ¹University of Wisconsin - Milwaukee, Milwaukee, WI. ²Drake University, Des Moines, IA. (Sponsor: Terry J. Housh, FACSM)

(No relevant relationships reported)

Research has demonstrated a link between dynamic balance ability, assessed via the star excursion balance test (SEBT), and musculoskeletal injury (MSKI) 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 (W38). SEBT reach distances were normalized to limb length and averaged between right and left reaches in the anterior (SEBT_{ANT}), posterolateral (SEBT_{PL}), posteromedial (SEBT_{PM}) directions. $\alpha = 0.05$ determined statistical significance for all analyses. **RESULTS:** An omnibus RM MANOVA revealed a significant and large effect of time on dynamic balance ability ($F_{6,100} = 13.463$, $\Lambda = 0.306$, $\eta^2_p = 0.447$, $P < 0.001$). Results of the *post hoc* RM

ANOVAs demonstrated significant main effects of time on SEBT_{ANT} ($F_{2,52} = 29.280$, $P < 0.001$), SEBT_{PL} ($F_{2,52} = 12.856$, $P < 0.001$), and SEBT_{PM} ($F_{2,39.754} = 4.460$, $P = 0.026$) reaches. Follow-up pairwise comparisons further revealed that from W1 to W14, SEBT_{PL} and SEBT_{PM} significantly increased, while a significant change was not observed in SEBT_{ANT}. 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_{ANT} but no significant changes were observed in the SEBT_{PL} and SEBT_{PM}. **CONCLUSIONS:** Results indicate that this firefighter recruit training academy yielded significant improvements in dynamic balance ability, particularly in SEBT_{PL} and SEBT_{PM} 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.

2971 Board #254 June 1 3:30 PM - 5:00 PM

Physical Activity Intensity Of Brazilian Militar Firefighters During A 24h On-duty Period

Leonardo Correa Segedi¹, Daniel Saint Martin², Edgard Koenig Soares³, Maciel Rosenkranz Nogueira¹, Keila Elizabeth Fontana², Gilliard Lago Garcia², Maria Korre³, Guilherme Eckhardt Molina², Denise L. Smith⁴, Stefanos N. Kales³, Luiz Guilherme Grossi Porto⁵. ¹University of Brasilia and Brasilia Fire Department and GEAFS, Brasilia, Brazil. ²University of Brasilia and GEAFS, Brasilia, Brazil. ³Harvard T.H. Chan School of Public Health, Boston, MA. ⁴Department of Health and Exercise Sciences, Skidmore College, Saratoga Springs, NY. ⁵University of Brasilia and Harvard T.H. Chan School of Public Health, Boston, MA and GEAFS, Brasilia, Brazil.
(No relevant relationships reported)

Firefighters' job activities expose firefighters to multiple physical stressors. In Brasilia Fire Department wildland firefighters are a specialized group that perform primarily wildland fire suppression and other tasks, such as rescues. **PURPOSE:** To evaluate the physical activity (PA) intensity of wildland firefighters during a routine 24-hour on-duty period. **METHODS:** We evaluated 26 wildland firefighters, aged 34.6±6 years, with BMI 25.3±2.9 kg/m² and VO_{2max} of 45.9±3.9 mL(kg.min)⁻¹. Each participant wore a Polar® heart rate (HR) transmitter with an ActiGraph accelerometer for HR data storage during a 24-hour period. Maximum HR (MHR) was estimated by Tanaka formula. PA intensity was defined in HR zones: very heavy (≥ 94% of MHR); heavy (77% - 93% of MHR); moderate (64% - 76% of MHR) and light (≤ 63% of MHR). Absolute and relative time spent in each zone were compared between those who participated or not on at least one episode of wildland fire suppression (Mann-Whitney test). Volunteers reported main duties on a written log. **RESULTS:** 17 participants (65.3%) accumulated at least 30min/day of moderate to vigorous physical activity (MVPA). 50% of the volunteers responded to wildland fires and classified those activities as light (31%) or moderate intensity (69%). Absolute and relative time in each HR zone were similar between those who responded or not to wildland fires ($p > 0.05$). 21 (81%) reached the HR of heavy intensity and 12 (46%) the very heavy one. Table 1 shows descriptive data.

Table 1: median (min - max) time of HR in different physical activity intensities (n = 26).

	Absolute (min)	Relative (%)
Light	1083.8 (562.5 - 1315.0)	95.5 (86.9 - 99.9)
Moderate	23.9 (3.3 - 140.6)	2.3 (0.3 - 11.1)
Heavy	15.7 (0.0 - 65.8)	1.3 (0.0 - 5.6)
Very heavy	0.0 (0.0 - 35.0)	0.0 (0.0 - 4.5)
Wear time	1180.5 (639.0 - 1323.0)	

Conclusion: Firefighters spent most of their time in light activities, including sedentary and resting periods. However, >80% of the volunteers interspersed the light activities with periods of MVPA. No firefighter reported any heavy demand during the monitored days. New studies including firefighters' activities during huge wildland fires are needed.

Funding: CNPq 480092/2013.3

2972 Board #255 June 1 3:30 PM - 5:00 PM

Firefighting Influences Cognitive Performance: The Heart of the Matter

Tina A. Greenlee¹, Daniel R. Greene², R. Mia Kaim³, Annmarie Chizewski³, Kathryn M. Rougeau⁴, Gavin P. Horn⁵, Steven J. Petruzzello, FACSM³. ¹The Geneva Foundation, San Antonio, TX. ²Augusta University, Augusta, GA. ³University of Illinois at Urbana-Champaign, Urbana, IL. ⁴Oakland University, Rochester, MI. ⁵Illinois Fire Service Institute, Champaign, IL.
(No relevant relationships reported)

Firefighters (FFs) work in hazardous, volatile environments with considerable physical and mental demands that might influence cognitive performance. The nature and extent of such influence requires examination. **PURPOSE:** Determine the influence of a night-burn FF drill on new-recruit FFs' perceptual sensations (thermal, respiratory, effort), physical workload (heart rate; HR), and cognitive performance (modified Flanker task), while identifying individual risk factors. **METHODS:** New-recruit, male FFs (N=28; 24.96 ± 4.2 yrs) participated in a live-fire night-burn drill (48:54±03:46 mins) as part of a 6-wk training program. This involved emergency response, fire attack, and search and rescue. Aerobic fitness was estimated from 1.5-mi run time. Cognitive behavioral performance on a modified Flanker task and perceptual states (thermal sensation, RPE, respiratory distress, feelings, felt arousal, fatigue, anxiety) of each FF were measured on a separate baseline day, as well as pre- and post-firefighting (Post-0, End). HR was continuously recorded throughout. **RESULTS:** After accounting for baseline, M HR during drill predicted variance in post-task affect (state anxiety: 24.5%, $P = 0.01$); TS: 18.1%, $P = 0.025$; FS: 14.6%, $P = 0.046$); VAS nervousness: 17.4%, $P = 0.028$). M HR during drill also predicted cognitive performance Post-0 for Flanker Accuracy on all trials (16.8%, $P = 0.033$). FS change from Pre to Post-0 also explained Accuracy for all trials (14.4%, $P = 0.047$). 1.5-mi run time predicted variance in Post-0 Flanker SD for all trials (20.2%, $P = 0.016$). VAS fatigue change from Pre to Post-0 also explained Flanker SD (16.5%, $P = 0.032$). **CONCLUSIONS:** Simple, on-line tracking of HR may be able to help incident commanders recognize FFs who, indicated by greater relative HR during emergency response, may have diminished decision-making capacity on the fireground. Other factors (e.g., trait anxiety, dispositional resilience) may influence physical effort put forth in an emergency scenario and may put certain FFs at higher risk for making errors. Future research should determine trainability of such factors in order to enhance performance and, ultimately, safety for FFs. Manifestation of such changes in cognitive performance, in terms of decision making during a live-fire emergency, needs further investigation.

2973 Board #256 June 1 3:30 PM - 5:00 PM

Firefighting Exercises, Heat Stress, And The Cardiovascular System In Recovery

Sarah Bergstrom¹, Summer Cook, FACSM¹, Robert Kenefick, FACSM², Timothy Quinn, FACSM¹. ¹University of New Hampshire, Durham, NH. ²U.S. Army Research Institute of Environmental Medicine, Natick, MA. (Sponsor: Timothy Quinn, FACSM)
(No relevant relationships reported)

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 heat 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 y; ht=1.8±0.1 m; wt=92.7±18.4 kg; VO_{2max} = 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_c), skin (T_{sk}), and temperature gradient (T_{grad}) measurements were obtained pre, during, and 5, 10, 20, 40, 60 min post-exercise. Subjects sat for a 60-min recovery while measurements were taken. A repeated measures MANOVA 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 HR was higher than pre (70±14bpm) throughout recovery (80±12bpm; $p < 0.05$). 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 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_c and T_{sk} 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 wore full firefighter turnout gear while completing two rounds of a firefighting-based exercise circuit in 40°C and 60% relative humidity. Five minutes following exercise completion, 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: -6.54 ± 6.86 bpm, FI: -28.36 ± 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 stress did not provide adequate recovery of heart rate or core temperature in a hot humid setting.

2975 Board #258 June 1 3:30 PM - 5:00 PM
The Effect of Personal Protective Equipment on Firefighter Occupational Performance

Ashley Y. Lesniak¹, Haley Bergstrom², Jody L. Clasey², Arnold J. Stromberg², Mark Abel¹. ¹*Lynchburg College, Lynchburg, VA.* ²*University of Kentucky, Lexington, KY.*

(No relevant relationships reported)

PURPOSE: To determine the effect of load carriage (LC) and the self-contained breathing apparatus (SCBA) on occupational performance of structural firefighters. **METHODS:** Twenty-one professional male structural firefighter recruits (Age: 28.6 ± 4.3 yr; Height: 178.6 ± 7.2 cm; Body mass: 94.1 ± 15.4 kg; Body fat: $17.8 \pm 8.4\%$) participated in the study. Occupational physical ability was assessed by time to complete a simulated fire ground test (SFGT). The SFGT was composed of a stair climb, charged hose drag, equipment carry, ladder raise, forcible entry, search, and victim rescue. Subjects performed 2 familiarization trials and 3 trials of a SFGT in different conditions: physical training clothes only (PT), wearing turnout gear and an SCBA (but not breathing through the SCBA (LC)), and wearing turnout gear and breathing through the SCBA (SCBA). RPE was also measured. Heart rate, blood lactate, and perceived exertion were assessed during the SFGT. Repeated measures ANOVAs were used to identify differences among trials. To describe within group changes, relative difference scores were calculated as follows: % difference = $([\text{experimental trial outcome} - \text{PT outcome}] / \text{PT outcome}) \times 100$. **RESULTS:** The SCBA trial took $44.5 \pm 15.5\%$ longer (345.9 ± 43.7 s; $p < .001$) and the LC trial took $38.3 \pm 12.6\%$ longer (331.2 ± 39.3 s; $p < .001$) than the PT trial (241.0 ± 33.3 s). The SCBA trial took longer than the LC trial ($p = .046$). Heart rate and lactate measures were not different between trials. RPE was higher in the SCBA trial (6.7 ± 1.7) and LC (6.3 ± 1.5) compared to the PT trial (4.6 ± 1.8 ; $p < .001$). **CONCLUSION:** Load carriage and the respirator elicit a large decrement in occupational performance. Performance in PT clothes is not an accurate depiction of performance in load carriage. Firefighters and practitioners must identify safe and effective training strategies to prepare firefighters for the occupational demands of load carriage and respirator use.

2976 Board #259 June 1 3:30 PM - 5:00 PM
The Influence Of Wildland Fire Operations On Adipose Tissue, Skeletal Muscle And Lipids

Michelle M. Johannsen¹, Grant Galvin¹, Colin Campbell¹, Carl J. Murphy¹, Brent C. Ruby, FACSM². ¹*University of Alaska - Fairbanks, Fairbanks, AK.* ²*University of Montana, Missoula, MT.* (Sponsor: Robert H. Coker, FACSM)

(No relevant relationships reported)

Wildland fire suppression requires extended work shifts in arduous settings that may include high ambient temperatures, altitude or compromised air quality. The physiological demands of the job have been well characterized with total energy expenditure (EE) often exceeding 5,000 kcal/day. **PURPOSE:** The purpose of this study was to evaluate changes in cross-sectional area of the muscles of the upper thigh (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 tissue 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 (HDL) and low-density lipoproteins (LDL). Results were analyzed using paired t-tests, presented as means \pm 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 and 24.5 ± 0.5) 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 over the fire season (N=27). Of the 27 participants that completed DXA and MRI scans, 18 completed blood sampling. There was an increase in CHOL (160 ± 8 and 176 ± 8) 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 Ruby, 2016.

2977 Board #260 June 1 3:30 PM - 5:00 PM
Prediction Of Heat Strain Using Trunk Posture While Wearing Personal Protective Clothing: A Pilot Study

Yongsuk Seo, Tyler D. Quinn, Patrick Yorio, Ali Aljaroudi, Aitor Coca, Jung-Hyun Kim, Raymond J. Roberge, Jon Williams. *National Institute for Occupational Safety and Health, Pittsburgh, PA.* (Sponsor: Edward J. Sinkule, FACSM)

(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 (T_{co}) and muscular fatigue from hyperthermia may result in alteration to the biomechanics of walking, which can be measured to estimate the level of heat strain. The purpose of this study was to determine if trunk posture is related to hyperthermia while walking on a treadmill with PPE. **METHODS:** Five healthy men walked on a treadmill in three conditions while wearing healthcare worker (HCW) PPE (1: 30 minutes walking at 3.0 mph and 0% grade, 20°C and 50% relative humidity (RH); 2: 30 minutes walking at 3.0 mph and 0% grade, 27.5°C and 60% RH; and 3: 30 minutes walking at 3.0 mph and 0% grade, 32.5°C and 70% RH). Trunk posture [degrees of trunk flexion (+) or extension (-)], T_{co}, and heart rate (HR) were measured continuously throughout exercise. **RESULTS:** Average end exercise T_{co} for all conditions was 37.3 ± 0.6 °C. Trunk posture (0.52 ± 5.6) displayed a significant positive relationship with age (22 ± 3 years) ($r = 0.29$) and T_{co} ($r = 0.21$) along with the control variable HR (126.1 ± 28.4 beats/min) ($r = 0.41$). Trunk posture was significantly negative related to BMI (25.1 ± 2.4 kg/m²) ($r = -0.28$) and height (178.7 ± 7.2 cm) ($r = -0.28$). Generalized Estimating Equations revealed that T_{co} was significantly and positively related to trunk posture while controlling for the other covariates ($B = 6.47$, $p < 0.001$). Age was shown to moderate the relationship between T_{co} and trunk posture ($T_{co} * \text{age}$, $B = 3.34$, $p < 0.001$). **CONCLUSIONS:** A significantly positive relationship was found between T_{co} and the magnitude of trunk flexion in hyperthermia. This relationship was shown to be moderated by age. Trunk posture measurement may be useful in predicting fall potential and magnitude of heat strain in individuals wearing PPE while exercising or working in hot and humid environments.

2978 Board #261 June 1 3:30 PM - 5:00 PM
Comparison between Six Hours of Continuous Walking to Six Hours of Intermittent Walking

Charli D. Aguilar, Nathaniel G. Bodell, Jeffrey Montes, Elizabeth A. Tanner, Andrea Woita, Jessica Knurick, James W. Navalta, FACSM. *University of Nevada Las Vegas, Las Vegas, NV.* (Sponsor: Dr. James Navalta, FACSM)
 (No relevant relationships reported)

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 and/or walking.

PURPOSE: The purpose of this study was to determine if repeated breaks from walking has an effect on productivity and satisfaction.

METHODS: 23 healthy adults (11 males, 12 females) mean age of 22.5 ± 3.4 years volunteered to participate in the study. Participants were split into two groups. Continuous walkers, (n=11) who walked around a standard 400 outdoor meter track at a self-selected pace for 6 hours with one 10 minute break at 3 hours. Intermittent walkers (n=12), who walked for 50 minutes followed by a 10 minute break, repeated 6 times. Heart rate (HR), Blood pressure (BP), laps, and feeling scale were analyzed at Pre-walking, Midpoint, and Post walking. Dependent variables were analyzed utilizing a 2 (group) x 3 (time) ANOVA with repeated measures on time. Significance was accepted at the $p < 0.05$ level.

RESULTS: Continuous group walked significantly more laps total and more laps per hour (mean 58.8 ± 5.93 vs. 46.9 ± 4.21 mean total laps, $p < 0.01$). However, there was no difference in number of laps per relative hours walked (9.8 ± 0.98 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.

2979 Board #262 June 1 3:30 PM - 5:00 PM
Pilot Project: Energy Expenditure Comparison of Active Dance Video Games Pauses in Work Place

Andrée-Anne A. Parent, Joséphine Sans, Alain-Steve Comtois. *Université du Québec à Montréal, Montréal, QC, Canada.*
 (No relevant relationships reported)

Health programs incorporating physical activity components in office space work environments are encouraged to reduce sedentary/sitting down time that has recently been shown to be detrimental to employee health. **PURPOSE:** 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 game dances 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, Montreal). The modifications were to play with a motion capture device (Kinect, Microsoft, USA), with a controller device (PSMove, Sony, Jp), and with a controller device in a sitting position (PSMove, Sony, Jp). The energy expenditure was measured by oxygen uptake using a portable metabolic analyser (K4b2, Cosmed, It) and the heart rate by a heart rate monitor (v800, Polar, Fi). **RESULTS:** The group average METS with Kinect vs PS vs sitting position during the Party Rock Anthem was 6.3 ± 0.8 , 5.5 ± 1.2 , and 3.0 ± 0.8 METS ($p < 0.001$). The group average METS on Kinect vs PS vs sitting position during Land of 1000 Dances was 7.4 ± 1.6 , 6.1 ± 1.4 , and 3.6 ± 1.4 METS ($p < 0.001$). Finally, the group average METS on Kinect vs PS vs sitting position during No limit was 6.8 ± 1.3 , 5.8 ± 1.3 , and 3.5 ± 1.1 METS ($p < 0.001$). **CONCLUSIONS:** Knowing that now these games are available using only a cell phone as a controller and a simple computer with internet, it seems feasible to use these video games to reach the minimum ACSM guidelines in a health program for an office company, even when modified for physically limited employees. However, a significant difference between the different types of play and individual needs must be considered in a workplace health program. Furthermore, additional research needs to be done to measure the impact of implementing physical active work breaks on personnel fitness changes and retention.

2980 Board #263 June 1 3:30 PM - 5:00 PM
An Analysis of the Physical Demands of National Ambulance Resilience Unit (NARU) Roles

Sam D. Blacker¹, Mark P. Rayson², Ella Walker¹, Carla Rue¹, Jane E.S Thompson¹, Jullianne Doherty¹, Stephen D. Myers¹. ¹*University of Chichester, Chichester, United Kingdom.* ²*Mark Rayson Consulting Limited, Bristol, United Kingdom.*
 (No relevant relationships reported)

PURPOSE: The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service (NHS) Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. NARU personnel are trained to deal with hazardous or difficult situations and mass casualty incidents. The aim of this study was to quantify the physically demanding tasks undertaken by NARU personnel. **METHODS:** The study was completed in two phases. In Phase 1, 10 subject matter experts from a range of NHS Ambulance Trusts participated in a two-day researcher led workshop to define the most physically demanding tasks performed by NARU personnel. In Phase 2, 34 participants (29 men and 5 women, stature 1.77 ± 0.08 m, body mass 84 ± 14 kg, estimated VO_{2max} 39 ± 7 mL·kg⁻¹·min⁻¹) performed scenarios of the tasks defined in Phase 1, with measurements of heart rate, speed of movement, load carried, and weights and forces of objects moved. Data are expressed as mean \pm standard deviation. **RESULTS:** Eleven criterion tasks were defined in Phase 1: Swift Water Rescue, Re-board Boat, Unload Vehicle and Set-up Decontamination Unit, Clinical Decontamination (CD), Movement in Gas Tight Suits, Marauding Terrorist Firearms Attack (MTFA), Over Ground Rescue, Unload Incidence Response Unit Vehicle, Above Ground Rescue, Over Rubble Rescue, and Subterranean Rescue. The shortest tasks were the Swift Water Rescue and Re-board Boat at ~ 1 min, with resultant heart rates of 76 ± 10 and 61 ± 14 %HR_{max}, respectively. The longest tasks were the CD and MTFA (~ 120 min) resulting in heart rates of 65 ± 11 and 73 ± 11 %HR_{max}, respectively. The greatest forces exerted were during equipment lifting and carrying (e.g. 167 kg by 6 people) and dragging of casualties (e.g. single person 88 kg casualty and stretcher drag). **CONCLUSION:** All five components of fitness (aerobic endurance, anaerobic endurance, muscular strength, muscular endurance and mobility) are required to successfully perform the criterion tasks undertaken by NARU personnel. These data can be used to inform interventions to enhance physical performance and develop physical employment standards for specialist ambulance responders. **ACKNOWLEDGEMENT** - This work was conducted in collaboration with the National Ambulance Resilience Unit in the United Kingdom.

F-65 Free Communication/Poster - Medical Issues

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

2981 Board #264 June 1 2:00 PM - 3:30 PM
Vitamin D Status in Elite South African (SA) Rugby Union Players: A Pilot Study

Pierre L. Viviers, FACSM¹, Jeandré Viljoen¹, Glen Hagemann², Alan Kourie², Danielle Roberts², Wayne Derman¹. ¹*Stellenbosch University, Stellenbosch, South Africa.* ²*Sharks Medical Centre, Durban, South Africa.*
 (No relevant relationships reported)

Evidence suggests that poor vitamin D status (VIT-D) has negative implications for the health, well-being and performance of athletes. To date, little is known about athletes from the Southern Hemisphere. **PURPOSE:** i) To assess vitamin D levels in elite SA Rugby Union players (RU); and ii) to ascertain whether a relationship exists between vitamin D status and seasonal climatic variation, dietary intake or skin type. **METHODS:** In this longitudinal observational study, a cohort of elite RU players were screened to determine factors related to their VIT-D status including: i) serum 25-hydroxyvitamin D [25(OH) D], ii) comprehensive dietary analysis and iii) a Fitzpatrick skin type classification questionnaire (evaluating genetic predisposition, reaction to sun exposure and tanning habits). Initially, forty-one players completed the summer assessment, whereas only 17 were available for follow-up 6 months later during the winter. **RESULTS:** The mean s-[25(OH)D] was 62.0 ± 22.4 ng/mL⁻¹ (95% CI: 50.5, 73.5) for the summer period, while at time point 2 the mean s-[25(OH)D] was 38.4 ± 11.2 ng/mL⁻¹ (95% CI: 32.6, 44.2). Analysis of paired data revealed that 88% (2/17) of players displayed adequate s-[25(OH)D] during summer with the remaining 12% (2/17) of cases showing signs of insufficiency. During winter, 82% (14/17) had adequate s-[25(OH)D] while 6% (1/17) and 12% (2/17) of players displayed concentrations indicative of insufficiency and deficiency. No association was found between reported dietary intake and s-[25(OH)D]. A negative correlation ($p = 0.05$) was found for summer s-[25(OH)D] and the Fitzpatrick skin type score. **CONCLUSIONS:**

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.

2982 Board #265 June 1 3:30 PM - 5:00 PM
Effects of Training Camp on Hematological Variables in Athletes with Sickle Cell Trait

Michael E. Owens¹, Haoyan Wang¹, Nathan P. Lemoine, Jr.¹, Jack Marucci¹, Shelly Mullenix¹, Arnold G. Nelson, FACSM¹, Ralph R. Castle¹, Brian A. Irving¹, Guillaume Spielmann¹, Jennifer Rood², Timothy S. Church², Brian Harrell³, Neil M. Johannsen¹. ¹Louisiana State University, Baton Rouge, LA. ²Pennington Biomedical, Baton Rouge, LA. ³Baton Rouge General Sports Medicine, Baton Rouge, LA. (Sponsor: Arnold G. Nelson, FACSM)

(No relevant relationships reported)

PURPOSE: To explore the hematological differences in African-American athletes with sickle cell trait (SCT) and healthy controls (CON) before pre-season camp and the changes that occur after pre-season training. **METHODS:** Sixteen (n=8 SCT; n=8 position matched, CON) NCAA Division 1 athletes (12 football, 2 each women's soccer and volleyball) had blood drawn before and after pre-season camp and analyzed for Hb electrophoresis (Hb-A, Hb-A2, Hb-S, and Hb-F), complete blood count with differential, chemistry panel 26, and prothrombin time, activity and international normalized ratio (INR). **RESULTS:** Baseline total Hb was similar between SCT and CON (mean±SD; 14.2±1.3 vs. 14.1±0.9g/dL, resp; P=0.87), but as expected, Hb-A was lower and Hb-A2 and Hb-S were higher in SCT than CON (P<0.001 for all). Baseline neutrophils were higher (4.43±1.29 vs. 3.28±0.93cellsx10³/mL, P<0.005) and lymphocytes tended to be lower (1.56±0.45 vs. 1.99±0.39cellsx10³/mL; P=0.09) amongst SCT compared to CON, respectively. Baseline amylase (99.4±25.4 vs. 72.9±18.8u/L; P=0.03), uric acid (6.8±1.7 vs. 5.5±0.8mg/dL; P=0.08), and creatinine (1.2±0.2 vs. 1.0±0.2mg/dL; P=0.07) were higher in SCT compared to CON. All Hb measures in SCT were similar after camp compared to baseline (P>0.33 for all). Baseline and position adjusted change in neutrophils were similar between SCT and CON (mean, 95%CI; -0.09, -2.06 to 1.89 vs. 0.36, -1.61 to 2.34cellsx10³/mL, resp; P=0.77). Similarly, the adjusted change in lymphocytes was not different between SCT and CON (0.53, 0.01 to 1.05 vs. 0.15, -0.37 to 0.67, resp; P=0.40), however, total lymphocyte counts increased in SCT over time (P<0.05). Creatinine responses differed between SCT and CON (-0.05, -0.12 to 0.02 vs. 0.05, -0.03 to 0.12; P=0.05) and potassium decreased a greater extent in SCT (-0.44, -0.6 to -0.3 vs. -0.2, -0.3 to -0.1; P=0.05) after camp. **CONCLUSION:** Despite major hematological differences due to SCT, very few changes occur during the exhaustive, pre-season camp at sea level. *Funded in part by the Robert and Patricia Hines Endowed Professorship in Kinesiology, LSU, and unrestricted funding provided in part by a gift to the Tiger Athletic Foundation.*

2983 Board #266 June 1 3:30 PM - 5:00 PM
Body Composition Changes in Male Collegiate Lacrosse Players from Preseason to Post Season

Caroline Varlotta¹, Hallie Zwiabel², Joanne DiFrancisco-Donoghue³. ¹New York Institute of Technology college of Osteopathic Medicine, Old Westbury, NY. ²New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY. ³New York Institute of Technology College of Osteopathic Medicine, Northport, NY. (Sponsor: Gerard P Varlotta, FACSM)

(No relevant relationships reported)

Body composition changes differ in all sports due to specific training. In the off season most 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 increased expenditure with more frequent practices and no adaptation to diet, which can lead to a decrease in lean body mass (LBM) along with rapid body fat percent loss in the competitive season. These changes can increase chances of injury, decrease performance, and slow recovery.

Purpose: To examine body composition changes in male collegiate lacrosse players from preseason to post season
Methods: We examined 18 male NCAA Division II collegiate lacrosse players (age 19.6±1.72) pre -competitive season, and post -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=0.42). Body fat % decreased by 2.5% (21.1±7.6 vs. 18.6±6.7, p=0.58). Lean body mass increased by 1.5 lbs. (133.9±16.44 vs. 135.3±15.3).

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.

2984 Board #267 June 1 3:30 PM - 5:00 PM
Stress Urinary Incontinence in Female Powerlifting: A Survey

John Petrizzo, Rori Alter-Petrizzo, John Wygand, FACSM, Robert M. Otto, FACSM. *Adelphi University, Garden City, NY.* (Sponsor: John Wygand, FACSM)

(No relevant relationships reported)

Stress urinary incontinence (SUI), usually defined as involuntary leakage from the urethra, synchronous with exertion/effort, or on sneezing or coughing with an incidence rate of 4-35% in the general population has an unknown incidence with female powerlifters. **PURPOSE:** The purpose of this anonymous online survey was to identify trends related to SUI in female powerlifters who do not otherwise have risk factors for or symptoms of SUI in their daily lives. **METHODS:** Female powerlifters between the ages of 18-35 who have successfully been competing for at least two years on a National level or higher, are nulligravida, and have no history of SUI symptoms with ADLs, as well as no history of kidney disease, bladder disease, diabetes mellitus, pelvic floor, bladder, or rectal prolapse were eligible to participate. Solicitation scripts were posted on both USA Powerlifting and the United States Powerlifting Association's Facebook pages. 51 competitive female powerlifters completed the survey (ht. 162.6 ± 7.0 cm, body mass 71.4 ± 13.7 kg, waist 77.2 ± 8.3 cm, and hip 100.3 ± 10.0 cm). **RESULTS:** 74.5% (38) of participants indicated that they have experienced SUI while training the power lifts. Only 7.8% (4) who reported suffering from SUI while lifting indicated that they spoke to their doctors about the condition. 35.3% (18) indicated that they had not tried anything to help them manage their symptoms. 68.6% (35) indicated that they experience SUI while performing the deadlift while 49% (25) reported experiencing SUI while performing the squat. No participants reported experiencing SUI while performing the bench press. Additionally, 31.4% (16) reported experiencing symptoms while performing sets of 2-3 reps while 21.6% (11) subjects reported experiencing symptoms only while performing singles. 56.9% (29) reported that their symptoms were worse while wearing a weightlifting belt. Finally, 35.3% (18) reported that their symptoms of SUI while lifting causes them distress or anxiety. **CONCLUSION:** SUI is a significant issue for female powerlifters that may cause distress and anxiety when training and competing. SUI is more prevalent during heavy lower body lifting and may be made worse when wearing a weightlifting belt. This information can be useful to coaches and lifters when trying to manage the symptoms of SUI.

2985 Board #268 June 1 3:30 PM - 5:00 PM
Differential Sweat And Urine Electrolyte Responses In Collegiate Football Players With Sickle Cell Trait

Nathan P. Lemoine, Jr.¹, Michael E. Owens¹, Haoyan Wang¹, Jack Marucci¹, Shelly Mullenix¹, Derek Calvert¹, Arnold Nelson, FACSM¹, Ralph R. Castle¹, Brian Irving¹, Guillaume Spielmann¹, Jennifer Rood², Timothy Church², Brian Harrell³, Neil Johannsen¹. ¹Louisiana State University, Baton Rouge, LA. ²Pennington Biomedical Research Center, Baton Rouge, LA. ³Baton Rouge General Sports Medicine, Baton Rouge, LA. (Sponsor: Arnold Nelson, FACSM)

(No relevant relationships reported)

Purpose: To determine the effects of sickle cell trait (SCT) on hydration status and body temperature regulation in collegiate football players during 17 days of pre-season training.

Methods: Twelve players were recruited to two groups: 6 with the SCT and 6 position-matched control players (CON). Body weight was measured and urine collected pre- and post-practice to examine urine color, specific gravity (USG), and electrolytes (Na⁺, K⁺, and Cl⁻). Sweat was collected using gauze covered by a waterproof patch on the lower back. Each player ingested a core temperature pill 4-6 hours prior to practice. Ambient and black globe temperatures and humidity were collected pre-and post-training to assess wet-bulb globe temperature (WBGT).

Results: Mean WBGT was 28.6±3.1°C (24.1-33.5°F). Average weight loss was -1.1±1.0kg (mean±SE). Weight loss, maximal core temp and heat storage (change in core temperature per hour) were similar in CON and SCT (P>0.05). However, SCT had significantly higher sweat sodium and chloride levels (Na⁺: 60.79±7.18 mmol/L; Cl⁻: 51.57±6.49 mmol/L) compared to CON (Na⁺: 47.54±7.17mmol/L; Cl⁻: 40.53±6.48 mmol/L; P<0.001 for both). CON had higher post-training USG (1.028±0.007) than SCT (1.018±0.007; P<0.001). Urine electrolytes were significantly higher for CON than SCT in all pre and post measurements (Pre Na⁺: 164.06±8.74 mmol/L vs. 100.31±9.10 mmol/L; Pre-K⁺: 52.84±4.43 mmol/L vs. 36.50±4.59 mmol/L; Pre-Cl⁻: 151.36±8.50 mmol/L vs. 87.61±8.80 mmol/L and Post-Na⁺: 118.47±8.79 mmol/L vs. 70.26±9.07 mmol/L; Post-K⁺: 62.74±4.61 mmol/L vs. 35.48±4.73 mmol/L, Post-

Cl: 99.06±5.14 mmol/L vs. 51.78±5.59 mmol/L, respectively; P<0.001 for all).
Conclusions: Sweat electrolyte levels were higher in the SCT group whereas urine electrolytes and USG were higher in CON for all measures. Future research should investigate whether the dissimilarities in sweat and urine electrolytes in SCT are meaningful and result in altered sodium or fluid balance concerns.
Funded in part by the Robert and Patricia Hines Endowed Professorship in Kinesiology, LSU, and unrestricted funding provided in part by a gift to the Tiger Athletic Foundation.

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'Lugos¹, Theresa M. Jorgensen¹, Joanna Harper², Corrie M. Whisner¹, Jared M. Dickinson, FACSM¹, Glenn A. Gaesser, FACSM¹, Siddhartha S. Angadi, FACSM¹. ¹Arizona State University, Phoenix, AZ. ²Providence Portland Hospital, Portland, OR.
(No relevant relationships reported)

PURPOSE: To assess the cardiovascular 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: anthropometry, 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:

	Baseline	2 weeks	6 weeks
BMI	18.5	19.8	19.6
Total body fat	18.80%	21.80%	22.50%
Visceral body fat	143 g	274 g	230 g
Absolute VO ₂	3.3	3.3	2.9
Relative VO ₂	58.7	55.8	50.3
SBP	118	111	109
DBP	73	71	65
cSBP	106	99	96
cDBP	74	71	65
cf-PWV	6.7	6.2	6.2
AiX@75	4.75	-13	-6

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

	Baseline	2 Weeks	6 weeks
EF (%)	58.74	60.66	62.29
SV (ml)	87.36	90.34	89.96
LVESV (ml)	61.14	58.58	54.45
LVEDV (ml)	148.73	148.92	147.92
LVSD (cm)	3.36	3.37	3.35
LVDD (cm)	5.3	5.31	5.33

EF: Ejection fraction; SV: Stroke volume; LVESV: Left Ventricular End Systolic Volume; LVEDV: Left Ventricular End Diastolic Volume; LVSD: Left Ventricular systolic diameter; LVDD: Left Ventricular diastolic diameter. **CONCLUSIONS:** Body composition and cardiorespiratory physiology are altered during the immediate weeks of male-to-female estrogen therapy

2987 Board #270 June 1 3:30 PM - 5:00 PM
Low Energy Availability Associated With Lower BMD And Bone Stress Injury Site In Female Athletes

Bryan Holtzman¹, Allyson L. Parziale¹, Katherine M. Cooper¹, Erin Flynn¹, Adam S. Tenforde², Kathryn E. Ackerman, FACSM¹. ¹Boston Children's Hospital, Boston, MA. ²Spaulding National Running Center, Cambridge, MA. (Sponsor: Kathryn E. Ackerman, FACSM)
(No relevant relationships reported)

Low energy availability (LEA) is a risk factor for impaired bone health and bone stress injury (BSI). Additionally, those with BSI at trabecular-rich bone sites are at higher risk for low BMD vs. those with BSI at only cortical-rich sites.

PURPOSE: To evaluate the association of LEA with BMD and site of BSI in female athletes.

METHODS: 1000 female athletes (ages 15-30 years) presenting to a sports medicine clinic completed a 400+ question survey covering topics related to relative energy deficiency in sport (RED-S), including female athlete triad risk factors and athletic activity. Comprehensive chart review was completed to identify athletes with history of BSI and available dual energy x-ray absorptiometry (DXA). LEA was defined as meeting ≥ 1 criterion: self-reported history of eating disorder/disordered eating (ED/DE), high score on the Brief Eating Disorder in Athletes Questionnaire (BEDA-Q), and/or high score on the Eating Disorder Screen for Primary Care (ESP). Athletes with BSI of the pelvis, femoral neck, sacrum, and/or calcaneus were categorized into the trabecular-rich BSI group; all others were categorized into the cortical-rich BSI group. Associations between EA status, BSI location, and DXA were assessed by chi-squared or t-test analysis (p<0.05).

RESULTS: Of the 1000 patients surveyed, 126 had a history of both BSI and available DXA. Of these patients, 53.2% had LEA. Patients with LEA had lower BMD Z-scores than those with normal EA at the lumbar spine (-0.92±1.06 vs. -0.49±0.98, p=0.022), total hip (-0.27±0.75 vs. 0.29±0.77, p=0.009), and femoral neck (-0.34±0.87 vs. 0.23±0.97, p=0.028). Patients with ≥ 1 trabecular BSI accounted for 21.4% of the sample. In the trabecular-rich BSI group, 70.4% had LEA, while 48.5% of those in the cortical-rich group had LEA (p=0.043). Additionally, those with trabecular-rich BSI had lower BMD than the cortical-rich BSI group at the lumbar spine (-1.19±1.10 vs. -0.58±0.99, p=0.015), but not at other sites assessed by DXA.

CONCLUSIONS: Our findings support the well-established relationship between LEA and impaired BMD. We also found that trabecular-rich BSI is associated with low EA and independently associated with low BMD. Therefore, trabecular BSI may serve as a clinical indicator for further bone health evaluation and assessment for LEA, including ED/DE.

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, FACSM)
(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 different outdoor playing surfaces at various heights.

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. The amount of reflected UVA radiation did not change across heights comparable to typical human stature, but varied between surfaces. Light-colored and/or smooth playing surfaces including concrete, infield dirt, and clay and green courts reflected the most UVA radiation. The lightest-colored and smoothest surface, the spectator stands, reflected by far the most UV radiation, with 22 times the rate of UVA reflection of the least reflective surface, brown turf.

Conclusion: Reflected 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.

2989 Board #272 June 1 3:30 PM - 5:00 PM
Differences In Return To Play Guidelines Using Red-s Cat And Triad Risk Assessment Guidelines For Female Athletes

Allyson L. Parziale¹, Bryan Holtzman¹, Katherine M. Cooper¹, Erin Flynn¹, Adam S. Tenforde², Kathryn E. Ackerman, FACSM¹. ¹Boston Children's Hospital, Waltham, MA. ²Spaulding National Running Center, Cambridge, MA. (Sponsor: Dr. Kathryn E. Ackerman, FACSM)
 (No relevant relationships reported)

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 within 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). The most discordance occurred 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.

2990 Board #273 June 1 3:30 PM - 5:00 PM
Game Day Glucose Values For A High School Soccer Player With Type 1 Diabetes: A Case Study

Timothy McKay, Jason R. Jagers, Kupper Wintergerst, University of Louisville, Louisville, KY. (Sponsor: Ann Swank, FACSM)
 (No relevant relationships reported)

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 be challenging, especially on the day of competition. Because of the hormonal response to stress of a game, blood glucose will be altered even if exerting a similar amount of energy. **PURPOSE:** The purpose of this case study was to examine average daily glucose for a period of 72- hours starting on and following a non-gameday (NGD) compared with a game day (GD) for a high school soccer player with type 1 diabetes. **METHODS:** Data from a 15 year old male athlete with T1DM was used for this case study. The athlete wore an accelerometer on his upper left arm during the same time period in which his continuous glucose monitor (CGM) and insulin pump was being observed. Average daily blood glucose from the athlete's CGM was obtained over a 72-hour period on NGD and GD following consent. **RESULTS:** Paired samples t-tests showed no difference in daily energy expenditure at either time points. Average insulin on GD was slightly higher compared to NGD (36.2 ± 1.48 vs. 28.26 ± 9.85) but did not reach significance. Average daily glucose over the NGD was significantly lower (p < 0.01) compared to GD (128.27 ± 32.72 mg/dL vs. 167.74 ± 58.32 mg/dL). This was confirmed by comparing 3 additional GD with 3 NGD (167 ± 9.62 mg/dL vs. 130 ± 5.71 mg/dL). On the day of competition, the CGM recorded a high of 308mg/dL and a low of 49mg/dL within 24 hours following the game, compared to a high of 227mg/dL and a low of 72mg/dL for the NGD. **CONCLUSION:** CGM averages displayed competition and post recovery glucose values that were significantly higher compared to those of NGD. The results suggest that hormonal stimuli from competition and the recovery associated with participation in competitive sports can influence glucose fluctuations in athletes with T1DM. This was confirmed by additional analysis that included values from 3 other GD CGM readings.

2991 Board #274 June 1 3:30 PM - 5:00 PM
Impact Of Seasonal Change In Body Composition On Hemoglobin Levels Among Long Distance Runners.

Masaya Tokita¹, Norimitsu Kinoshita¹, Kenta Okuyama². ¹Hosei University, Tokyo, Japan. ²Shimane University, Shimane, Japan.
 (No relevant relationships reported)

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 within +/- 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 between pre- and peak-seasons for each group. Changes of Hb and ferritin were analyzed by 2-way repeated measures ANOVA between CNT and DCR. P<0.05 was considered statistically significant. Written informed consent was obtained from each runner.

RESULTS: Only fat mass (FM) and %fat were significantly different between CNT and DCR in pre-season (3.4 vs. 4.4 kg and 6.3 vs. 8.1 %, respectively); other variables (age, lean soft tissue mass [LM], Hb, and ferritin) were not (20.3 vs. 19.9 y/o, 51.2 vs. 50.1 kg, 14.9 vs. 15.3 g/dl, and 43.3 vs. 60.7 ng/ml, respectively). Total running mileage (March - July) was not significantly different between CNT and DCR (3193 vs. 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 in peak-season); but not 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 to 14.3 g/dl, DCR: 15.3 to 14.4 g/dl) and ferritin (CNT: 43.3 to 32.9 ng/ml, DCR: 60.7 to 48.5 ng/ml). 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- to peak-seasons with or without decrease in %fat among lean runners. It is recommended to conduct blood test periodically for recognition of developing anemia which would impair performance.

2992 Board #275 June 1 3:30 PM - 5:00 PM
Hormonal Responses after Exercise-induced Muscle Damage in Healthy Humans

Anastassios Philippou¹, Roxane Tenta², Maria Maridaki, 17237¹, Michael Koutsilieris¹. ¹National and Kapodistrian University of Athens, Athens, Greece. ²School of Health Science and Education, Harokopio University, Athens, Greece.
 (No relevant relationships reported)

Mechanically overloaded muscle and its subsequent damage are strong stimuli for eliciting acute hormonal changes, and muscle adaptation following exercise-induced muscle damage may involve complex hormonal responses before 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 (1.20±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, 1.17±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

hormones and muscle regeneration. Further studies are needed to characterize the mechanisms by which those hormonal responses are triggered and regulated at the systemic level during recovery after exercise-induced muscle damage.

F-66 Free Communication/Poster - Clinical Exercise Physiology of Cancer and Exercise

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

2993 Board #276 June 1 3:30 PM - 5:00 PM Physical Functioning in Older Breast Cancer Survivors: A 12-Month Randomized-Controlled Trial with 6-month Follow Up.

Mary E. Medysky¹, Sydnee Stoyles¹, Nathan F. Dieckmann¹, Kerri M. Winters-Stone, FACSM². ¹Oregon Health and Science University, Portland, OR. ²Knight Cancer Institute, Portland, OR. (Sponsor: Kerri Winters-Stone, FACSM)
(No relevant relationships reported)

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 radio-therapy 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 (amean=2.72 \pm 1.7) and CON (amean=-3.06 \pm 2.0) for self-report physical function at both 12 (p=0.04) and 18 months (p=0.005), 2) AER (amean=0.4 \pm 0.0) and CON (amean=-0.03 \pm 0.0) at 12-months for average walk speed and, 3) AER (amean=0.32 \pm 0.3) and RES (amean=0.50 \pm 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.

2994 Board #277 June 1 3:30 PM - 5:00 PM The Relationship Between Six Minute Walk Distance And Dyspnea Symptoms Among Preoperative Lung Cancer Patients

sung-a kong¹, Jaekyung Lee¹, Jinhee Lee², Hyeyun Park², Juhee Cho¹. ¹Sungkyunkwan University, seoul, Korea, Republic of. ²Samsung Medical Center, seoul, Korea, Republic of.
(No relevant relationships reported)

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, 61.51yr) 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 perform before surgery. Cardiorespiratory fitness (CRF) was assessed six minute walk distance using the 6-minute walk test (6MWT). The symptoms was assessed using the mMRC 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).

Results: Lung cancer patients with low 6MWD (<450m) were more likely to have dyspnea than those with high 6MWD(>450m). mMRC and CAT score were -0.256 (95% CI -0.387, -0.125), -2.427(95% CI -3.751, -1.104). Quality of life were general health score 10.456 (95% CI -5.030, 15.882), fatigue score -8.891 (95% CI -14.618, -3.165). **Conclusions:** Preoperative 6MWD was significantly associated with preoperative symptoms and QoL in patients who underwent lung resection for malignancies **Key words:** Lung cancer, Cardiorespiratory fitness, symptoms Supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No. 2015R11 1A 2A 01055805).

Different of dyspnea and QoL by 6MWD before surgery			
	mMRC score	CAT score	General Health_QoL
6MWD <450m	0.53 (0.52-0.54)	8.10 (7.88-8.30)	58.53 (58.02-59.04)
6MWD >450m	0.24 (0.24-0.25)	5.43 (5.32-5.55)	67.41 (67.14-67.70)

2995 Board #278 June 1 3:30 PM - 5:00 PM Cognition Improves In Cancer Survivors After A Multi-dimensional Cancer Rehabilitation Program

Hillary Conner¹, Tim Burnham¹, Ralf Greenwald¹, Robert Pritchett¹, Katie Kemble². ¹Central Washington University, Ellensburg, WA. ²University of Washington, Seattle, WA.
(No relevant relationships reported)

Cancer Related Cognitive Impairment (CRCI), or “chemo-brain,” has become a recognized problem for cancer survivors; however, limited evidence exists about concerning interventions that may improve cognition for cancer this population. Symptoms include: short-term memory loss, decreased concentration, mental “fogginess” and fatigue. These symptoms may contribute to a decrease in quality of life. **PURPOSE:** To measure the effectiveness of a multi-dimensional cancer survivor rehabilitation program on cognition as well as physical and psychosocial functioning. **METHODS:** Sixty-two post-treatment cancer survivors, (7 men, 55 women, 35-77 years) were subjects in a one group, pre-post, quasi-experimental design. Subjects were cleared for exercise prior to participation. The program consisted of two, 90 minute sessions per week for 12 weeks. Each meeting was divided into 3 sections: an educational activity, cardiovascular endurance training, and a strength and flexibility session. A subset of this group (n= 22) participated in brain exercise games once per week for 15 minutes. Dependent measures included: the Montreal Cognitive Assessment (MoCA), the General Practitioner assessment of Cognition (GPCOG), aerobic capacity, body fat %, lower body flexibility, handgrip strength, quality of life, Schwartz fatigue scale, and the LASA scale (fatigue, anxiety, confusion, depression, energy and anger). **RESULTS:** The following measures showed statistically significant (p < .05) improvements: GPCOG increased 6.6%, aerobic capacity increased 20.7%, body fat decreased by 1.9%, lower body flexibility improved 14.3%, handgrip strength increased 11.6%. Quality of life increased 10.4%. Fatigue measured by the Schwartz scale decreased 18.5%. LASA scale results: fatigue decreased 36.7%, depression decreased 49.2%, confusion decreased 42.7%, energy increased 23.8%, anger decreased 40.8%, anxiety decreased 30.7%. MoCA increased 4.3% and approached significance (p= .056). **CONCLUSION:** The combination of tools acquired in the cancer rehabilitation program proved effective in improving cognition and reducing symptoms often seen in post-treatment cancer survivors. The mechanism for cognitive improvement cannot be ascertained from the design of this study but may hold promise for future studies.

2996 Board #279 June 1 3:30 PM - 5:00 PM Skeletal Muscle Blood Flow, Oxygen Extraction and Consumption in Women Receiving Chemotherapy for Breast Cancer

Amy A. Kirkham, David Ian Paterson, Edith Pituskin, Justin Grenier, Esther Yang, Richard B. Thompson. University of Alberta, Edmonton, AB, Canada.
(No relevant relationships reported)

PURPOSE: Cardiac muscle injury is a well-recognized side effect of anthracycline chemotherapy and trastuzumab therapy for breast cancer. Preclinical studies have identified parallels in cell damage response and dysfunction between cardiac and skeletal muscle. However, assessment of the effect of treatment on skeletal muscle in patients has been limited to muscle strength.

METHODS: Early stage breast cancer patients receiving chemotherapy including anthracyclines or trastuzumab enrolled into a RCT of a multi-disciplinary team intervention versus usual care. Patients underwent a MRI scan before the first and after the third chemotherapy treatment. A maximal incremental single leg plantar flexion test was performed followed by 15 min of rest. A 4-min steady state test was

then performed at 60% of peak power. Beginning at end-exercise, time-resolved blood flow (popliteal vein, phase contrast MRI) and venous oxygen saturation ($S_{v}O_2$, susceptometry-based oximetry using deoxyhemoglobin as an intrinsic contrast agent) were measured with custom methods. These values were used to calculate lower leg VO_2 using the Fick equation with [hemoglobin] (hb) extracted from clinical records and $S_{a}O_2$ measured via pulse oximetry.

RESULTS: Twelve patients have completed both scans. Preliminary analyses were of change over time 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 ($hb \times 1.34 \times S_{a}O_2$) was significantly decreased (median change = -17% , $p=0.004$) due to reduced hemoglobin (13.5 ± 13 to 11.2 ± 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. $S_{a}O_2$ and $S_{v}O_2$ did not change appreciably ($\sim 98\%$ and 60% , respectively). As a result there was a small but non-significant increase in leg VO_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.

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)

(No relevant relationships reported)

PURPOSE: As obesity is recognized as a risk factor for breast cancer recurrence, the assessment of body composition is vital in breast cancer survivors (BCS) to guide appropriate weight management interventions. Dual-energy X-ray absorptiometry (DXA) is a highly valid and accurate method for assessing body composition, however, the use of DXA is limited due to availability and high cost. Bio-electrical impedance analysis (BIA) is an alternative method to estimate body composition due to safety, low cost, and ease of use. The purpose of this study was to verify whether DXA and BIA yield similar results for body composition including: body fat percentage (BFP), lean body mass (LBM) and fat mass (FM) in BCS. We 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. BFP, LBM and FM were estimated using BIA (InBody 520) and followed immediately by DXA (GE Lunar Prodigy). 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/m²), overweight (25.0 - 29.9 kg/m²), obese (30.0 - 34.99 kg/m²), and severely obese (>35.0 kg/m²). Agreement between the devices was assessed by Bland-Altman analysis.

RESULTS: Our study population included a total of 89 BCS (52.7 ± 10.4 yr), primarily Hispanic (63.6%), with BMI of 29.2 ± 5.6 kg/m². There was no agreement between the two devices in assessments of BFP (DXA: 44.2 ± 6.2 vs BIA: $40.4 \pm 7.8\%$), LBM (DXA: 39.1 ± 7.6 vs BIA: 42.9 ± 5.9 kg) and FM (DXA: 32.4 ± 10.8 vs BIA: 30.6 ± 11.0 kg). 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 on FM (DXA: 48.7 ± 7.2 vs BIA: 47.9 ± 5.7 kg) in severely obese BCS ($n=17$; $P=0.102$).

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.*

(No relevant relationships reported)

PURPOSE: Breast cancer treatments may lead to elevated fasting insulin levels and gains in fat mass causing insulin resistance in skeletal muscle and subsequent reductions in muscle strength (MST). Exercise is a non-pharmacologic strategy to improve elevated insulin and reduced MST. In particular, combined aerobic and resistance exercise (CE) reduces insulin levels and improves MST, and has been shown

to be superior to resistance or aerobic exercise alone at reducing insulin resistance in patients with type 2 diabetes. The purpose of this study was to determine whether fasting insulin levels and muscle strength (MST) can be improved following a 16-week supervised CE intervention in overweight and obese breast cancer survivors (BCS). We further sought to determine whether exercise-induced changes in fasting insulin are associated with changes in MST.

METHODS: Sedentary, overweight/obese (BMI >25 kg/m²) BCS (Stage I-III) were randomized to the Control (CON) or the Exercise (EX) groups. EX underwent supervised CE sessions 3 times per week for 16 weeks. CON was asked to maintain their current level of activity. Fasting serum insulin was measured using enzyme-linked immunoabsorbent assays. MST was assessed from 10-RM (repetition maximum) tests of the leg extension (LE) and chest press (CP) to estimate 1-RM values. Repeated measures ANOVA was used to examine the effects of exercise on MST and insulin. Pearson's correlations were performed to examine the association between MST changes for each exercise and insulin.

RESULTS: At baseline, EX ($n=48$) and CON ($n=46$) did not differ by age (53.0 ± 10.4 yr), insulin (35.2 ± 15.4 pmol/L), or BMI (33.5 ± 5.5 kg/m²). Post-intervention, insulin was significantly reduced ($-13.5 \pm 3.1\%$) and all MST measures ($35.9 \pm 6.7\%$) significantly increased in EX compared to CON ($P<0.01$). Significant correlations were found between reduced insulin and improved MST for LE ($r=-0.67$, $p=0.001$) and CP ($r=-0.81$, $p=0.01$) in EX.

CONCLUSION: A 16-week supervised CE intervention is an effective approach to reduce insulin, and increase MST, and reductions in insulin are associated with improved muscle strength in BCS. Collectively, this supports the utilization of aerobic and resistance exercise as vital components of cancer rehabilitation following completion of cancer treatment.

F-67 Basic Science World Congress/Poster -
Skeletal Muscle II

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

2999 Board #282 June 1 3:30 PM - 5:00 PM
Sex Differences In Objectively Measured Physical Activity Among Individuals With ACL Reconstruction

Christopher Kuenze¹, Lisa Cadmus-Bertram², Karin Pfeiffer, FACSM¹, Caroline Lisee, FACSM¹, Stephanie Trigsted³, Dane Cook², David Bell². ¹Michigan State University, East Lansing, MI. ²University of Wisconsin - Madison, Madison, WI. ³High Point University, High Point, NC. (Sponsor: Karin Pfeiffer, FACSM)

(No relevant relationships reported)

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 MVPA in which an individual engages as well as the likelihood that an individual will meet national guidelines for weekly MVPA. **Methods:** 31 individuals with a history of ACLR (Sex = 22F/9M, Age = 20.3 ± 1.7 years, BMI = 23.3 ± 2.8 kg/m², Time since surgery = 28.2 ± 17.1 mo) and 32 healthy individuals (Sex = 22F/10M, Age = 20.8 ± 1.6 years, BMI = 23.3 ± 30 kg/m²) enrolled in this study. Objective MVPA in Freedson 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 (M/F) differences in MVPA in Freedson 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 MVPA recommendations (MVPA > 150 min/wk) among individuals with ACLR. **Results:** Overall, individuals with ACLR (MVPA = 114 ± 95 min/week) participated in less MVPA in Freedson Bouts per week as compared to healthy individuals (MVPA = 212 ± 138 min/wk, $p = 0.002$). Females (MVPA = 184 ± 133 min/wk) were more active than males (MVPA = 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 MVPA guidelines when compared to males (36.3% , $p = 0.05$). **Conclusion:** Individuals with ACLR participate in less MVPA 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 MVPA guidelines which may have implications for long term health risks associated with ACLR.

3000 Board #283 June 1 3:30 PM - 5:00 PM
Road Bicycle Saddle Shape Preference and its Potential Determinants
 Sewan Kim¹, James E. Peterman¹, Todd M. Carver², Garrett Y.D. Getter², William C. Byrnes, FACSM¹. ¹University Colorado Boulder, Boulder, CO. ²Specialized Bicycle Components, Boulder, CO. (Sponsor: William Byrnes, FACSM)
 (No relevant relationships reported)

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 hr/wk and training for a cycling 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 widthwise and concave lengthwise). The 1st and 3rd 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 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. Supported by Specialized Bicycle Components.

3001 Board #284 June 1 3:30 PM - 5:00 PM
Associations of Intracortical Facilitation and Inhibition of the Soleus with Popliteal Venous Flow
 Masafumi Terada, Keisuke Senoo, Kaede Kaneda, Syunsuke 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, Syunya Nonoyama, Tadao Isaka. Ritsumeikan University, Shiga, 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 have 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 (8M, 2F; 20.3 ± 0.9 yrs; 165.0 ± 7.6 cm; 61.0 ± 5.4 kg) were enrolled in this current study. Paired-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 and immediately after five repetitions of maximum voluntary isometric contraction (MVIC) strength of the plantar flexors. Peak velocity and time-averaged maximum velocity (TAMAX) were assessed. Pearson Product Moment Correlations were used to examine associations of ICF and SICI in the soleus with measures of blood flow velocity in the popliteal vein. Significance was set a priori at $p < 0.05$. **RESULTS:** TAMAX immediately after MVIC was moderately correlated with ICF ($r = 0.63$, $p = 0.03$) and SICI ($r = 0.59$, $p = 0.04$). **CONCLUSION:** These findings indicate the potential for associations of intracortical facilitation and inhibition of the soleus with blood flow velocities in the popliteal vein. Further study with a large sample size is needed to examine these associations in specific pathological condition in order to determine the effects of clinical dysfunctions on venous return.

3002 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 Panaligan, 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)) participants 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 3min 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) beats per minute (bpm). HR strap recorded 78(11)bpm for resting HR. Bland-Altman analysis showed high agreement between SW and HR strap (mean difference= -.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(54) bpm, respectively. HR strap measurement were 76(12), 102(25), and 110 (14) bpm. Poor agreement was seen for the treadmill task at 30spm (-49(-171-73)), 45spm (-25(-116-66)), and 60sprpm (-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 91(15)bpm. Mean differences (LoA) were 5(-74-83), -2(-79-76), and 9(-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(4)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, with -58(-207-92) 38.5% and -128(-283-28) 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.

3003 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 fayazmilani, Aynaz Pourmohammadi. *Shahid Beheshti University, Tehran, Iran, Islamic Republic of.*
 (No relevant relationships reported)

Maturation-Related Change in Neuromuscular Component of Force Production in Trained and Untrained Girls
 Rana Fayazmilani¹, Aynaz Pourmohammadi²
¹Faculty member of Shahid Beheshti University, Exercise Physiology, r_milani@sbu.ac.ir
² Master Student of Exercise Physiology, Shahid Beheshti University, ai.pourmohammadi@mail.sbu.ac.ir
Abstract
Purpose: the main 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 the 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 familiarity 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)

3004 Board #287 June 1 3:30 PM - 5:00 PM
**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.