

**B-07 Thematic Poster - Cardiac Physiology**

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
Room: 304

573 **Chair:** Serge P. von Duvillard, FACSM. *University of Salzburg, St. Cloud, MN.*

(No relationships reported)

574 **Board #1** May 31 1:00 PM - 3:00 PM

**Associations Of Heart Rate Variability Measured During Orthostatic Test And During Daily Routine Activities**

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(No relationships reported)

Measuring resting heart rate variability (HRV) indices constitutes an interesting, non-invasive and simple tool to monitor fatigue and performance responses. The orthostatic test (OT) where heart beat-to-beat (RR) intervals are measured is widely used to measure HRV. The feasibility in daily use would, however, increase considerably if vagal related HRV indices could be analysed from free living physical activity. **PURPOSE:** To determine the reliability and validity of HRV indices during daily routine situations. **METHODS:** Eight white-collar workers were recruited to participate in this study. RR intervals were recorded using a personal HR monitor (V800, Polar Electro Oy, Kempele, Finland). Data was collected every morning at home upon awakening and at work during routine situations on 16 different days. A total amount of 127 cycles of sitting periods followed by walking breaks were included for consecutive pairwise analysis of trials for reliability[SD1] (coefficient of variation (CV) and typical error (TE) with confidence limits of 95% were calculated). When reliability was found, the values from the morning OT were plotted against the corresponding routines at work. **RESULTS:** Mean RR-interval and HR values at work showed high levels of repeatability [CV during sitting and walking was 4.71 and 3.99, respectively, with a TE of 3.73 (3.34-4.25) and 3.65 (3.31-4.09)]. Although reliable, HR data recorded in the morning did not correlate with the corresponding routines at work ( $r = 0.28$  for supine vs. sitting and  $r = 0.05$  for standing vs. walking,  $p > 0.05$ ). The root-mean-square difference of successive normal RR (RMSSD) was revealed not to be repeatable in those routine situations [CV during sitting and walking was 19.99 and 29.05, respectively, with a TE of 7.9 (7.15-8.85) and 9.43 (8.53-10.57)]. Furthermore, RMSSD values analyzed from the HRV recordings during standing did not correlate ( $r = 0.138$ ,  $p > 0.05$ ) with the respective values during walking in the morning upon awakening. **CONCLUSION:** Analyzing RMSSD from daily routine activities was not reliable or valid. To monitor training status, RMSSD should therefore be calculated from recordings in standardized conditions such as the OT in the morning. It would be much more feasible to get this information from free living activities but it does not seem to be a valid procedure.

575 **Board #2** May 31 1:00 PM - 3:00 PM

**The Relationship Between Lifelong Exercise Volume and Coronary Atherosclerosis**

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(No relationships reported)

Higher levels of physical activity are associated with a lower risk of cardiovascular events. Nevertheless, there is debate on the dose-response curve of exercise and cardiovascular outcomes and whether high volumes of exercise may accelerate coronary atherosclerosis. **PURPOSE:** To determine the relationship between lifelong exercise volumes and atherosclerotic coronary artery disease (CAD) characteristics. **METHODS:** Middle aged men engaged in competitive or recreational leisure sports underwent a non-contrast and contrast-enhanced computed tomography scan to assess coronary artery calcification (CAC) and plaque characteristics. Participants reported lifelong exercise history patterns. Exercise volumes were multiplied by Metabolic Equivalent of Task (MET) scores to calculate MET-min/week. Participants were allocated to <1000 MET-min/week, 1000-2000 MET-min/week or >2000 MET-min/week. **RESULTS:** 284 participants (55±7 years) were included. CAC was present in 150/284 (53%) participants with a median CAC score of 35.8 [9.3-145.8]. Athletes

with a lifelong exercise volume >2000 MET-min/week (n=75) had a significantly higher CAC score (9.4 [0-60.9] versus 0 [0-43.5],  $p=.02$ ) and prevalence of CAC (68%, OR=3.2 (95%CI: 1.6-6.6)) and plaque (77%, OR=3.3 (95%CI: 1.6-7.1)) compared to <1000 MET-min/week (n=88, 43% and 56% respectively). Among participants with CAC>0, there was no difference in CAC score ( $p=.20$ ), area ( $p=.21$ ), density ( $p=.25$ ) and regions of interest ( $p=.20$ ) across exercise volume groups. Among participants with plaque, the most active group had a lower prevalence of mixed plaques (48% versus 69%, OR=0.35 (95%CI: 0.15-0.85) and more often had only calcified plaques (38% versus 16%, OR=3.57 (95%CI: 1.28-9.97)) compared to the least active group. There was no difference in location of CAC or plaque. **CONCLUSION:** Participants in the >2000 MET-min/week group had a higher prevalence of CAC and atherosclerotic plaques. The most active group did however have a more benign composition of plaques, with fewer mixed plaques and more often only calcified plaques. These observations may explain the increased longevity typical of endurance athletes despite the presence of more coronary atherosclerotic plaque in the most active participants.

576 **Board #3** May 31 1:00 PM - 3:00 PM

**High Intensity Interval Training in a Rat Model of Severe, Angioproliferative Pulmonary Arterial Hypertension**

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(No relationships reported)

**PURPOSE:** We previously demonstrated superior benefit of high intensity interval training (HIIT) over continuous exercise training (CET) in a monocrotaline rat model of mild pulmonary arterial hypertension (PAH). Here we investigate HIIT in a model that elicits a more severe, angioproliferative PAH. **METHODS:** SD rats (~200g, male) received Sugen5416 (20mg/kg), followed by 3 wks of hypoxia ( $P_{am}=362$  mmHg) and 4 wks of room air to induce PAH (SuHx, n=33). Subgroups of SuHx then underwent 6 wks of treadmill training performed as either HIIT (2 min at ~80-90% $VO_{2R}$  reserve [ $VO_{2R}$ ] + 3 min at 30% $VO_{2R}$ , for 4-5 cycles, n=12), or low intensity CET (45-60 min at 50% $VO_{2R}$ , n=11), with the remainder untrained (SED, n=10). Values are mean±SE. **RESULTS:** Mortality in SuHx was unexpectedly worse for HIIT (4 deaths at 56, 60, 68, and 71 days), vs. CET (2 deaths at 60, and 73 days), and SED (2 deaths at 66 days). While all animals had similar baseline echocardiographic measures of cardiac output (CO, in uL) and stroke volume (SV, in mL/min), SuHx that died prematurely (n=8) had greater impairment in CO (141±19) and SV (424±52) following PAH induction (at pre-training) compared to surviving SuHx (n=25, 235±26, 598±38). Final CO and SV were higher for both HIIT (239±49, 540±58) and CET (207±41, 529±51) vs. SED (122±12, 405±35) SuHx rats, and were similar to untrained healthy controls (CON, n=6, 268±59, 548±71). SuHx-induced elevation in right ventricular (RV) systolic pressure (mmHg) and RV hypertrophy (as RV mass/LV+septum mass, and as RV thickness on echo in mm) were not improved by training with HIIT (61±7; 0.60±0.07, 2.2±0.2) or CET (60±8; 0.47±0.04, 2.0±0.2), vs. SED (55±8; 0.52±0.06, 2.2±0.2), and were higher than CON (28±3; 0.24±0.01, 1.3±0.1). Final  $VO_{2max}$  (mL/kg/min) in SuHx was also not improved for either HIIT (44±1.9) or CET (46±1.7) vs. SED (46±3.8). **CONCLUSION:** Both HIIT and CET promoted better RV function in SuHx rats despite no amelioration of RV hypertrophy, PAH, or exercise impairment. However, in contrast to previous findings in a mild PAH rat model, exercise training, particularly with HIIT, increased mortality for animals with poorer cardiac function prior to training onset and suggests that further investigation is needed to optimize training approach for patients with more severe RV dysfunction. **Funding:** NIH-NHLBI R-15 (to MB Brown)

577 **Board #4** May 31 1:00 PM - 3:00 PM

**The Impact of Menopausal Status on Cardiac Responses to Exercise Training and Acute Moderate-Intensity Exercise**

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(No relationships reported)

The menopause is generally associated with lower cardiovascular function. However, most investigations have only assessed resting function, and the impact of the menopause on functional capacity and cardiac plasticity is poorly understood. **PURPOSE:** To investigate the impact of menopausal status on left ventricular (LV) function and rotational mechanics in response to exercise training and acute exercise.

**METHODS:** Eleven pre-menopausal (Pre-M) and 14 post-menopausal (Post-M) middle-aged women (age 45–58 years) completed 12 weeks of exercise training (3 sessions/week consisting of 4 × 4 min intervals at 90–95% maximum heart rate). Maximal aerobic capacity on an upright cycle ergometer was assessed before and after exercise training. LV function was assessed via echocardiography at 20, 40 and 60% peak power output during supine cycling. Due to poor image quality, data on LV rotational mechanics are only reported for 8 pre- and 10 post-menopausal women. **RESULTS:** Peak power output and maximal aerobic capacity increased after exercise training ( $P<0.01$ ), but this increase was greater in pre-menopausal than post-menopausal women (mean±SD; Pre-M-before 147±29 vs. after 179±28, Post-M-before 145±26 vs. after 169±24 W; Pre-M-before 29±5 vs. after 37±5, Post-M-before 29±6 vs. after 34±5 mL/min/kg, respectively, both  $P<0.05$ ). General hemodynamics, and LV function and rotational mechanics both at rest and up to 60% exercise were mostly similar in pre- and post-menopausal women in response to training (interaction effects  $P>0.1$ ). Specifically, the increase in peak basal rotation during exercise was smaller in post-menopausal women after training (three-way interaction  $P<0.01$ ; mean increase from rest to 60%: Pre-M-before 4.0; Pre-M-after 3.9; Post-M-before 3.7; Post-M-after 2.6°).

**CONCLUSION:** Middle-aged pre-menopausal women showed greater adaptability to 12 weeks of interval training than middle-aged post-menopausal women. The functional cardiac reserve up to 60% exercise was largely similar in pre- and post-menopausal women. Future work investigating LV function and mechanics at higher exercise intensities will likely provide further insight into the impact of menopausal status on training adaptations.

Amanda Nio is the beneficiary of a doctoral grant from the AXA Research Fund.

578 Board #5 May 31 1:00 PM - 3:00 PM

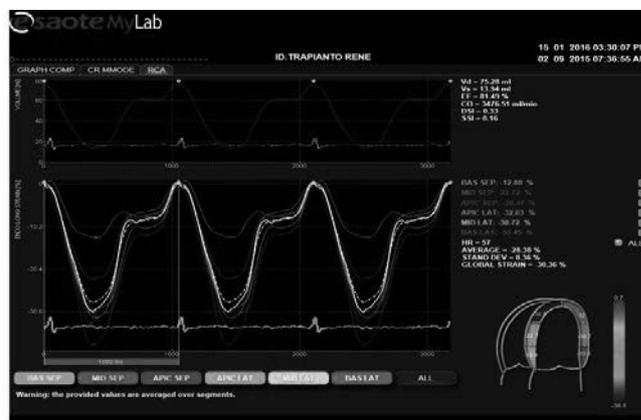
### Assessment Of Myocardial Mechanics In Renal Transplant Recipients Using Speckle Tracking Echocardiography

Gianni Pedrizzetti<sup>1</sup>, Laura Stefani<sup>2</sup>, Stefano Pedri<sup>3</sup>, Enrico Minetti<sup>4</sup>, Benedetta Tosi<sup>2</sup>, Giorgio Galanti<sup>2</sup>. <sup>1</sup>University of Trieste -Italy, Trieste, Italy. <sup>2</sup>Sports and Exercise Medicine, Florence, Italy. <sup>3</sup>Esaote Spa -Italy -Medical Affairs Manager, Florence, Italy. <sup>4</sup>University Hospital Careggi, Florence, Italy, Florence, Italy.

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**PURPOSE:** Renal transplant recipients (RTR) have a high risk of cardiovascular mortality, despite surgical treatment and physical exercise is normally allowed to reduce the global morbidity risk. Quantitation of myocardial function by Global Longitudinal Strain (GLS) from 2-dimensional images based on speckle tracking echocardiography plays an important role in detecting the early myocardial dysfunction in many diseases. The aim of this study was to analyze the changes in myocardial strain during 12 months of exercise as prescription model. **MATERIALS AND METHODS:** We studied 17 renal transplant recipients, mean age 56 ± 8 y, submitted to the exercise prescription model followed ACSM guidelines. Longitudinal peak systolic strain were determined by velocity vector imaging from apical 4- and 2-chamber views (MyLab seven -Esaote). All the other standard 2D echo parameters (LVDD, LVSD, CMI, IVS, PW; EF) and the diastolic parameters were evaluated. **RESULTS:** Mean heart rate and systolic and diastolic blood pressure and the LV systolic and diastolic parameters maintain normals during the follow up. After training, GLS and Longitudinal peak systolic strain at basal and mid-segments of the lateral wall were significantly higher after 6 months (GLS<sup>10</sup> -20.7±4% vs GLS<sup>16</sup> -23.7 ±4.1% with  $p<0.05$ ) and after 12 months of exercise (GLS: -24.4±3%) in RTR with respect of the values of the onset of the protocol ( $p<0.01$ ). Average longitudinal systolic strain from the 4-chamber view and GLS was normal in controls (-22.3±2.6%<sup>10</sup>; -21.8±3.6%<sup>16</sup>; -23.4±4.2%<sup>112</sup>) and not significantly different if compared to RTR during all the time of the protocol. **CONCLUSIONS:** Differences in myocardial function in patients renal transplant recipients submitted to the exercise prescription can be found and it can be quantified by strain imaging. Any possible other differences comparing subjects with end-stage renal or before the transplantation and RTR will need further studies.



579 Board #6 May 31 1:00 PM - 3:00 PM

### Non-targeted Metabolomics Identifies Exercise-induced Cardioprotective Metabolic Pathways That Negate Ischemia Reperfusion Injury.

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(No relationships reported)

The effects of exercise on the heart and its resistance to disease are well-documented. Recent studies have identified exercise-induced resistance to arrhythmia is due to the preservation of mitochondrial membrane potential. **PURPOSE:** To identify novel metabolic changes that occurred parallel to these mitochondrial alterations, we performed non-targeted metabolomics analysis on hearts from sedentary (Sed) and exercise-trained (Ex) rats challenged with isolated heart ischemia-reperfusion injury (I/R). **METHODS:** Eight week old Sprague-Dawley rats were treadmill trained five days/week for six weeks (exercise duration and intensity progressively increased to 1 hour at 30 m/min up to 10.5% incline, 75-80% VO<sub>2</sub>mx). **RESULTS:** The recovery of pre-ischemic function for sedentary rat hearts was 28.8±/5.4% (N=12) compared to exercise trained hearts which recovered 51.9%±/5.7 (N=14,  $p<0.001$ ). Non-targeted GC-MS metabolomics analysis of 1) Sedentary rat hearts; 2) Exercise-trained rat hearts; 3) Sedentary rat hearts challenged with global ischemia-reperfusion (I/R) injury; and 4) Exercise-trained rat hearts challenged with global I/R (10/group) revealed 20 statistically significant metabolites between groups by ANOVA using Metaboanalyst ( $p<0.001$ ). Enrichment analysis of these metabolites for pathway-associated metabolic sets indicated a >10 fold enrichment for ammonia recycling and protein biosynthesis (L-Glutamic acid; L-Proline; L-Histidine; L-Serine; L-Aspartic acid; L-Glutamine) ( $p<4.05E-05$ , FDR=0.0024). Subsequent comparison of the sedentary hearts post-I/R and exercise-trained hearts post-I/R further identified significant differences in metabolites related to Aminoacyl-tRNA biosynthesis and nitrogen metabolism (4) ( $p<1.24E-05$ , FDR<=5.07E-4). **CONCLUSION:** These studies shed light on novel mechanisms in which exercise-induced cardioprotection occurs in I/R which complement both the mitochondrial stabilization and antioxidant mechanisms recently described. These findings also link protein synthesis and protein degradation (protein quality control mechanisms) with exercise-induced cardioprotection and mitochondrial susceptibility for the first time in cardiac I/R.

**B-08 Thematic Poster - Exercise, Obesity, and Diabetes**

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
Room: 404

580 **Chair:** Ann M. Swartz, FACSM. *University of Wisconsin-Milwaukee, Milwaukee, WI.*  
(No relationships reported)

581 **Board #1** May 31 1:00 PM - 3:00 PM  
**Maximal Fat Oxidation: Optimal Exercise Intensity for Weight Management and Its Dissociation from Anaerobic Threshold**

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(No relationships reported)

Maximal fat oxidation ( $FOX_{max}$ ) is the exercise intensity at which the highest caloric expenditure is attributed to fat metabolism and appears to be influenced by aerobic capacity and obesity. Determining, directly or indirectly,  $FOX_{max}$  holds relevance with respect to optimal intensity for exercise prescription for weight loss and maintenance. **Purpose:** To determine if  $FOX_{max}$  is sex-dependent and its agreement with the anaerobic threshold (AT), another intensity at which exercise can be prescribed to improve aerobic conditioning. **Hypothesis:** We hypothesized that: 1)  $FOX_{max}$  in obese men and women is similar; 2)  $FOX_{max}$  is not concordant with AT; and 3) heart rate (HR) at  $FOX_{max}$  relative to real peak HR ( $HR_{pk}$ ) is equivalent to that relative to  $HR_{pk}$  predicted from a recognized prediction formula ( $208-0.7*age$ ). **Methods:** Forty obese adults (BMI:  $40.3 \pm 1.1$  kg·m<sup>-2</sup>), women (OW, n=20) and men (OM, n=20), aged 20 to 45 years, underwent a cardiopulmonary exercise test (CPX). Oxygen uptake ( $VO_2$ ), carbon dioxide production ( $VCO_2$ ), respiratory exchange ratio (RER) and heart rate (HR) were measured at  $FOX_{max}$ , AT and at the peak of the test ( $HR_{pk}$ ). Fat oxidation rates were calculated ( $FOX-R=1.67*VO_2-1.67*VCO_2$ ) and the highest value was set as the  $FOX_{max}$ . AT was defined according to the V-Slope method. T-test, MANCOVA and partial correlations were applied.  $\alpha$  level was set at 0.05. **Results:**  $VO_2$  at AT and  $FOX_{max}$  were identified at  $77.4 \pm 1.4$  and  $58.6 \pm 1.2\%$  of  $VO_{2pk}$  and HR at  $80.5 \pm 1.2\%$  and  $68.6 \pm 1.0\%$  of  $HR_{pk}$  respectively. Although  $VO_2$  and HR at  $FOX_{max}$  differed from AT for both groups ( $p < 0.01$ ), sex-adjusted positive correlations between them were observed ( $FOX_{max}$  vs AT for  $VO_2$  [ $r=0.78$ ] and for HR [ $r=0.61$ ],  $<0.01$ ). Sex-based comparisons showed that OW had higher  $FOX-R$ , and at the AT higher HR,  $VO_2$  percent of  $HR_{pk}$  and  $VO_{2pk}$  ( $p < 0.05$ ). However, OM had a higher percent of  $VO_{2pk}$  at  $FOX_{max}$ . Similar  $HR_{pk}$ , HR at  $FOX_{max}$  and percent of  $HR_{pk}$  were observed in both groups. HR at  $FOX_{max}$  relative to the predicted  $HR_{pk}$  from the formula  $208-0.7*age$  were  $66 \pm 1\%$  in OM and  $67 \pm 1\%$  in OW. **Conclusions:** Sex differences exist at AT and  $FOX_{max}$  for  $VO_2$ . Meanwhile, chronotropic responses (HR) at  $FOX_{max}$  are equal for both and can be inferred from a usual formula when CPX is unavailable. **Funding:** Fundação de Amparo à Pesquisa do Estado de São Paulo (2009/01842-0, 2013/15681-3), SP, Brazil.

582 **Board #2** May 31 1:00 PM - 3:00 PM  
**The Combined Effects Of Regular Activity Breaks And Physical Activity On Postprandial Metabolism**

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(No relationships reported)

Regularly interrupting sedentary behavior with short bouts of activity lowers postprandial glycemia, however, the effects on lipid responses are inconsistent. Additionally, little is known about how the effects of regular activity breaks and continuous physical activity may combine to affect postprandial metabolism. **Purpose:** To compare the effects of prolonged sitting and regular activity breaks with or without 30 min of continuous physical activity on postprandial metabolism. **Methods:** A randomized, crossover study was conducted; 36 adults (mean age 25 y (SD 3.9), BMI 23.9 (SD 3.9),  $VO_{2max}$  36.2 (SD 9.2) mL·kg<sup>-1</sup>·min<sup>-1</sup>) completed the following four two-day interventions: Prolonged sitting on both days, without (SED+SED) or with (PA+SED) a 30 min bout of continuous walking (60%  $VO_{2max}$ ) at the end of day 1; sitting on both days interrupted with regular activity breaks (2 min walking every thirty minutes at 60%  $VO_{2max}$ ), without (RAB+RAB) or with (PA+RAB) a 30 min bout of continuous walking (60%  $VO_{2max}$ ) at the end of day 1. Postprandial metabolic responses to a standardized test meal (0.71 g/kg CHO, 0.70 g/kg FAT, 0.32 g/kg PRO,

43.24 kJ/kg) were measured in venous blood samples over 5 h on day 2 - at baseline, 30 and 45 min, and then hourly. Plasma glucose, insulin, and triglycerides were used to calculate total area under the response curve (AUC). Mixed model regression was used to compare the effects of interventions on AUC.

**Results:** There was no effect of intervention on glucose AUC ( $p=0.26$ ). Compared to SED+SED, insulin AUC was significantly lower in PA+SED (-15%; 95% CI -4, -24%;  $p=0.01$ ), RAB+RAB (-11%; 95% CI 0, -20%;  $p=0.05$ ) and PA+RAB (-23%; -12, -31%;  $p < 0.001$ ). PA+RAB lowered insulin AUC more than PA+SED (-13%; 95% CI -4, -22%;  $p=0.01$ ). Neither PA+SED nor RAB+RAB alone affected triglyceride AUC. However, PA+RAB significantly lowered triglyceride AUC compared to both SED+SED (-0.74 mmol·L<sup>-1</sup>·5h; 95% CI -1.28, -0.20;  $p=0.01$ ) and PA+SED (-0.67 mmol·L<sup>-1</sup>·5h; 95% CI -1.15, -0.19;  $p=0.01$ ). **Conclusions:** The results indicated that all patterns of physical activity cause an acute improvement in insulin sensitivity. Regular activity breaks and physical activity combined provides the greatest improvements in insulin sensitivity, while also lowering postprandial lipids. Support: Heart Foundation, Lotteries, & University of Otago

583 **Board #3** May 31 1:00 PM - 3:00 PM  
**Influence of Aerobic Exercise on Ghrelin-o-Acyltransferase in Normal Weight and Obese Adults: A Pilot Study**

Michael L. Bruneau Jr.<sup>1</sup>, Susan Sotir<sup>2</sup>, Richard J. Wood<sup>2</sup>, Samuel A.E. Headley, FACSM<sup>2</sup>, Elizabeth O'Neill<sup>2</sup>, Susan E. Lachowski<sup>3</sup>, Vincent J. Paolone, FACSM<sup>2</sup>. <sup>1</sup>Drexel University, Philadelphia, PA. <sup>2</sup>Springfield College, Springfield, MA. <sup>3</sup>American International College, Springfield, MA. (Sponsor: Vincent Paolone, FACSM)  
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(No relationships reported)

Obesity is a major public health issue in the United States (US), affecting an estimated 78 million US adults. Aerobic exercise (AE) is recommended by the American College of Sports Medicine to prevent and treat obesity, yet the effect of AE on circulating hunger hormones, including ghrelin and its biological catalyst, ghrelin-o-acyltransferase (GOAT), are less known. **Purpose:** To determine the influence of AE on circulating GOAT in normal-weight (NW) and obese (OB) adults. **Methods:** A preliminary power analysis was performed to detect a medium to large effect size with 80% power. A sample size of nine was determined to be able to detect a medium effect size of 0.50 with 84% power and was used as the pilot sample for this study. Of the pilot sample, four were NW (body mass index [BMI] =  $21.3 \pm 1.3$  kg/m<sup>2</sup>) and five were OB (BMI =  $38.9 \pm 6.2$  kg/m<sup>2</sup>). Physical characteristics were measured at baseline with a health fitness assessment. Participants then returned to the laboratory on three separate occasions, separated by 48 hours to perform AE and control sessions in a randomly counterbalanced order. AE sessions were performed on cycle ergometers at 30% and 60% oxygen uptake reserve for 40 minutes. Control sessions were performed with seated rest and no AE for 40 minutes. Fifteen mL of blood was taken pre-and-post-AE and pre-and-post-control and were assayed in duplicate. Mixed factorial analysis of variance (ANOVA) was used to determine whether mean differences existed between NW and OB for GOAT in response to AE and control. Alpha levels were set *a priori* at  $p < 0.05$ . **Results:** No significant mean difference was found between NW and OB ( $F[1, 4] = 0.66, p = 0.44$ ) AE and control ( $F[1, 8] = 0.05, p = 0.96$ ), or the interaction between body weight and treatment condition ( $F[1, 8] = 0.75, p = 0.49$ ). **Conclusion:** We found the change in GOAT to be similar between NW and OB across treatment and control conditions in this pilot study. Our findings indicate that further investigation of GOAT is warranted in combination with other appetite regulating hormones in response to exercise. Such investigations should expand upon our findings and implement study designs that include larger samples of men and women to better understand the role GOAT may play as a biological catalyst in the suppression of hunger. Supported by the Graduate Student Research Fund at Springfield College.

584 **Board #4** May 31 1:00 PM - 3:00 PM  
**Two Weeks of Interval Training Improves Metabolic Flexibility and Glucose Tolerance in People with Prediabetes**

Nicole M. Gilbertson, Natalie ZM Eichner, Jacquelyn R. Moxey, Julian M. Gaftan, Zhenqi Liu, Eugene J. Barrett, Arthur Weltman, FACSM, Steven K. Malin. *University of Virginia, Charlottesville, VA.* (Sponsor: Arthur Weltman, FACSM)  
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(No relationships reported)

**Purpose:** Impaired metabolic flexibility is associated with hyperglycemia. Although exercise improves metabolic flexibility, the optimal exercise dose is unclear. Thus, we tested the effect of a 2-week interval (INT) vs. continuous (CONT) training intervention on fuel selection in relation to glucose tolerance in adults with prediabetes.

**METHODS:** Subjects (Age: 57.8±2.2y, BMI: 34.5±2.2kg/m<sup>2</sup>) were screened for prediabetes using the American Diabetes Association criteria (75g OGTT and HbA<sub>1c</sub>). Subjects were randomized to 60 min/d of supervised INT (n=7; 90% HRmax for 3 min and 50% HRmax for 3 min) or work matched CONT (n=6, 70% HRmax) exercise for 12 bouts. Fitness (VO<sub>2max</sub>), body composition (BIA), and glucose tolerance (180 min 75g OGTT) were assessed pre- and post-intervention. Respiratory exchange ratio (RER; indirect calorimetry) was measured at 0, 60, 120 and 180 min of the OGTT to assess fasting and post-prandial (average of 60-180 min) metabolic flexibility. **RESULTS:** INT and CONT training increased VO<sub>2max</sub> (+2.06±0.53 vs. +0.48±1.06 mL/kg/min, P=0.04), decreased skeletal muscle mass (SMM; -0.51±0.12 vs. -0.33±0.15 kg, P=0.001), and reduced fasting RER (-0.05±0.02 vs. -0.03±0.01 a.u., P=0.01). However, only INT exercise lowered 2-hr plasma glucose (-10.43±6.10 vs. +9.50±12.55 mg/dL, P=0.03) and increased post-prandial RER (+0.003±0.02 vs. -0.051±0.02 a.u., P=0.10) when compared with CONT training. Decreased SMM was significantly correlated with increased 2-hr glucose (r=-0.59, P=0.04) and enhanced post-prandial RER (r=-0.61; P=0.04). **CONCLUSION:** Independent of fitness and despite reductions in muscle mass, INT training favorably shifts fasting fat oxidation and post-prandial carbohydrate use in people with prediabetes. This suggests that exercise dose may be important for glycemic control and type 2 diabetes prevention.

585 Board #5 May 31 1:00 PM - 3:00 PM  
**Rate of Response in Insulin and Glucose Measures to Different Exercise Amounts and Intensities**  
 Louise de Lannoy, John Clarke, Paula Stotz, Robert Ross, FACSM, *Queen's University, Kingston, ON, Canada.* (Sponsor: Robert Ross, FACSM)  
 Email: 13ldl2@queensu.ca  
*(No relationships reported)*

Variability in glucose and insulin response to exercise is a largely neglected phenomenon. Here we analyze this variability by measuring the rate of response, defined as the number of individuals with an improvement in glucose and insulin values beyond the day-to-day variability of measurement.

**Purpose:** To determine the separate effects of exercise amount and intensity on the rate of response for glucose and insulin variables.

**Methods:** Participants were 171 sedentary, middle-aged abdominally obese adults who completed at least 90% of 5 weekly exercise sessions prescribed over a 24-week intervention. Participants were randomly assigned to (1) no-exercise control (n=51), (2) low-amount, low-intensity exercise (LALI; n=38), (3) high-amount, low-intensity exercise (HALI; n=52), or (4) high-amount, high-intensity exercise (HAHI; n=30). Two-hour glucose level, insulin area under the curve (AUC), and fasting insulin were measured at 16 and 24 weeks in response to a 2-hour, 75g oral glucose tolerance test. Biological variability for these measures was calculated to be ±2.2 mmol/L, ±940.2 pmol/L, and ±38.9 pmol/L, respectively.

**Results:** At 24 weeks, the rate of response for 2-hour glucose was 2.0%, 13.2%, 5.8%, 13.3% in the control, LALI, HALI, and HAHI groups, respectively. The rate of response for insulin AUC was 12.0%, 21.6%, 25.0%, 20.0% in the control, LALI, HALI, and HAHI groups, respectively. The rate of response for fasting insulin was 11.8%, 15.8%, 15.4%, 6.7% in the control, LALI, HALI, and HAHI groups, respectively. The rate of response was not different between control and any of the exercise groups for 2-hour glucose, insulin AUC, and fasting insulin (p>0.05). Exposure to exercise did not affect the rate of response for 2-hour glucose or fasting insulin between 16 and 24 weeks (p>0.05). Exposure data was not available for insulin AUC.

**Conclusion:** There was substantial variability of response for all measures of insulin and glucose that was not reduced by increasing exercise amount or intensity, where a maximum of 25% of participants improved in these measures beyond the day-to-day variability. This observation underscores the importance of accounting for the variability of measurement when interpreting treatment efficacy for a given individual.

586 Board #6 May 31 1:00 PM - 3:00 PM  
**Interventions to Change Physical Activity Behavior in Type 2 Diabetes: A Systematic Review and Meta-analysis**  
 Marjan Mosalman Haghghi, Yorgi Mavros, Maria A. Fiatarone Singh, *The University of Sydney, Sydney, Australia.* (Sponsor: Professor Glen Davis, FACSM)  
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*(No relationships reported)*

Low physical activity (PA) is a modifiable risk factor for health outcomes in individuals with type 2 diabetes (T2D). Sustained increases in PA are required to improve metabolic health and cardiovascular risk in this cohort, but have been difficult to achieve or poorly measured.

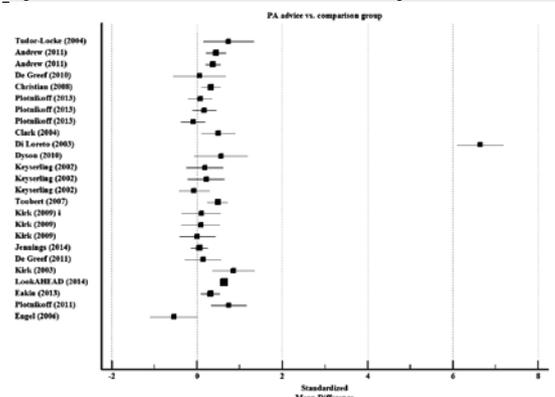
**Purpose:** To systematically review the effects of supervised exercise or lifestyle intervention including PA advice on long term PA in individuals with T2D.

**Method:** An electronic search of the literature was performed from earliest record to September 2016. Eligible trials were RCTs in T2D which included an objective or subjective measure of PA at baseline and at least one follow-up time point ≥ 6 months after enrolment. Mean differences, relative effect sizes (ES; Hedge's) and heterogeneity statistics (I<sup>2</sup>) were calculated using a random effects model.

**Results:** Among 107799 citations retrieved, 23 RCTs (including 18 RCTs of lifestyle advice and 5 RCTs of exercise) met the inclusion criteria (n=11673, 46.1% men, age 60.0 ± 4.0). All 5 exercise trials demonstrated increased PA relative to control [2/5 reported stable habitual PA plus an additional 3 d/week structured exercise; 3/5 reported moderate to large increases in total PA (relative ESs 0.6 to 1.5)]. The relative ESs for PA advice trials are shown in Fig. 1 (pooling not appropriate; I<sup>2</sup> = 96%). Only 10/18 trials demonstrated significantly increased total PA (ES ranging from 0.3 to 0.8 and one very large ES of 6.6.) Subjective PA measurement was used in 60% of trials that reported significant increases in PA, vs. only 12.5% of non-significant trials.

**Conclusion:** Supervised exercise was associated with increased overall PA (inclusive of study-related and habitual activity levels) in T2D in 5/5 trials. By contrast, only 55% of PA advice trials reported significant increases in PA. This heterogeneity, plus reliance on subjective reporting methods, limits confidence in the efficacy and consistency of unstructured/unsupervised PA advice in T2D.

Fig.1. Relative ES of PA Advice Trials on PA Behaviour Change



587 Board #7 May 31 1:00 PM - 3:00 PM  
**Power Training In Older Adults With Type 2 Diabetes; Outcomes From The Great2do Study.**  
 Guy Wilson<sup>1</sup>, Yorgi Mavros<sup>1</sup>, Shelley Kay<sup>1</sup>, David Simar<sup>2</sup>, Kylie Simpson<sup>1</sup>, Michael Baker<sup>3</sup>, Yi Wang<sup>4</sup>, Renru Zhao<sup>1</sup>, Jacinda Meiklejohn<sup>1</sup>, Nathan De Vos<sup>5</sup>, Mike Climstein, FACSM<sup>1</sup>, Anthony O'Sullivan<sup>6</sup>, Bernhard Baune<sup>7</sup>, Steven Blair, FACSM<sup>8</sup>, Nalin Singh<sup>1</sup>, Maria Fiatarone Singh<sup>1</sup>. <sup>1</sup>University of Sydney, Sydney, Australia. <sup>2</sup>University of New South Wales, Sydney, Australia. <sup>3</sup>Australian Catholic University, Sydney, Australia. <sup>4</sup>University of California, California, CA. <sup>5</sup>Balmain Hospital, Sydney, Australia. <sup>6</sup>University of New South Wales, Sydney, Australia. <sup>7</sup>University Of Adelaide, Adelaide, Australia. <sup>8</sup>University of South Carolina, Columbia, SC. (Sponsor: Mike Climstein, FACSM)  
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*(No relationships reported)*

**PURPOSE:** Muscle power declines with age and disease and predicts functional impairment. Although effective in some other cohorts, the benefits of high intensity, high velocity progressive resistance training (power training) on muscle strength, power, contraction velocity and lower limb function in older adults with type 2 diabetes has not been investigated.

**METHODS:** 103 overweight/obese older adults (>60 years) were randomized to receive high intensity power training [80% peak strength (1RM)] or sham-exercise, 3 days per week for 1 year. Peak muscle power, peak contraction velocity and 1RM were measured on Keiser knee extension (KE) and chest press (CP) machines before and after the intervention. Lower limb function was assessed using habitual and maximal gait speed, repeated chair stand and stair climb power. **RESULTS:** KE and CP 1RMs significantly increased following power training compared to sham-exercise [mean difference (CI) = 28.97 (5.17, 52.77) Nm and 75.99 (40.25, 111.74) N respectively]. Similar results were observed for KE and CP peak power [(mean difference = 75.83 (35.82, 115.84) W and 26.77 (6.30, 47.24) W, respectively]. No effects were observed for changes in contraction velocity for KE or CP (p<0.05). Both groups showed similar improvements in habitual and maximal gait speed and chair stand time (p<0.05). Increases in KE peak power were explained by increases in KE 1RM (r=0.32, p=0.003), but not changes in KE contraction velocity (r=0.12,

$p=0.26$ ). In contrast, increases in CP peak power were explained by increases in CP contraction velocity ( $r=0.52$ ,  $p<0.001$ ) but not increases in CP 1RM ( $r=0.17$ ,  $p=0.26$ ). Neither changes in KE 1RM nor peak power were associated with changes in lower limb function. **CONCLUSIONS:** 1 year of power training significantly improved upper and lower body strength and power in older adults with type 2 diabetes. Improvements in lower limb power were associated with increases in strength but not contraction velocity. Conversely, improvements in upper limb power were associated with increases in contraction velocity but not strength. Unexpectedly, improvements in lower extremity function were not associated with changes in lower leg strength or power, suggesting that unaddressed factors such as obesity may have attenuated the benefits of power training on functional performance.

588 Board #8 May 31 1:00 PM - 3:00 PM  
**Randomized Controlled-Trial of Milk and High-Intensity Interval Training on Metabolic Health in Type 2 Diabetes**

Monique E. Francois, Cody Durrer, Jonathan P. Little. *University of British Columbia, Kelowna, BC, Canada.*  
 (No relationships reported)

Milk consumption post-exercise may provide additional lean mass gains and body fat loss. Such favorable body composition changes could promote further improvements in glycemic control and quality of life (QoL) in exercising older adults with type 2 diabetes (T2D).

**Purpose:** To determine if the addition of post-exercise low-fat milk to high-intensity interval training (HIIT) improves metabolic health more than HIIT and isolated milk-protein, or HIIT alone.

**Methods:** In a proof-of-concept, randomized double-blind controlled trial, 47 adults with physician-diagnosed T2D ( $58 \pm 10$  y, A1c:  $7.1 \pm 0.8\%$ , BMI:  $35 \pm 7$  kg/m<sup>2</sup>) were randomly assigned to one of three nutritional beverages (500 mL skim-milk, milk-protein isolate or flavored water placebo) after HIIT exercise (2x cardio- and 1x resistance-based / wk) for 12 weeks. Body composition (dual-energy X-ray absorptiometry), glycemic control (hemoglobin A1c, continuous glucose monitoring) and QoL (SF-36) were measured before and after the intervention. Inferential analyses for clinical chances were performed using the spreadsheet at [www.newstats.org](http://www.newstats.org).

**Results:** There were main effects of time but no group X time interactions. All results are therefore presented as main effects of time with groups collapsed, with probability of change being clinically beneficial shown for select variables. Body mass was unchanged ( $-0.8 \pm 3.2$  kg,  $p=0.13$ ), however, lean mass ( $+1.3 \pm 2.9$  kg,  $p<0.01$ , *likely beneficial*) and percent body fat ( $-0.85 \pm 1.6\%$ ,  $p<0.01$ , *possibly beneficial*) were improved in all groups. Hemoglobin A1c ( $-0.2 \pm 1.6\%$ ,  $p<0.01$ , *most likely trivial*), 24-h mean glucose ( $-0.4 \pm 1.2$  mmol/L,  $p=0.04$ ) and glycemic variability (MAGE:  $-1.1 \pm 2.9$ ,  $p=0.02$ ) were reduced. QOL also increased (95%CI:  $+5.3-17\%$ , *most likely beneficial*) after HIIT.

**Conclusion:** The consumption of milk or protein after HIIT does not result in additional benefits for metabolic health compared to HIIT alone. In line with current evidence, HIIT is a potent stimulus for improving several aspects of metabolic health in patients with type 2 diabetes.

**B-09 Thematic Poster - Exercise Psychology and Clinical Populations**

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
 Room: 403

589 **Chair:** Melanie Poudevigne, FACSM. *Clayton State University, Morrow, GA.*  
 (No relationships reported)

590 Board #1 May 31 1:00 PM - 3:00 PM  
**Leisure Time Physical Activity Among U.S. Adults with Elevated Symptoms of Attention Deficit Hyperactivity Disorder**

Kathryn Fritz, 30606, Ashlyn Powell, Patrick J. O'Connor, FACSM. *University of Georgia, Athens, GA.* (Sponsor: Patrick O'Connor, FACSM)  
 Email: [kmfritz@uga.edu](mailto:kmfritz@uga.edu)  
 (No relationships reported)

Physical activity in adults with elevated ADHD symptoms is understudied. **PURPOSE:** This study surveyed U.S. adults with elevated ADHD symptoms for the purpose of (i) describing their leisure time physical activity (LTPA) and (ii) quantifying relationships between LTPA and ADHD symptoms. **METHODS:** 3,111 Amazon Mechanical Turk workers reported their age online and completed the six-item Adult ADHD Self-Report Scale-V.1.1 Screener (ASRS). 228 adults screened positive for ADHD and completed

45 questions about demographics, health and physical activity. 221 individuals were included in the final analysis because 7 were excluded as outliers ( $\geq 5$  SD above mean) or for responding incorrectly on the Godin. **RESULTS:** The sample was 56% female and 82% Caucasian with 83% between the ages of 18 and 59 years; 33% had some college and 30% were college graduates. Most respondents reported no current ADHD diagnosis (75%) or medication use to treat ADHD symptoms (83%). ADHD medication use was unrelated to the LTPA (all  $p$  values  $> .40$ ). Past week physical activities were: walking (88% of sample), home activities (63%), stretching (35%), jogging (34%), weight lifting (30%), yardwork (27%), bicycling (22%), home repair (20%), yoga/mind-body (19%), gardening (16%), swimming (15%), sports (14%), playing music (9%), social dance (5%), aerobic dance (4%) and fishing/hunting (4%). Compared to men, women reported significantly less strenuous ( $t=3.43$ ,  $p=.001$ ) and overall LTPA ( $t=2.886$ ,  $p=.004$ ), including less engagement in home repair activities ( $t=2.493$ ,  $p=.014$ ), jogging ( $t=2.204$ ,  $p=.029$ ), sports ( $t=2.188$ ,  $p=.03$ ), music ( $t=2.119$ ,  $p=.036$ ) and bicycling ( $t=2.012$ ,  $p=.046$ ). Log transformed total LTPA scores were significantly ( $p<.05$ ) related to ASRS question 2 (difficulty getting organized,  $r=-.18$ ), the inattention subscale ( $r=-.18$ ) and total ASRS scores ( $r=-.17$ ). **CONCLUSION:** In a sample of U.S. adults with elevated symptoms of ADHD, LTPA is low and physical activity modes are similar when compared to U.S. samples of adults without ADHD. ADHD symptoms are negatively related to LTPA and unrelated to ADHD medication use.

591 Board #2 May 31 1:00 PM - 3:00 PM  
**Effects Of Aerobic Exercise Intensity On Acute Serum Levels Of Bdnf In Patients With Depression**

Jorn Heggelund<sup>1</sup>, Ole Christian Mehlum<sup>2</sup>, Andreas Brabrand<sup>2</sup>, Mona Nygaard<sup>2</sup>, Einar Vedul-Kjelsaas<sup>1</sup>, Ismail Cüneyt Güzey<sup>1</sup>.  
<sup>1</sup>St. Olavs University Hospital, Trondheim, Norway. <sup>2</sup>Norwegian University of Science and Technology, Trondheim, Norway.  
 Email: [jorn.heggelund@ntnu.no](mailto:jorn.heggelund@ntnu.no)  
 (No relationships reported)

Serum level of brain-derived neurotrophic factor (BDNF) is reduced in patients with depression and improved BDNF has been linked to antidepressant response. Aerobic endurance training increases BDNF levels but it is unknown whether this response is intensity dependent in patients with clinical depression.

**Purpose:** To examine the changes in serum BDNF levels after high aerobic intensity training (HIT) compared to long slow distance training (LSD). **Methods:** In an intraindividual design, 16 patients (6 women/10 men;  $36 \pm 11$  yrs) with depression (ICD-10: F32-F33) performed the LSD and HIT with an interval of one week. HIT was warm up at 60-70 % of HR<sub>max</sub> for 10 min, followed by 4x4 min intervals at 85-95 % of maximal heart rate (HR<sub>max</sub>), intermitted by 3 min active rest periods at 60-70 % of HR<sub>max</sub>. LSD was continuous running or walking for 45 min at 60-70 % of HR<sub>max</sub>, with similar caloric expenditure as HIT. Blood samples were taken 5-10 min before each training session and within 3 min after completing the last 4 min interval (HIT) or upon completion of the LSD session. **Results:** Increase in serum BDNF after HIT was more pronounced compared to LSD ( $p < 0.001$ ; Cohen's  $d = 2.81$ ). Baseline BDNF levels were  $32.11 \pm 6.24$  ng/mL and  $30.62 \pm 5.61$  ng/mL in LSD and HIT, respectively. **Conclusion:** The serum BDNF response to aerobic exercise is intensity dependent in patients with clinical depression.

592 Board #3 May 31 1:00 PM - 3:00 PM  
**The Effects of Exercise Training on Anxiety in Fibromyalgia Patients: A Quantitative Synthesis**

Cillian P. McDowell<sup>1</sup>, Dane B. Cook, FACSM<sup>2</sup>, Matthew P. Herring<sup>1</sup>. <sup>1</sup>University of Limerick, Limerick, Ireland. <sup>2</sup>University of Wisconsin, Madison, WI. (Sponsor: Dr Dane Cook, FACSM)  
 Email: [cillian.mcdowell@ul.ie](mailto:cillian.mcdowell@ul.ie)  
 (No relationships reported)

Physical inactivity and comorbid anxiety symptoms are prevalent among fibromyalgia (FM) patients. Exercise training may be an effective alternative therapy to reduce these symptoms. **Purpose:** To evaluate the effects of exercise training on anxiety symptoms in patients with FM, and to examine whether variables of theoretical or practical importance moderate the estimated mean effect. **Methods:** Twenty-five effects were derived from 10 articles published before June 2016 located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 2,914 patients with FM and included both randomization to exercise training or a non-active control condition and an anxiety outcome measured at baseline and during and/or after exercise training. Hedges'  $d$  effect sizes were computed, data for moderator variables were extracted, and random effects models were used to estimate sampling error and population variance for all analyses. Meta-regression quantified the extent to which patient and trial characteristics moderated the mean effect. **Results:** Exercise training significantly reduced anxiety symptoms by a mean effect  $\Delta$  of 0.28 (95%CI: 0.16-0.40). No significant heterogeneity was observed ( $Q_w=30.79$ ;  $P=0.16$ ;  $I^2=25.29\%$ ). Program duration ( $\beta=1.44$ ;  $z=2.50$ ;  $p \leq 0.01$ ) was significantly related to the overall effect, with significantly larger anxiety improvements resulting from programs lasting greater

than 26 weeks ( $\Delta=0.35$ ; 95%CI, 0.05-0.66) compared with those lasting less than 26 weeks ( $\Delta=0.26$ ; 95%CI, 0.13-0.39). Session duration ( $\beta=-0.53$ ), frequency ( $\beta=-0.25$ ), intensity ( $\beta=0.23$ ), control ( $\beta=0.66$ ), anxiety recall time frame ( $\beta=0.07$ ), and exercise setting ( $\beta=0.45$ ) were not significantly related to effect size (all  $p \geq 0.07$ ). **Conclusion:** Exercise training improves anxiety symptoms among FM patients. Thus, in addition to the physical benefits of exercise, persons with FM should be encouraged to exercise as a potential low-risk, adjuvant treatment for anxiety symptoms. The findings also suggest that larger anxiety symptom reductions will be achieved by focusing on longer exercise programs while promoting long-term adherence. Future well-designed investigations are required to examine the potential moderating effect of pain-related improvements in FM patients.

593 Board #4 May 31 1:00 PM - 3:00 PM  
**Comparison of Physical Activity and Sports Participation in Children With and Without Autism Spectrum Disorder**

Jeanette M. Garcia<sup>1</sup>, Kayla M. Baker<sup>1</sup>, David J. Rice<sup>2</sup>, Sean Healy<sup>3</sup>. <sup>1</sup>University of Central Florida, Orlando, FL. <sup>2</sup>Florida Southern College, Lakeland, FL. <sup>3</sup>Humboldt State University, Arcata, CA.  
 Email: jeanette.garcia@ucf.edu  
 (No relationships reported)

**PURPOSE:** To compare psychosocial factors associated with physical activity and participation in sports between children with Autism Spectrum Disorder (ASD) and typically developing (TD) children.  
**METHODS:** The sample consisted of 49 nine-year old children with ASD (85% male) and 70 nine-year old TD children (85% male) who were part of a large, national study, the Growing Up in Ireland Study, which examined a series of demographic, behavioral, and psychosocial variables in children. Children and parents completed questionnaires that asked about their physical activity (PA), participation in sports, social factors (friends, bullying), and psychological variables (perception of intelligence, popularity, happiness, anxiety). T-tests compared differences between activity and psychosocial variables in children with ASD and TD children, while multiple regression examined which factors were associated with PA and sports participation.  
**RESULTS:** Independent samples t-tests revealed that children with ASD had lower amounts of PA ( $p=0.01$ ), spent less time with friends ( $p=0.0001$ ), had fewer close friends ( $p<0.0001$ ), viewed themselves as less popular ( $p<0.0001$ ), reported greater feelings of anxiety ( $p=0.01$ ), and were less likely to participate in sports ( $p=0.02$ ). Regression analyses indicated that being a victim of bullying ( $\beta=-.28$ ,  $p=0.03$ ) was associated with lower levels of PA in TD children, with a trend towards greater perceptions of popularity ( $\beta=.1$ ,  $p=.08$ ) associated with greater levels of PA. Children who were victims of bullying also reported less sports participation ( $\beta=-.23$ ,  $p=0.03$ ). In children with ASD, greater time spent with friends ( $\beta=.45$ ,  $p=0.0006$ ) and greater perceptions of intelligence ( $\beta=-.2$ ,  $p=.004$ ) were associated with greater levels of PA, while none of the psychosocial variables were associated with sports participation.  
**CONCLUSIONS:** Children with ASD have lower levels of PA and sports participation than TD children. Interventions aimed to increase PA in children with ASD need to take into account differences in psychosocial factors associated with PA compared to TD children.

594 Board #5 May 31 1:00 PM - 3:00 PM  
**Exercise Induced Analgesia in Survivors of Cancer**

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 (No relationships reported)

**PURPOSE:** Chronic pain of varying origins is experienced by potentially greater than 50% of cancer survivors. Associated with reduced physical function and reduced health-related quality of life, it is a significant barrier to initiating and continuing exercise for cancer survivors. Aerobic exercise has been shown to have an acute analgesic effect demonstrated by a reduction in subjectively reported pain, or an increase in pain thresholds, for 10 to 30 minutes immediately following exercise. The hypoalgesic effect of exercise has been well demonstrated in healthy populations as well as some chronic diseases, but has not yet been investigated for cancer survivors. The aim of the current study is to investigate if cancer survivors experience an analgesic response to an acute bout of exercise, and if this response changes after repeated exercise sessions.  
**METHODS:** Participants ( $n = 6$ ) who had a diagnosis of breast, colorectal or prostate cancer who were 3-12 months post completion of primary treatment (hormone therapy excepted) were included in this study. Six participants completed individualised test bout of exercise (30-70% HRR, duration 15-20min). Pain thresholds were measured using an algometer over the rectus femoris muscle of the leg before and after the exercise. Five participants repeated the test exercise bout following a 2-week training period of 6 exercise sessions. Questionnaire measures of pain were also recorded using pain specific subscale from the SF-36 (0-100, 100=best).

**RESULTS:** The participants variously reporting being impacted by pain (SF-36 bodily pain 59.4± 8.1 range: 22.5 - 100) during the 4 weeks before testing commenced. Following two weeks of training, bodily pain was reported as 41.9 ± 23.8 out of 100. Pressure pain thresholds increased after exercise on day 1 (Mean diff ± SD: 0.54 ± 0.40 kg/cm<sup>2</sup>; Cohens d (95% CI): 0.2 (0.04 - 0.49),  $p<0.05$ ), indicative of exercise-induced hypoalgesia. This response was similar following 2 weeks of training (mean± SD: 0.52 ± 0.09 kg/cm<sup>2</sup>; Cohens d (95% CI): 0.43,  $p<0.001$ ). **CONCLUSIONS:** Cancer survivors experienced an analgesic response to a single bout of exercise. This response was stable across a 2 week training period, despite higher levels of self-reported bodily pain.

595 Board #6 May 31 1:00 PM - 3:00 PM  
**Physical Activity and Brain Responses during Pain Modulation in Gulf Veterans with Chronic Muscle Pain**

Aaron J. Stegner<sup>1</sup>, Laura D. Ellingson<sup>2</sup>, Stephanie M. Van Riper<sup>1</sup>, Dane B. Cook, FACSM<sup>3</sup>. <sup>1</sup>University of Wisconsin-Madison, Madison, WI. <sup>2</sup>Iowa State University, Ames, IA. <sup>3</sup>William S. Middleton Memorial Veterans Hospital, Madison, WI. (Sponsor: Dane B. Cook, FACSM)  
 (No relationships reported)

Chronic medically unexplained muscle pain (CMP) is a primary complaint among the more than 200,000 US Gulf War Veterans (GVs) currently suffering from debilitating multisymptom illnesses. Veterans of the more recent Iraq War are also dealing with CMP. Previously our lab demonstrated a positive relationship between physical activity (PA) and brain responses to pain modulation (PM) in civilian CMP patients. We also reported significant correlations between PA and behavioral indices of PM in healthy GV. The relationship between PA and the underlying brain responses during PM, however, has not been thoroughly explored. **PURPOSE:** To examine the association between brain responses during PM and objectively-measured PA in GV with and without CMP. **METHODS:** Twenty two GV (12 CMP; 10 healthy) underwent thermal pain testing with and without distraction during an fMRI scan. Veterans were exposed to 15 heat stimuli (20 s) relativized to 'slightly intense' pain. Stimuli were administered alone or with distraction (i.e., congruent [CS] and incongruent versions [IS] of the Stroop Task). Pain intensity and unpleasantness ratings were collected for each stimulus. PA was assessed with hip-mounted accelerometers worn for a week. Brain responses during PM were modeled using SPM12 and correlated to six PA indices derived from the PA data. Voxel-level significance was set to 0.005 with a minimum cluster size of 330 mm<sup>3</sup>. **RESULTS:** Ratings of pain with distraction, CS and IS, were significantly ( $p<0.01$ ) reduced compared to without for both groups. During CS, healthy GV exhibited a positive correlation between activity in the right precentral gyrus during PM and sedentary minutes, while activity in the middle and prefrontal cortices was negatively related to PA at light, moderate and vigorous intensities. For IS, positive correlations were found between activity in the contralateral insula and indices of low intensity PA. GV with CMP had only a negative correlation between activity in the right anterior cingulate cortex during CS and minutes spent in activities of daily living. **CONCLUSIONS:** Pain modulation during distraction appears uncompromised in GV with CMP. However, the influence of PA on modulatory responses seems diminished in GV with CMP compared to their healthy peers. Supported by Dept. of Veterans Affairs grant: 561-00436

596 Board #7 May 31 1:00 PM - 3:00 PM  
**Associations Between Physical Activity, Flourishing, Bullying And Emotional Difficulties In Children Autism**

Stephanie M. McCoy, Joann Judge. University of Southern Mississippi, Hattiesburg, MS.  
 (No relationships reported)

Physical activity (PA) is a significant indicator of present and future health in adolescents. However, it is unknown whether engaging in regular PA is associated with measures of child flourishing as well as bullying and emotional difficulties in children with autism spectrum disorder (ASD). **PURPOSE:** To examine associations between physical activity levels and measures of child flourishing as well as bullying and emotional difficulties. **METHODS:** Analyses include 1, 363 (82% male) aged 6-17 (mean 11.54 ± 3.29 years) with ASD from the 2011-12 National Survey of Children's Health. Adolescents were grouped into two categories: those who engaged in regular PA ( $\geq 3$  days/week) and those who did not engage in regular PA. Outcomes included emotional difficulties (excessive arguing and unhappiness) bullying or being cruel to others, and measures of flourishing (finishing tasks, staying calm and in control when faced with a challenge, showing interest in learning new things, and caring about doing well in school). Logistic regression models, adjusted for age, sex, gender, household income, and education assessed the odds of each outcome comparing those who engaged in regular PA to those who did not. **RESULTS:** Unadjusted prevalences showed that 69% of those with ASD were regularly physically active ( $\geq 3$  days/week). Regular physical activity was not associated with excessive arguing, bullying or being cruel to others, or unhappiness. Those with ASD who participated in regular PA were 58% more likely to finish tasks (OR=1.58;  $p=0.001$ ) compared to those who did not

WEDNESDAY, MAY 31, 2017

engage in regular PA. Additionally, those who engaged in regular PA were 44% more likely to stay calm and in control when faced with a challenge (OR=1.44;  $p=0.007$ ). Furthermore, those who engaged in regular PA were 75% more likely to show interest and curiosity in learning new things (OR=1.75;  $p=0.006$ ), and 65% more likely to care about doing well in school (OR=1.65;  $p=0.004$ ) compared to those who did not engage in regular PA. **CONCLUSIONS:** Children with ASD that engaged in regular PA were significantly more likely to finish tasks, stay calm when faced with a challenge, show interest and curiosity in learning new things, and care about doing well in school. These findings suggest engaging in regular PA may increase flourishing in children with ASD.

597 Board #8 May 31 1:00 PM - 3:00 PM  
**Acute Exercise Effects on Mood Among Young Adults with Worry Symptoms Indicative of Generalized Anxiety Disorder**  
 Matthew P. Herring<sup>1</sup>, Mats Hallgren<sup>2</sup>, Mark J. Campbell<sup>1</sup>.  
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 (No relationships reported)

Evidence supports the effects of exercise training on clinical severity, associated signs and symptoms, dimensions of sleep quality and quantity, and health-related quality of life among individuals with Generalized Anxiety Disorder (GAD). However, little is known about the acute effects of exercise among individuals with clinical or subclinical GAD.

#### Purpose

This study quantified mood responses to either acute aerobic exercise or quiet rest, examined potential sex-related differences in response, and explored potential moderators of response among young adult men and women with worry symptoms indicative of GAD.

#### Methods

Twenty-five young adults (8 males; 17 females; 21.1±1.3y) with Penn State Worry Questionnaire scores ≥45 (58±8) completed two 30-min conditions in counterbalanced order: vigorous treadmill running or seated quiet rest. Outcomes included worry symptoms, state anxiety, feelings of tension, depression, anger, energy, fatigue, and confusion, and total mood disturbance. RM-ANOVA examined differences across condition and time and between males and females. Hedges' *d* effect sizes (95%CI) were calculated to quantify and compare the magnitude of change in response to exercise compared to control. Regression explored potential moderators of mood response.

#### Results

Average heart rate was 163±5.4 bpm and participants reported an average session RPE of 13±2 (range: 9 to 17). Compared with control, acute exercise significantly improved state anxiety, feelings of depression, anger, energy, fatigue, and confusion, and total mood disturbance (all  $p<0.04$ ). Moderate-to-large improvements were found for anger ( $d=0.57$ , 95%CI: 0.01, 1.13), fatigue ( $d=0.67$ , 95%CI: 0.10, 1.24), confusion ( $d=0.87$ , 95%CI: 0.29, 1.45), and energy ( $d=0.87$ , 95%CI: 0.29, 1.45), and total mood disturbance ( $d=1.10$ , 95%CI: 0.50, 1.69). The magnitude of improvements were greater (i.e., larger effect sizes) among men for all outcomes except feelings of energy and fatigue and worry symptoms. High trait anxiety, depression, and poor sleep did not moderate exercise effects (all  $p>0.10$ ).

#### Conclusion

Findings provide initial support for both the positive effects of acute aerobic exercise on mood and potential sex-related differences in exercise effects among young adults with worry symptoms indicative of GAD.

## B-10 Thematic Poster - Growing Up Active: Physical Activity in Youth

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
 Room: 505

598 **Chair:** John R. Sirard. *University of Massachusetts Amherst, Amherst, MA.*  
 (No relationships reported)

599 Board #1 May 31 1:00 PM - 3:00 PM  
**Using Accelerometry To Measure Physical Activity Opportunities During The School Day In Rural Elementary Schools.**  
 Evan Hilberg<sup>1</sup>, Patrick Abi Nader<sup>2</sup>, John M. Schuna, Jr<sup>1</sup>, Deborah John<sup>1</sup>, Katherine B. Gunter, FACSM<sup>1</sup>. <sup>1</sup>Oregon State University, Corvallis, OR. <sup>2</sup>Université de Moncton, Moncton, NB, Canada.  
 (Sponsor: Katherine Gunter, FACSM)  
 (No relationships reported)

Physical activity (PA) guidelines for children recommend accruing 60 minutes or more of moderate to vigorous physical activity (MVPA) per day. Rural children accumulate the majority of their PA at school, so PA opportunities, such as physical education (PE), recess, and classroom-based PA (CBPA) in the rural school environment are critical for this population. There is limited research exploring these PA opportunities in the rural elementary school setting to understand which opportunities provide the most MVPA. **PURPOSE:** To determine the proportion of time rural children spend at different intensities during three specific PA opportunities available during the school day: PE, recess, and CBPA. **METHODS:** Objectively measured PA levels were collected over a period of four school days at six rural elementary schools using research-grade accelerometers. Accelerometers were worn on the waist during school hours by 292 children (grades 1-5). Daily wear times and school schedules were provided by teachers and were matched to the children's accelerometer data to determine the amount of time spent at different intensities during each PA opportunity. ANOVA was used to detect differences with an alpha level of 0.05. **RESULTS:** The average duration for each PA opportunity was 44 minutes of recess, 32 minutes of PE, and 19 minutes of CBPA. Children in our sample of rural elementary schools spent 18 ± 14% (M±SD) of recess time in MVPA, 16 ± 15% of PE in MVPA, and 11% ± 15% of CBPA in MVPA. Boys engaged in higher levels of MVPA than girls across all PA opportunities ( $p<0.001$ ). First grade children accrued more time in MVPA across domains when compared to their fifth grade counterparts ( $p<0.001$ ). Sedentary and light intensity activities were higher for older children and girls ( $p<0.001$ ). **CONCLUSION:** Scheduling PA opportunities with the highest proportion of MVPA may be an effective method to increase activity in rural elementary school children. This sample of children are not meeting the recommendations of 50% for proportion of time spent in MVPA during recess and PE. Targeting approaches to increase MVPA during these already scheduled opportunities may help children reach daily recommendations. Supported by a grant from the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2011-68001-30020.

600 Board #2 May 31 1:00 PM - 3:00 PM  
**Infancy Weight Gain And Fat Mass In Youth- Does Physical Activity Modify The Association?**  
 Guro P. Bernhardsen, Trine Stensrud, Ulf Ekelund, FACSM.  
*Norwegian School of Sport Sciences, Oslo, Norway.* (Sponsor: Jorunn Sundgot-Borgen, FACSM)  
 Email: g.p.bernhardsen@nih.no  
 (No relationships reported)

Rapid weight gain in infancy has been linked to increased risk of obesity in youth. Hence, an increased knowledge on possible strategies to prevent excessive total fat mass (total FM) and trunk fat mass (trunk FM) is important to avoid development of obesity. One possible strategy could be moderate-to-vigorous physical activity (MVPA) or vigorous physical activity (VPA), since MVPA and VPA has been associated with lower levels of adiposity. However, it is unknown whether physical activity may modify the association between rapid infant weight gain and later adiposity. **PURPOSE:** To examine whether MVPA and VPA modifies the associations between weight gain the first year of life and total FM and trunk FM in youth. **METHODS:** We used data from a sub-cohort of the Norwegian Mother and Child Cohort Study (MoBa), including assessment of total FM and trunk FM by dual-energy X-ray absorptiometry (DXA), and MVPA (≥2296 cpm) and VPA (≥4012 cpm) assessed by Actigraph accelerometers. Weight gain was calculated as change in weight z-scores between birth and 1 year. We used multiple regression analyses to examine the association between infancy weight gain and total FM and trunk FM (with adjustments for sex, birth weight, gestational age, height and family income), and included the interaction term weight gain x MVPA and weight gain x VPA to

examine the modifying effect of MVPA and VPA (adjustments for monitor wear time included). **RESULTS:** The mean age (sd) of the 147 participants (45.6% girls) were 11.0 (0.61) years. There was a positive association between infancy weight gain and total FM ( $B=1.1$ , 95%CI= 0.40, 1.8) and trunk FM ( $B=0.5$  95%CI= 0.16, 0.89). MVPA did not modify the association between infancy weight gain and total FM ( $p=0.157$ ) and trunk FM ( $p=0.116$ ), whereas VPA modified both total FM ( $B(\text{gain} \times \text{VPA}) = -0.061$ ,  $p=0.026$ ) and trunk FM ( $B(\text{gain} \times \text{VPA}) = -0.034$ ,  $p=0.014$ ). **CONCLUSION:** These findings indicate that VPA, but not MVPA, modifies the associations between weight gain during the first year of life and total FM and trunk FM in youth. Vigorous intensity PA may be considered as one of many public health strategies to curb childhood obesity, especially in those who are prone to obesity due to rapid infant weight gain.

601 Board #3 May 31 1:00 PM - 3:00 PM

### Physical Activity And Markers Of Inflammation In Children

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(No relationships reported)

Inflammatory markers have been linked to adiposity, atherosclerosis and risk factors for development of cardiovascular disease. Regular physical activity (PA) is associated with potential benefits for many health outcomes. However, few studies have examined the associations between objectively assessed PA and inflammatory markers in healthy children. Moreover, these studies often include small sample sizes and few inflammatory markers.

**PURPOSE:** To examine the associations of objectively measured overall PA (counts per minute, CPM), moderate-to-vigorous PA (MVPA) and vigorous PA (VPA) with markers of inflammation in children.

**METHODS:** Of the 1467 children invited in 2005-2006, 1306 children participated, giving an overall participation rate of 89%. Inflammatory markers were; C-reactive protein (CRP), leptin, adiponectin, plasminogen activator inhibitor-1 (PAI-1), tumor necrosis factor  $\alpha$  (TNF $\alpha$ ) and interleukin-6 (IL-6). PA was assessed objectively by accelerometry (ActiGraph 7164). Outcomes variables were overall PA (CPM) as well as time spent in MVPA (> 2000 CPM) and VPA (> 6000 CPM). We used linear regression analysis to examine the association between PA and inflammatory markers, and one-way analysis of variance to analyze differences between groups. **RESULTS:** Time spent in VPA was negatively associated with CRP ( $\beta = -0.162$ ), PAI-1 ( $\beta = -0.138$ ) and leptin ( $\beta = -0.208$ ) ( $p < 0.001$  for all) after adjustment for sex. Further, there was a significant negative association between overall PA (CPM) and MVPA with CRP, PAI-1 and leptin ( $p < 0.05$  for all), although the magnitude of association was less pronounced compared with VPA. We observed a graded association of CRP, PAI-1 and leptin across tertiles of VPA ( $p \leq 0.01$  for all). **CONCLUSIONS:** Our results show that PA were negatively associated with inflammatory markers in Norwegian nine-year old children. Despite this being a cross-sectional study, the results indicate the importance of overall PA level. The association was most pronounced for VPA, suggesting that vigorous intensity activity may be more beneficial than moderate intensity in relation to inflammatory markers.

602 Board #4 May 31 1:00 PM - 3:00 PM

### Moderate-to-vigorous Physical Activity Predicts Change In Clustered Cardio-metabolic Risk In 10-year-old Children

Turid Skrede<sup>1</sup>, Mette Stavnsbo<sup>1</sup>, Eivind Aadland<sup>1</sup>, Katrine Nyvoll Aadland<sup>1</sup>, Sigmund Alfred Anderssen<sup>2</sup>, Geir Kåre Resaland<sup>1</sup>, Ulf Ekelund, FACSM<sup>2</sup>. <sup>1</sup>Sogn og Fjordane University College, Sogndal, Norway. <sup>2</sup>Norwegian School of Sport Sciences, Oslo, Norway.

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(No relationships reported)

**PURPOSE:** Examine the independent, prospective associations between objectively measured sedentary time and sub-components of physical activity with individual and clustered cardio-metabolic risk factors in 10-year-old healthy children.

**METHODS:** We included 700 boys and girls in which sedentary time, and physical activity were measured by accelerometry. Systolic blood pressure, waist circumference and fasting blood sample (total cholesterol, high-density cholesterol, triglycerides, glucose, fasting insulin) were measured by standard clinical methods and analysed individually and as a clustered cardio-metabolic risk score standardized by age and sex (z score). Exposure and outcome variables were measured at baseline and at follow-up seven months later.

**RESULTS:** Sedentary time was not associated with any of the individual cardio-metabolic risk factors nor clustered cardio-metabolic risk in prospective analyses. Moderate physical activity at baseline predicted higher levels of triglyceride ( $\beta -0.086$  (-0.160 - -0.013,  $p=0.021$ ) and insulin resistance ( $\beta -0.070$  (-0.132 - -0.008,  $p=0.027$ ) at follow-up independent of sex, socio-economic status, Tanner stage, monitor wear time, and waist circumference. One SD increase in moderate-to-vigorous physical activity predicted 0.056 SD lower clustered cardio-metabolic risk at follow-up ( $p=0.043$ ). However, these associations were attenuated following adjustment for waist circumference.

**CONCLUSIONS:** Physical activity, but not sedentary time, is prospectively associated with cardio-metabolic risk in healthy children. Public health strategies aimed at improving children's cardio-metabolic profile should strive for increasing levels of physical activity of at least moderate intensity rather than reducing sedentary time.

603 Board #5 May 31 1:00 PM - 3:00 PM

### High And Low Impact Physical Activity Substitution And Pediatric Bone Density

Jonathan A. Mitchell<sup>1</sup>, Diana L. Cousminer<sup>1</sup>, Alessandra Chesi<sup>1</sup>, Shana E. McCormack<sup>1</sup>, Heidi J. Kalkwarf<sup>2</sup>, Joan M. Lappe<sup>3</sup>, Vicente Gilsanz<sup>4</sup>, Sharon E. Oberfield<sup>5</sup>, John A. Shepherd<sup>6</sup>, Andrea Kelly<sup>1</sup>, Struan FA Grant<sup>1</sup>. <sup>1</sup>Children's Hospital of Philadelphia, Philadelphia, PA. <sup>2</sup>Cincinnati Children's Hospital Medical Center, Cincinnati, OH. <sup>3</sup>Creighton University, Omaha, NE. <sup>4</sup>Children's Hospital of Los Angeles, Los Angeles, CA. <sup>5</sup>Columbia University Medical Center, New York, NY. <sup>6</sup>University of California San Francisco, San Francisco, CA.

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(No relationships reported)

**PURPOSE:** To determine if substituting time spent in high and low impact physical activity (PA) associated with changes in pediatric bone mineral density (BMD) and content (BMC).

**METHODS:** We analyzed data from the longitudinal Bone Mineral Density in Childhood Study (N=1,856 with up to 7 visits). Spine, total hip, and femoral neck areal BMD (aBMD) and total body less head (TBLH) BMC were measured by DXA, with sex and age specific Z-scores, adjusted for height calculated. Hours per day (h/d) spent in total, high impact, and low impact PA were self-reported. Partition and isotemporal substitution-modeling frameworks were applied to linear mixed models; the latter framework to test how substituting high for low impact PA (and vice versa) affects bone health in an observational study. Statistical interactions with sex, self-reported race (Black or non-Black), genetic ancestry (African, European or Asian), and bone fragility genetic scores for Europeans only (percentage of BMD lowering alleles carried at 63 common loci and at 18 WNT signaling loci) were separately tested.

**RESULTS:** In partition models, high impact PA was positively associated with each aBMD bone Z-score (e.g., total hip aBMD:  $\beta=0.05$ ,  $P=5.5 \times 10^{-14}$ ) and TBLH-BMC Z-score ( $\beta=0.05$ ,  $P=4.0 \times 10^{-22}$ ), whereas low impact PA was not associated with each aBMD bone Z-score (e.g., total hip aBMD:  $\beta=0.00$ ,  $P=0.878$ ) and TBLH-BMC Z-score ( $\beta=-0.01$ ,  $P=0.125$ ). In isotemporal substitution models, replacing 1 hour per day of low impact PA for high impact PA was associated with an increase in each aBMD bone Z-score (e.g., total hip aBMD:  $\beta=0.05$ ,  $P=1.6 \times 10^{-8}$ ) and TBLH-BMC Z-score ( $\beta=0.06$ ,  $P=4.2 \times 10^{-15}$ ). Conversely, the opposite 1 hour per day substitution was associated with a decrease in each aBMD bone Z-score (e.g., total hip aBMD:  $\beta=-0.05$ ,  $P=1.6 \times 10^{-8}$ ) and TBLH-BMC Z-score ( $\beta=-0.06$ ,  $P=4.2 \times 10^{-15}$ ). The substitution associations were similar by sex and race, genetic ancestry, the common variant genetic score, and the WNT signaling genetic score (interaction P-values >0.05). **CONCLUSION:** Dedicating a significant proportion of daily PA to high impact activities is beneficial to the growing skeleton for all children. Importantly, replacing low impact PA with more high impact PA is beneficial even for European children genetically predisposed to bone fragility.

604 Board #6 May 31 1:00 PM - 3:00 PM

### Sedentary Time and Anthropometric Characteristics Among Hispanic Children in Puerto Rico

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(No relationships reported)

Too much sedentary time (ST) is associated with poor overall health among adults. However, the effect of ST on children's health is not clear. **PURPOSE:** To evaluate the association between ST, percent of the day in ST (ST%), sedentary breaks (STB), length of sedentary breaks (LSTB) and anthropometric measurements among Hispanic children in Puerto Rico. **METHODS:** A group of 114 children (54 girls and 60 boys; mean age =  $7.0 \pm 0.73$  years, range = 6 to 8 years) completed measurements of height, weight, skinfolds, and waist circumference. They also wore an accelerometer for 7

days attached to an elastic belt placed on the right hip area. T-tests were conducted to detect gender differences, and Spearman correlations to detect associations between ST, ST%, STB, LSTB, age, and anthropometric variables. **RESULTS:** No gender differences were detected for ST (4.9±1.2 hrs/day girls, 4.9±1.1 hrs/day boys), ST% (41.1±8.2 % girls, 40.5±6.6 % boys), STB (4.7±2.1 breaks/day girls, 5.0±1.8 breaks/day boys), LSTB (65.3±2.4 min/day girls, 63.4±2.1 min/day boys), and most anthropometric measurements (BMI percentile (65.7±29.8 girls, 64.5±28.7 boys), waist circumference (57.5±8.8 cm girls, 57.3±5.9 cm boys), waist to height ratio (0.45±0.08 girls, 0.46±0.03 boys). Percent body fat was higher in girls compared with boys (21.1±5.9 % girls, 16.6±7.2 % boys;  $P < 0.01$ ). No correlation was observed between sedentary related measures (ST, ST%, STB, LSTB), anthropometric and body composition measures. However, age correlated with ST ( $\rho = 0.27$ ,  $p < 0.01$ ), ST% ( $\rho = 0.30$ ,  $p < 0.01$ ), STB ( $\rho = 0.29$ ,  $p < 0.01$ ), LSTB ( $\rho = 0.24$ ,  $p < 0.01$ ), BMI percentile ( $\rho = 0.19$ ,  $p = 0.04$ ), percent body fat ( $\rho = 0.33$ ,  $p < 0.01$ ), and waist circumference ( $\rho = 0.40$ ,  $p < 0.01$ ). **CONCLUSIONS:** Although too much ST is not likely a concern, the observed increase in ST, BMI percentile, percent body fat, and waist circumference with age in this group of young children could represent a future health problem. Interventions must be implemented to help reduce this possible trend. Funded by University of PR-FIPI Institutional Grant.

605 Board #7 May 31 1:00 PM - 3:00 PM  
**Longitudinal Changes in Normalized Grip Strength is Associated with Cardiometabolic Health Maintenance and Improvement among Adolescents.**

Mark D. Peterson, FACSM<sup>1</sup>, Sonja Smeding<sup>2</sup>, Paul Visich<sup>3</sup>, Paul Gordon, FACSM<sup>2</sup>. <sup>1</sup>University of Michigan, Ann Arbor, MI. <sup>2</sup>Baylor University, Waco, TX. <sup>3</sup>University of New England, Biddeford, ME.

(No relationships reported)

**PURPOSE:** There is an association between normalized grip strength (NGS) and prevalent cardiometabolic health among adolescents; and yet, what remains to be determined is the extent to which changes in NGS predict subsequent changes in health status. The purpose of this study was to determine the longitudinal effect of NGS on changes in health status in a cohort (n=368) of adolescents.

**METHODS:** Cardiometabolic risk variables included elevated fasting glucose, high blood pressure, elevated plasma triglycerides levels, and low HDL-cholesterol. Fully-adjusted, multinomial logistic regression models were used to quantify the odds of experiencing health maintenance (no risk factors identified at either time point), health improvement (presence of  $\geq 1$  baseline risk factor, and no risk factors at follow-up), or onset of health risk (no risk factor at baseline, and presence of  $\geq 1$  risk factor at follow-up) over a 2-year period. **RESULTS:** For every 0.05 unit increase in NGS from baseline, there was a 1.35 (95%CI: 1.05-1.74) and 1.33 (95%CI: 1.06-1.73) increased odds for health maintenance and health improvement, respectively, even after adjusting for baseline body fat percentage, baseline grip strength, cardiorespiratory fitness and objectively-measured physical activity. Conversely, improvements in NGS were inversely associated with odds of onset of health risk (OR: 0.74, 95%CI: 0.57-0.95). **CONCLUSIONS:** Longitudinal increases in NGS are associated with health maintenance and health improvements in adolescent boys and girls. On the other hand, declines in NGS could be used as a prognostic indicator of onset cardiometabolic risk and to identify adolescents that would benefit from lifestyle interventions to improve muscular fitness and reduce risk.

606 Board #8 May 31 1:00 PM - 3:00 PM  
**Physical Activity Bout Patterns From Childhood Through Adolescence: NHANES 2003-2006**

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(No relationships reported)

Moderate-to-vigorous intensity physical activity (MVPA) accumulated in bouts greater than 5 minutes in length are related to beneficial cardiometabolic health outcomes independent of total MVPA in youth. While it has been established that total MVPA decreases as youth age, the associations between age and MVPA bout patterns in youth is unknown. **Purpose:** To identify physical activity (PA) bout patterns by age and sex in 6-18 years old youth. **Methods:** This cross-sectional analysis examined accelerometer data from the National Health and Examination Survey '03-'04 and '05-'06. Participants (n=4069; male=2036, female=2033; mean age 12.5 ± 3.6yrs) were required to wear uniaxial accelerometers set on 1-minute epochs on the right hip for 7 days. Included data had a minimum of 3 days of at least 10 hours of valid wear time. PA patterns were assessed by comparing percent time of total MVPA in sporadic (1-4 minutes), short (5-9 minutes), and medium-to-long (med-long) ( $\geq 10$  minute) bouts of MVPA by age and sex. Multivariable regression analysis was used to determine independent associations of age, sex, race, ethnicity, income, and PA bout patterns. **Results:** Data are presented as percent time. Significant differences by age group were

observed for: sporadic bouts (6-7yrs, 91.2 ± 3.9; 8-9yrs, 92.5 ± 4.1; 10-11yrs, 93.7 ± 4.2; 12-13yrs, 93.7 ± 5.4; 14-15yrs, 93.4 ± 6.3; and 16+yrs, 93.5 ± 8.3;  $p < 0.001$ ), short bouts (6-7yrs, 6.4 ± 2.7; 8-9yrs, 5.5 ± 2.8; 10-11yrs, 4.7 ± 3.1; 12-13yrs, 4.5 ± 3.8; 14-15yrs, 4.6 ± 4.5; and 16+yrs, 4.6 ± 5.8;  $p < 0.001$ ), and med-long bouts (6-7yrs, 2.4 ± 1.8; 8-9yrs, 2.0 ± 2.1; 10-11yrs, 1.6 ± 1.9; 12-13yrs, 1.8 ± 2.6; 14-15yrs, 2.0 ± 3.1; and 16+yrs, 1.9 ± 4.4;  $p = 0.002$ ) of MVPA. Males participated in less sporadic bouts of MVPA (male: 91.7% ± 2.6; female: 94.6% ± 5.6,  $p < 0.001$ ), more short bouts of MVPA (male: 5.8% ± 4.3; female: 4.1% ± 4.1,  $p < 0.001$ ), and more med-long bouts (male: 2.5% ± 3.1; female: 1.4% ± 3.0,  $p < 0.001$ ) of MVPA. Results remained significant after multivariable adjustment for sex, race/ethnicity, income, and age. **Conclusions:** In addition to decreasing total minutes of MVPA, there are also changes in PA bout patterns as youth age. Changes in PA bout patterns by age are moderated by race/ethnicity and sex. Future interventions could focus on changing PA patterns in addition to increasing total minutes of MVPA.

## B-11 Thematic Poster - Landing Biomechanics

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
 Room: 101

607 **Chair:** Kevin R. Ford, FACSM. *High Point University, High Point, NC.*

(No relationships reported)

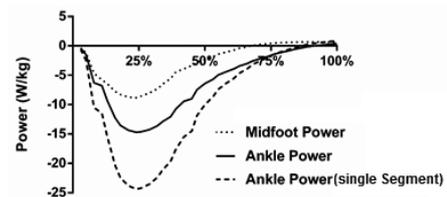
608 Board #1 May 31 1:00 PM - 3:00 PM  
**The Role of the Midtarsal Joint in Drop Landings**

Dustin A. Bruening, Mark T. Olsen, A. Wayne Johnson, Sarah T. Ridge. *Brigham Young University, Provo, UT.*

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(No relationships reported)

Multi-segment foot models have allowed the foot to be studied in greater detail, in particular separating the functions of the ankle andmidtarsal joints. While these models have been used in walking and running, they have been limited in application to other sports movements, such as jumping and landing. **Purpose:** To investigate the role of themidtarsal and ankle joints in energy absorption during drop landings using a multi-segment foot modeling approach, and to compare these results with those obtained from a single segment model. **Methods:** Twelve volunteer female collegiate athletes [age: 20.5±1.4 years, height: 162.1±5.4 cm, weight: 58.2±6.1 kg] performed one legged barefoot drop landings from a height of 40 cm. Hanging from wooden rings, each subject dropped onto two adjacent force platforms, so that the hindfoot and forefoot contacted separate plates. Sufficient trials were performed until 3 accurate landings were achieved. 28 reflective markers, attached to the subjects' dominant leg, were used to create a custom kinetic multi-segment foot model. Ankle andmidtarsal joint angles, powers, and total work were calculated from initial contact through the lowest point of the subject's center of mass, representing the energy absorption phase of the landing. **Results:** Themidtarsal joint was plantarflexed prior to contact and moved through nearly as great a range of motion (90%) as the ankle (24.6 ± 7.3° ankle vs. 21.9 ± 7.5°midtarsal), while performing two-thirds the amount of work done by the ankle (0.63 ± 0.21 J/kg at the ankle vs. 0.42 ± 0.17 J/kg at themidtarsals). The single segment foot overestimated both range of motion (40.4 ± 8.8°) and work done (1.05 ± 0.28 J/kg) by 40%. **Conclusion:** Themidtarsals can play a substantial role in impact energy absorption, which may have implications in injury prevention strategies. Future studies should attempt to separate active (i.e. muscles) and passive (e.g. ligaments, windlass mechanism, etc.) contributions tomidtarsal function.



609 Board #2 May 31 1:00 PM - 3:00 PM  
**Effects of Achilles Tendon Taping on Joint Energetics in Jumping and Landing**

Evan McConnell, Philip Hernandez, Robin Queen, FACSM. *Virginia Tech, Blacksburg, VA.* (Sponsor: Robin Queen, FACSM)

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(No relationships reported)

Taping of the Achilles tendon is used by athletes to manage pain during recovery. Previous work has shown differences in ankle work but no differences in force

production with various ankle taping techniques during athletic tasks. **PURPOSE:** To examine the effects of an Achilles tendon assistive taping technique and gender on lower extremity joint work, power generation, and power absorption during jumping and landing in healthy recreational athletes. **METHODS:** 29 subjects - 16 males (20.9 ± 2.4 years, 1.79 ± 0.06 m, 79.0 ± 11.9 kg) and 13 females (21.4 ± 3.2 years, 1.66 ± 0.06 m, 66.1 ± 7.6 kg) - participated in the study. Each subject's dominant limb underwent an Achilles tendon assistive taping procedure by a certified athletic trainer. Subjects performed 5 trials of a stop jump task in both a taped and non-taped condition (randomized test order). The first landing and subsequent jump were analyzed with a 10-camera motion analysis system (240Hz). Joint power was determined based on data from 2 embedded force plates (1920 Hz) using inverse dynamics and was integrated to yield joint work. 2x2 ANOVAs were performed ( $p < 0.05$ ) to determine gender and taping condition effects on peak power generation, power absorption, and work at each joint during landing and jumping. **RESULTS:** Subject height ( $p < 0.001$ ) and mass ( $p = 0.002$ ) differed based on gender, but age ( $p = 0.633$ ) did not. No significant interactions and no taping condition main effects existed for power or work during either jumping or landing. A main effect of gender was identified, with females showing decreased peak power generation at each joint during jumping (Table 1). **CONCLUSIONS:** The assistive taping does not alter peak power generation, power absorption or joint work during landing and jumping in healthy subjects, but gender-specific differences in power generation do exist. Future work is needed to determine the effect of this taping technique in injured athletes.

**Table 1: Peak Power Generation**

		Females		Males		Gender Effect
		Non-Taped	Taped	Non-Taped	Taped	
Ankle	Landing	-12.3 ± 4.6	-12.3 ± 4.5	-13.0 ± 4.6	-11.6 ± 4.8	$p = 0.863$
	Jumping	15.6 ± 5.4	13.4 ± 4.2	18.1 ± 3.8	15.9 ± 4.0	$p = 0.042$
Knee	Landing	-17.3 ± 2.9	-18.6 ± 5.5	-21.0 ± 6.0	-20.0 ± 5.4	$p = 0.077$
	Jumping	11.2 ± 2.9	11.5 ± 3.3	15.2 ± 3.5	14.7 ± 3.4	$p = 0.001$
Hip	Landing	-7.6 ± 5.0	-6.1 ± 3.2	-13.3 ± 6.1	-14.9 ± 6.1	$p = 0.040$
	Jumping	6.3 ± 5.0	4.6 ± 1.9	10.2 ± 8.1	9.6 ± 6.4	$p = 0.009$

\* Units in N\*m/(BW\*BH\*s)

**610 Board #3 May 31 1:00 PM - 3:00 PM**  
**Lateral Extrinsic Foot Muscle Size Best Predicts Time To Stability In Single Leg Landing**

Julia L. Dunbar, Sarah T. Ridge, Dustin Bruening, Kelsey R. Garner, Dennis L. Eggett, Aaron W. Johnson. *Brigham Young University, Provo, UT.* (Sponsor: Ty Hopkins, FACSM)  
*(No relationships reported)*

A single leg, barefoot landing is a functional movement often executed in athletic events. The inability to quickly stabilize the ankle joint during a landing may contribute to injury risk. **PURPOSE:** To determine whether the size of specific medial and lateral extrinsic foot muscles can be used to predict shorter time to stability in female athletes performing single leg, barefoot landings. **METHODS:** Twenty-one female collegiate gymnasts and cheerleaders (age: 21.2 ± 1.4 years; height: 1.6 ± 0.06 m; weight: 58.1 ± 5.7 kg) completed a dominant single leg, barefoot landing onto a force plate from a height of 28 cm. The time to stability was calculated from the recorded medial to lateral force after landing. The size of the tibialis anterior (TA), tibialis posterior (TP), flexor digitorum longus (FDL), fibularis brevis (FB), and fibularis longus (FL) were measured using ultrasound imaging (12L probe, GE Logiq P6). The TA, TP, and FL were assessed at a distance of 30% from the knee joint-line to the tip of the lateral malleolus. FDL was measured at a distance of 50% from the knee joint-line to the medial malleolus while FB was measured at a distance of 50% from the knee joint-line to the lateral malleolus. Muscle sizes (thickness for the TA and TP and cross sectional area for FDL, FB, and FL) were measured from the ultrasound images ( $p \geq 0.05$ ). **RESULTS:** A stepwise regression (including height, weight, and muscle size(s)) indicated that the two best predictors of time to stability were the FB and FL ( $r^2 = 0.45$ ,  $FB p = 0.002$ ,  $FL p = 0.083$ ; cross-sectional areas:  $FB = 3.4 \pm 1.2 \text{ cm}^2$ ,  $FL = 4.8 \pm 1.1 \text{ cm}^2$ ). **CONCLUSION:** It appears athletes with larger FB and FL had shorter time to stability. These results suggest strengthening of the lateral extrinsic muscles may be a key component in both the prevention and rehabilitation of ankle injuries among gymnasts and other barefoot athletes.

**611 Board #4 May 31 1:00 PM - 3:00 PM**  
**Landing Patterns of Collegiate Female Volleyball Players During Practice and Game Competition**

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*(No relationships reported)*

Women's volleyball is generally recognized as a high-volume jumping sport. This repetitive jumping and landing can lead to overuse injuries, especially if performed exclusively on a single-leg. While some data is available regarding jumping volume during competition, there have been few reports on jumping load during practice, and minimal characterization of the double- (DL) and single- (SL) leg landing patterns during the sport to help shape training and/or rehabilitation procedures. **PURPOSE:** To quantify and characterize the jump landing patterns that occur during women's collegiate volleyball practice and game competition. **METHODS:** Recordings from two video cameras from four consecutive competitions (three practices, one game) of 14 Division-1 collegiate women's court volleyball players were analyzed for this study. Recordings were viewed by one of two raters who noted the total number of jumps and categorized each landing as a DL landing, or SL landing on the right (SL<sub>R</sub>) or left (SL<sub>L</sub>) side. Repeated measures ANOVAs identified differences in jumping load, and the ratio of DL to SL, and SL<sub>R</sub> to SL<sub>L</sub> landings among practices and between practice and game competition ( $p < 0.05$ ). **RESULTS:** On average, there was a significantly higher overall jumping load (practice: 66.7 ± 40.1 jumps (j), game: 41.5 ± 44.6 j;  $p = 0.01$ ), and frequency of DL (practice: 50.5 ± 38.5 j, game: 31.9 ± 38.6 j;  $p = 0.03$ ) and SL (practice: 16.2 ± 12.8 j, game: 9.6 ± 15.8 j;  $p = 0.04$ ) landings during practice than games. However, individual patterns of DL to SL (practice: 0.76 ± 0.13, game: 0.75 ± 0.18;  $p = 0.99$ ) and SL<sub>R</sub> to SL<sub>L</sub> (practice: 0.35 ± 0.17, game: 0.36 ± 0.39;  $p = 0.89$ ) were consistent across competitive events. There were no significant differences in any of the jumping or landing variables between practices ( $p > 0.05$ ), yet substantial variability of landing patterns was identified between individuals, with the percentage of DL landings ranging from 35.8-96.0% of total landings and SL<sub>R</sub> landings ranging from 3.6-97.4% of SL landings. **CONCLUSIONS:** Volleyball players were found to jump significantly more often during practices than games, but DL and SL landing patterns remained consistent. These data may help clinicians and coaches design training and/or rehabilitation procedures to better simulate the landing demands during volleyball competition.

**612 Board #5 May 31 1:00 PM - 3:00 PM**  
**Influence of Hip Extension Strength on Landing Biomechanics In Collegiate Basketball Players**

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*(No relationships reported)*

Decreased hip strength has been suggested to contribute to landing biomechanics that increase the risk of ACL injuries. However, the relationship between hip strength and landing biomechanics is conflicting. Previous studies are limited to examining the peak torque produced during isometric or isokinetic assessments of hip strength. Understanding how the isokinetic torque production of the hip through a range of motion may help clarify the role of hip strength in landing biomechanics. **PURPOSE:** To examine the influence of hip isokinetic eccentric (ECC) and concentric (CON) work on landing biomechanics in male and female basketball players. **METHODS:** Twenty-three male (N=11, 20.5 ± 1.4 yrs, 189.2 ± 8.0 cm, 90.2 ± 10.4 kg) and female (N=12, 19.9 ± 1.4 yrs, 172.4 ± 6.8 cm, 78.9 ± 13.8 kg) Division 1 basketball players participated. Using an isokinetic dynamometer, 5 repetitions of isokinetic CON and ECC hip extension torque were measured at 60 deg/s, with the work per repetition of the middle 3 repetitions used for analyses. Established 3D motion analysis techniques were used to collect three trials of a drop vertical jump and quantify the left limb's sagittal, frontal, and transverse plane hip and knee joint excursions and peak external joint moments, normalized to body weight and height (BWHT). Separate step-wise, linear regressions determined the extent to which CON and ECC work predicted landing biomechanics in males and females. **RESULTS:** In males, the average ECC and CON work per repetition was 0.98 ± 0.15 J/BWHT and 0.92 ± 0.18 J/BWHT, respectively. In females, the average ECC and CON work per repetition was 0.91 ± 0.25 J/BWHT and 0.94 ± 0.21 J/BWHT, respectively. Greater ECC work predicted less hip adduction moment (0.40 ± 0.29 Nm/BWHT,  $R^2 = 0.411$ ,  $P = 0.025$ ) in females. ECC and CON work was not predictive of any other hip or knee joint excursions or peak moments in males or females (all  $P > 0.05$ ). **CONCLUSIONS:** With the exception of hip adduction moment in females, ECC and CON hip strength was not predictive of landing biomechanics. This suggests that a combination of neuromuscular factors at the hip, such as muscle activation, combine to predict lower extremity biomechanics during dynamic activities. Further work is needed to clarify this relationship in more demanding tasks.

613 Board #6 May 31 1:00 PM - 3:00 PM  
**The Changes in Impacts and Soft-tissue Responses of Lower Limbs between Active and Unanticipated Landings**

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 (No relationships reported)

Muscle activity patterns can be modulated in response to soft-tissue vibrations of lower extremity induced by the magnitude of the peak impact and the high loading rate of vertical ground reaction force during landing to reduce the high injury risk. However, the sudden changed pattern of unexpected landing would potentially influence the impact force (as a input signal) and the soft-tissue vibration (as a response), which may further affect the landing performance or even cause injury.

**PURPOSE:** To determine the biomechanical differences of impact force and soft-tissue vibration between active landing (AL) and unexpected landing (UL).  
**METHODS:** Twelve trained male basketball volunteers were requested to land from self-made elevated platform at three heights (30, 45, and 60cm) in two different landing maneuvers (AL & UL). The 3D force plates and accelerometers were used to collect the impact and soft-tissue vibration characteristics. The variables for AL & UL included: 1) impact characteristics: the peak of impact force (BW), maximum loading rate (kN/s) and impact frequency (Hz); 2) soft-tissue vibration: maximum amplitude (g) and damping coefficient ( $s^{-1}$ ) of soft-tissue vibration of quadriceps & hamstrings. A 2 × 3 (landing style × height) repeated measures analysis of variance was used to examine the differences between conditions. **RESULTS:** For the impact characteristics, the peak of impact force (30cm: 3.90 ± 1.16 vs. 2.17 ± 0.50 ; 45cm: 4.35 ± 1.02 vs. 2.82 ± 0.80; 60cm: 4.73 ± 0.84 vs. 3.60 ± 0.64), maximum loading rate (30cm: 240.3 ± 63.8 vs. 88.4 ± 22.5; 45cm: 273.9 ± 77.3 vs. 157.3 ± 36.0; 60cm: 301.6 ± 73.3 vs. 203.3 ± 46.0), and impact frequency (30cm: 15.6 ± 2.3 vs. 7.96 ± 2.2; 45cm: 23.1 ± 2.2 vs. 8.73 ± 1.7; 60cm: 26.1 ± 2.4 vs. 10.38 ± 1.5) in UL was significantly higher than those in AL ( $p < .05$ ) for all three drop heights, respectively. For soft tissue vibration, UL had a significantly greater maximum amplitudes of vibration of quadriceps (except for 60 cm) and hamstrings ( $p < .01$ ) and lower damping coefficients ( $p < .05$ ) compared with AL. **CONCLUSION:** If the neuromuscular system fails to prepare properly for an unexpected landing impact, increased magnitude of impact forces and soft-tissue vibrations emerged which might be detrimental to the impact-related injury.  
 Supported by NSFC grant (81302131).

614 Board #7 May 31 1:00 PM - 3:00 PM  
**Effect of Different Sports on Hip and Knee Biomechanics in Adolescent Females During a Jump-Landing**

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 (No relationships reported)

Anterior Cruciate Ligament (ACL) injury is common in adolescent female athletes, with those who participate in soccer (SC) being at the highest risk for primary and secondary ACL injury. However, little is known about the biomechanical differences that may contribute to the variance in injury rate between SC and other sports in adolescent females. Previous research demonstrates that college-age females who participate in SC exhibit greater frontal plane projection angle (FPPA) values than those who participate in basketball (BKB). **PURPOSE:** To assess for differences in hip and knee frontal plane kinematics between adolescent female SC and BKB players. **METHODS:** Cross-sectional study design. Females (N = 30) participating in BKB (Age = 15.33 ± 1.68 yrs; Ht = 167.14 ± 5.91 cm; Mass = 60.49 ± 9.59 kg) or SC (Age = 15.33 ± 1.68 yrs; Ht = 162.86 ± 3.84 cm; Mass = 56.55 ± 5.85 Kg). Participants had International Knee Documentation Committee Subjective Knee Form (IKDC) scores ≥ 95, were healthy at time of testing, and were matched by age and side of dominance (DOM = limb used to kick a ball). During three separate jump-landing tasks, bilateral lower extremity joint angles and moments were assessed at initial contact. Joint displacement (DSP = maximum or minimum - IC) and FPPA (2-dimensional measure of knee valgus) were calculated. Separate independent t-tests were performed to examine differences between groups. **RESULTS:** DOM hip adduction (ADD) DSP was significantly greater in the SC group (9.51 ± 1.3°) compared to the BKB group (4.9 ± 3.1°,  $t_{(28)} = -5.2, p < .001$ ). DOM hip abduction DSP was significantly greater in the BKB group (-3.7 ± 3.2°) compared to the SC group (-1.0 ± 0.9°,  $t_{(28)} = -3.1, p = .004$ ). DOM FPPA negative DSP (knee varus) (BSK = -9.8 ± 8.0°, SC = -5.29 ± 3.9°,  $t_{(28)} = -1.96, p = .05$ ) and non-DOM FPPA negative DSP (BKB = -13.5 ± 4.4°, SC = -6.3 ± 3.0°,  $t_{(28)} = -2.7, p = .01$ ) was significantly greater in the BKB group compared to the SC group. No other significant differences were observed. **CONCLUSIONS:** Greater hip ADD DSP is associated with higher ACL injury risk. Female SC players may be at increased ACL injury risk partially due to higher hip ADD DSP exhibited during

landing as compared to the BKB group. The ability of female BKB players to maintain greater knee varus when compared to SC may also contribute to the variance in ACL injuries in these sports.

615 Board #8 May 31 1:00 PM - 3:00 PM  
**Landing Biomechanics Influence Circulating Stress Hormone Levels**

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 (No relationships reported)

High training load (HTL) exposure and stiff landing biomechanics increase an individual's risk of lower extremity injury during sport and physical activity participation. **Purpose:** To determine the influence of movement profile on systemic stress response to HTL exposure. **Methods:** 40 physically active, healthy, college-aged females were enrolled in this study and were assigned to a low-risk / soft (n=19; age=20.5±1.9 yr, height=1.44±0.44 m, mass= 64.5±7.8 cm) or a high-risk / stiff (n=21; age=20.4±1.3 yr, height=1.63±0.23 m, mass= 64.9±6.1 cm) movement profile group defined by The Landing Error Scoring System. Participants completed five cycles of 5-minute treadmill running at a speed coincident with 110-120% ventilatory threshold and 10 jump-landings from a 30 cm box. Blood samples were collected at baseline and 30 minutes following HTL exposure. Menstrual cycle phase, prior diet and exercise were controlled. Samples were analyzed using commercially available ELISA kits to determine serum cortisol concentrations [C]. A two-way mixed model ANOVA was used to evaluate the effect of movement profile on systemic stress response to HTL exposure. **Results:** No significant movement profile-by-time interactions were observed ( $F_{1,38} = 0.157, p > 0.05$ ). There were significant main effects for group ( $F_{1,38} = 10.81, p < 0.05$ ) and time ( $F_{1,38} = 9.64, p < 0.05$ ), with a high-risk / stiff movement profile being associated with greater overall circulating cortisol, and HTL exposure inducing increases in cortisol in both movement profile groups. Movement profile and time descriptive statistics and effect sizes are presented in table 1. **Conclusions:** A high-risk / stiff movement profile is associated with elevated cortisol, a biomarker of systemic stress. Movement profile may moderate systemic stress levels via a high or low level of biomechanical efficiency and shielding against or amplifying mechanical loads experienced during activities of daily life and physical activity.

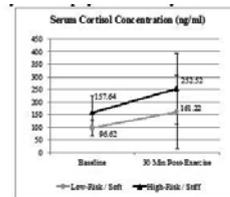


Figure 1. - Raw group serum cortisol response to HTL exposure.

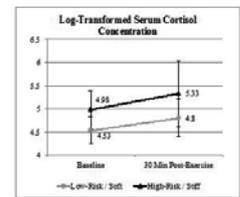


Figure 2. - Log-transformed group serum cortisol response to HTL exposure.

Table 1. - Means, standard deviations, 95% confidence intervals, and effect sizes for the main effects of movement profile and high training load exposure on serum cortisol concentrations [C].

	Baseline			30 min Post-Exercise			Cohen's D
	n	Mean (SD)	95% CI	n	Mean (SD)	95% CI	
Log Cortisol [C]	40	4.77 (0.42)	[4.63, 4.9]	40	5.08 (0.76)	[4.84, 5.32]	0.51
Raw Cortisol [C] (ng/ml)	40	128.66 (59.84)	[110.11, 147.2]	40	209.15 (147.87)	[163.33, 254.98]	0.71
	Low-Risk/ Soft			High-Risk/ Stiff			Cohen's D
	n	Mean (SD)	95% CI	n	Mean (SD)	95% CI	
Log Cortisol [C]	19	4.66 (0.36)	[4.41, 4.91]	21	5.16 (0.61)	[4.90, 5.42]	0.84
Raw Cortisol [C] (ng/ml)	19	128.92 (108.12)	[80.31, 177.53]	21	205.08 (118.30)	[154.49, 255.68]	0.67

**B-12 Free Communication/Slide - Exercise Psychology**

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
Room: 401

616 **Chair:** Dane B. Cook, FACSM. *University of Wisconsin-Madison, Madison, WI.*

(No relationships reported)

617 May 31 1:00 PM - 1:15 PM

**Real-time Assessment of the Relationship Between Exercise and Psychological Stress in Overweight Women**

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(No relationships reported)

Although higher physical activity (PA) levels are associated with lower psychological stress, real-time associations between PA and stress have not been adequately examined. It is unclear whether stress more often serves as a barrier to PA, thus reducing the likelihood of exercising when stress is high, or whether PA is used as a coping strategy for reducing stress. **PURPOSE:** This study combined objective PA monitors with real-time psychological stress assessments to examine the pattern of stress prior to and following an exercise bout and to determine whether the magnitude of stress predicted PA engagement. **METHODS:** 52 women with overweight/obesity (BMI: 31.5±4.5 kg/m<sup>2</sup>, age: 48.9±9.0 years) were instructed to respond to 5 semi-random prompts delivered daily via their smartphone over a 14-day period while simultaneously wearing an objective PA monitor (SenseWear armband). Stress ratings at each prompt were reported using a 1-7 Likert scale (ranging from 'not at all' to 'very much so'). Moderate-to-vigorous intensity PA bouts (MVPA; ≥3 METs & ≥ 10 minutes in duration) were identified and examined in relation to stress ratings. **RESULTS:** Compliance to answering the surveys (88.0±9.1%) and wearing the armband was high (13.1±1.9 days; 14.1±1.6 hrs/day). On average, participants engaged in 17.3±16.2 min/day of bout-related MVPA and stress ratings were 2.17±0.03 (mean±SE). There was no association between each participant's total MVPA minutes and average stress over the 14-day period ( $r=-0.03$ ,  $p=0.81$ ). However when examined acutely, stress decreased in the time preceding exercise and continued to decrease following exercise ( $p=0.04$ ). Further, when stress was high during the first prompt of the day (stress≥5; 16% of all cases), participants were significantly less likely to exercise on that day compared to when stress was low (stress<5;  $\beta=0.70$ ,  $p=0.004$ ). **CONCLUSIONS:** When PA and stress were assessed using a unique combination of real-time data collection methods, overweight women did not appear to use PA as a method of coping with stress; rather PA occurred more often when stress was low and on a downward trajectory. These findings suggest that reducing stress may be a useful strategy for promoting PA adoption. Future studies should examine this relationship in other populations, including those with higher stress levels.

618 May 31 1:15 PM - 1:30 PM

**Age Moderates the Association Between Short Sleep Duration and Reduced Exercise Frequency**

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(No relationships reported)

Chronic short sleep increases the risk of a driving accident, obesity and cardiovascular disease mortality. Whether the frequency of resistance and aerobic exercise is reduced among short sleepers has not been examined across a broad range of ages. **PURPOSE:** To assess relationships between sleep duration and self-reported aerobic or resistance exercise frequency according to age. **METHODS:** 8,479 female and male online game players, aged 13 to 79 years, completed a lifestyle survey. Participants provided demographics (age, gender, education level), typical sleep duration, and typical weekly frequency of aerobic and resistance exercise. Data also were obtained on smoking and caffeinated coffee and tea use. Sleep duration (short [ $< 7$  hours per night] vs. normal [7 to 9 hours per night]) x Age (13-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79) ANCOVAs were used to examine relationships. **RESULTS:** Compared to normal sleepers (68% of the sample), short sleepers reported fewer weekly resistance (1.77 vs. 1.99) and aerobic exercise (2.62 vs. 2.92) bouts, effects that interacted with age (RESISTANCE: sleep x age interaction  $F=2.243$ ,  $P=.036$ ; AEROBIC: sleep x age interaction  $F=2.142$ ,  $P=.046$ ). The sleep x age interaction remained significant for both resistance ( $F=2.744$ ,  $P=.012$ ) and aerobic ( $F=2.449$ ,  $P=.023$ ) exercise after including

gender, education level, smoking and caffeinated coffee and tea in the models as covariates. Post-hoc tests showed that compared to normal sleepers, weekly resistance exercise frequency was lower in 40-year old (1.46±1.61 [n=428] vs. 1.75±1.66 [n=752],  $t=-2.892$ ,  $df=1,178$ ,  $P=.004$ ) and 50-year old (1.50±1.57 [n=593] vs. 1.81±1.64 [n=1161],  $t=-3.741$ ,  $df=1,752$ ,  $P<.001$ ) short sleeper groups only. Compared to normal sleepers, weekly aerobic exercise frequency was lower in the 40-year old (2.32±1.83 [n=435] vs. 2.82±1.98 [n=756],  $t=-4.282$ ,  $df=1,189$ ,  $P<.001$ ), 50-year old (2.58±2.06 [n=597] vs. 3.04±1.98 [n=1173],  $t=-4.572$ ,  $df=1,160.228$ ,  $P<.001$ ) and 60-year old (2.81±2.04 [n=455] vs. 3.05±1.99 [n=1017],  $t=-2.115$ ,  $df=1,470$ ,  $P=.035$ ) short sleepers. **CONCLUSION:** Age moderates the association between short sleep duration and self-reported aerobic and resistance exercise in online game players.

619 May 31 1:30 PM - 1:45 PM

**Exploring The Link Between Exercise Identity And Intervention Dosage: I-fit (Initiating Feelings Of Individual Transformation)**

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(No relationships reported)

Adolescent overweight and obesity in the United States has increased in past decades, resulting in numerous physiological and psychological consequences. Obesity interventions often aim to increase physical activity (PA). Such interventions may strengthen Exercise Identity (EI). A strong EI has been positively related to long-term PA engagement, as individuals seek to engage in behaviors congruent with the role identity of "exerciser." Greater dosage of PA intervention may progressively increase EI, and enhance future exercise behavior. However, the relationship between PA intervention dosage and EI in an overweight and obese adolescent population is unclear.

**PURPOSE:** To determine if a PA intervention, when delivered in varying dosages, may strengthen an overweight or obese adolescent's EI.

**METHODS:** Fifty overweight and obese adolescents (age=14.16 ± 1.88 years, BMI=35.66 ± 7.87 kg/m<sup>2</sup>, BMI percentile=97.5% ± 3.7%) were recruited from a behavior change summer camp, which included a PA intervention component. Age, gender, height, and weight were collected, and BMI was calculated. The participants were categorized into three separate groups, according to length of PA intervention (dosage): 3 week PA dosage, 4-5 week PA dosage, and 6-7 week PA dosage. Participants completed the Anderson Exercise Identity Scale and 3 Day Physical Activity Recall (3DPAR) at pre- and post-intervention. Group comparisons of EI were made using two-way ANOVA. Changes in vigorous physical activity (VPA) within groups were calculated using Log-Rank, Kaplan-Meier, and Wilcoxon. Activities on the 3DPAR were categorized and coded to compare exercise behavior within groups.

**RESULTS:** Upon comparison, the mean EI in the 6-7 week intervention group significantly differed from other group means and resulted in a significant increase in EI within groups ( $p<0.001$ ). All intervention groups demonstrated significant increases in VPA ( $p<0.05$ ), and complied with National PA Guidelines of 60+ minutes of MVPA daily; VPA performed on at least 3 days/week.

**CONCLUSION:** Exercise Identity may be increased in overweight and obese adolescents following a physical activity intervention. Greater dosage of physical activity intervention will result in greater benefits to Exercise Identity, and may ultimately enhance long-term exercise behavior.

620 May 31 1:45 PM - 2:00 PM

**Physical Activity Beliefs in Middle-aged, Weight-challenged Women with Sedentary Jobs**

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(No relationships reported)

Physical inactivity, overweight, and obesity are major public health problems in the United States and in the developed world, leading to increased morbidity and mortality. More information is needed regarding physical activity beliefs, attitudes, and perceived self-control among those who are currently sedentary, weight-challenged, and who are frequently underserved by the health/fitness industry.

**Purpose:** To elicit physical activity beliefs about feasibility, pleasure, and movement descriptions from middle-aged, weight-challenged women with sedentary jobs.

**Method:** Open-ended questions were utilized throughout individual 30-minute interviews with 23 female participants (age:  $M = 52.0$ ,  $SD = 7.3$ ; BMI:  $M = 34.2$ ,  $SD = 9.79$ ). The intention of the questions was to obtain in-depth insights into participants' beliefs, attitudes, perceived norms, and physical activity behaviors. Questions were asked regarding physical activity descriptions, preferences, pleasurable, and motivating phrases used by physicians and fitness professionals. After the interview process, participants were divided into those who reported they were completely sedentary (12 non-doers) and those who reported they regularly engaged in physical activity (11 doers).

**Results:** A content analysis and independent *t*-test revealed that non-doers were significantly less active and had more perceived barriers to physical activity (4.58 + 1.88) than doers (1.27 + 1.49;  $p < 0.05$ ). The most frequently cited perceived barriers were injuries, caregiving responsibilities, time, age, dislike of sweating, and depression. Non-doers were significantly more likely to prefer easy-to-moderate intensities, while doers preferred moderate-to-vigorous intensities. Non-doers were also significantly less likely than doers to report physical activity as pleasurable, and they were more likely to cite needing an exercise buddy. The most frequently cited pleasurable activities in both groups were yoga, movement to music, stretching, and walking.

**Conclusions and implications:** This study provides useful information for health educators and health/fitness professionals seeking to promote physical activity among middle-aged women with weight challenges.

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### Body-heart-brain Interaction On Exercise: Effects Of Intensity On Inhibitory Control, Affect, Autonomic Cardiac Function And Brain Oxygenation

Wesley Quirino Alves da Silva<sup>1</sup>, Eduardo Bodnariuc Fontes<sup>1</sup>, Zayonara Larissa Lima<sup>1</sup>, Rodrigo Menezes Forti<sup>2</sup>, Alexandre Hideki Okano<sup>1</sup>, Andréa Camaz Deslandes<sup>3</sup>, Erika Hussey<sup>4</sup>, Nathan Ward<sup>4</sup>, Hassan Mohamed Elsangedy<sup>1</sup>. <sup>1</sup>Federal University of Rio Grande do Norte, Natal, Brazil. <sup>2</sup>Campinas State University, Campinas, Brazil. <sup>3</sup>State University of Rio de Janeiro, Natal, Brazil. <sup>4</sup>Tufts University, Medford/Somerville, MA.

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(No relationships reported)

Recent work suggests that inhibitory control influences affective regulation and is an important neurobiological mechanism that contributes to physical activity behavior. However, the effects of exercise intensity in this complex interaction body-heart-brain remain unclear. **PURPOSE:** Investigate the effects of exercise intensity on inhibitory control, affect, autonomic function and prefrontal cortex (PFC) oxygenation. **METHODS:** 37 sedentary young adults were randomly assigned to two experimental conditions (control or exercise). For the exercise condition, a maximum incremental test was performed on a cycle ergometer with continuous measurements of PFC oxygenation, heart rate variability (HRV), inhibitory control (Stroop test), associative and dissociative thoughts (ADT) and affect scale every 2 minutes at each of 8 intensity increments. For the control condition, the same assessments were carried out, but participants sat on a cycle ergometer without active pedaling. We evaluated the effects with a two-way repeated measures ANOVA with *Bonferroni* adjustments to compare the effects and interactions of condition and intensity. Then, *Pearson's correlations* to evaluate the relationship between affect and inhibitory control, ADT, HRV and PFC oxygenation. **RESULTS:** Intensities above the ventilatory threshold (VT) induced poorer inhibitory control ( $F=33.64$ ;  $p < 0.001$ ), more ratings of unpleasantness ( $F=200.60$ ;  $p < 0.001$ ), increased HRV activity ( $F=29.96$ ;  $p < 0.001$ ) and increased oxygenation of the PFC ( $F=55.97$ ;  $p < 0.001$ ). Pleasure perception was correlated with ADT at almost all intensities from 2-VT to VT+2 ( $r_s > -0.33$ ,  $p_s < 0.05$ ). We also found pleasure correlation with HRV lower frequencies analysis ( $r = -0.34$ ;  $p < 0.05$ ) and ratio between low and high frequency ( $r = -0.33$ ;  $p < 0.05$ ), in the last stage of intensity, and to PFC deoxy was found at VT+2 intensity ( $r = -0.37$ ;  $p < 0.05$ ). **CONCLUSION:** Exercise at high intensities reduces inhibitory control and affect (ratings of pleasantness). Displeasure correlates to increases in thoughts associated to exercise, and at high intensities, displeasure is correlated with PFC deoxygenation and sympathetic activity. These findings strengthen the existence of an integrative body-heart-brain system and suggests a role of the exercise intensity in this interaction.

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### Associations Between Mother'S And Children'S Moderate-to-vigorous Activity And Sedentary Time In The Family Context

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(No relationships reported)

Little is known about association between moderate-to-vigorous physical activity (MVPA) and sedentary time (ST) among mothers and their children in different settings (e.g., home, outside of home, weekday vs. weekend).

**PURPOSE:** (1) Describe the association of MVPA and ST among mothers and their children, overall and while they are at home together, (2) determine how children's and parents' characteristics, and setting, moderate the association in their respective MVPA and ST.

**METHODS:** We used Healthy Families baseline data from 55 mothers and their children (aged 3-5 years [ $n=25$ ] and 10-13 years [ $n=30$ ]). MVPA and ST data were collected using accelerometry over a seven day period. Proportion of time in sedentary behavior and MVPA between 08:00 h and 20:00 h was calculated. Mixed-effects models were used to examine the association between mothers' levels of ST and MVPA and those of their children.

**RESULTS:** There was little variability in levels of ST and MVPA by time of day among mothers or children, overall and while at home together. After controlling for child and parent characteristics, and setting variables, mother-child ST and MVPA levels were positively associated ( $P < 0.001$ ). The association for ST and MVPA were 2.2 times ( $\beta = 0.254$  versus  $\beta = 0.116$ ) and 1.7 times ( $\beta = 0.365$  versus  $\beta = 0.215$ ) stronger, respectively, when mother and child were at home together (compared to when one or neither were at home). The association did not differ by day of the week.

**CONCLUSION:** MVPA and ST in mothers and their children are directly associated, and that association differed by changes in setting. These results support the rationale for developing a family-centered interventions that take place in the home to increase PA and decrease ST.

Variables	Models	
	Child's ST	Child's MVPA
Mother's ST/MVPA	0.116 (0.050, 0.182)*	0.215 (0.066, 0.363)*
Mother's ST/MVPA by both at home	0.138 (0.059, 0.217)*	0.150 (0.013, 0.286)*

\*adjusting for child's gender, child's age group, mother's BMI, age, education, race/ethnicity, family income to needs ratio, number of electronic devices at home, number of available PA equipment pieces at home, day of the week, both at home or not. \* $P < 0.001$

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### A New Test to Measure Neuromuscular Fatigue During and Immediately After Cycling Exercise: A Reliability Study

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(No relationships reported)

Neuromuscular (NM) fatigue has often been measured in human participants through single-joint isometric exercise tests. However, this task is not representative of whole-body exercise (WBE) such as running, and cycling. Furthermore, most studies assessing NM fatigue from WBE have delayed measurement for 1-4 minutes after task failure, despite the knowledge that the NM system can recover quickly. **PURPOSE:** To demonstrate the reliability of a new cycling ergometer for the measurement of NM fatigue in healthy subjects during and immediately after WBE. **METHODS:** A sample consisting of 12 healthy adult males and females aged 19 to 32 was recruited. Each subject performed a fatiguing protocol on the new cycling ergometer on two separate occasions. This protocol had subjects pedal until task failure at pre-determined power outputs scaled to their body weight that increased after NM assessments performed at three-minute intervals. NM assessments included voluntary and evoked force production of the quadriceps measured through instrumented pedals within the ergometer. Evoked contractions were achieved through electrical nerve stimulation and transcranial magnetic stimulation. Reliability was determined with intraclass correlation coefficients (ICC) and coefficients of variation (CV). **RESULTS:** During the two sessions, the new cycling test produced a significant mean percent reduction in maximal voluntary contraction (MVC) force from pre to post test of  $36 \pm 12\%$  ( $p < .0001$ ). There was no significant difference in MVC measured on the ergometer between sessions ( $p > .05$ ), with excellent relative (ICC =  $0.97 \pm 0.06$ ) and absolute reliability (CV =  $3.2 \pm 1.6\%$ ). Evoked twitch force, a measure of peripheral fatigue, was reduced by  $46 \pm 14\%$  ( $p < .0001$ ) from pre to post test and showed excellent reliability as well (ICC =  $0.97 \pm 0.06$ ; CV =  $5.2 \pm 1.5\%$ ). There was no significant change ( $p > .05$ ) in percent voluntary activation, a measure of central fatigue, within each session, however there was excellent absolute reliability (CV =  $1.3 \pm 0.5\%$ ;  $97 \pm 2\%$  vs.  $97 \pm 2\%$  measured at pre). **CONCLUSION:** The results suggest that the new ergometer is a reliable tool for measuring NM fatigue during and immediately after exercise. Ultimately, a greater knowledge and understanding of the etiology of NM fatigue will be gained by measuring it during WBE.

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**Lap Time Variation Predicts Task Error During Dual-Task Walking In Cognitively Healthy Women**Joaquin U. Gonzales<sup>1</sup>, Youngdeok Kim<sup>1</sup>, Hyung Suk Yang<sup>2</sup>, Daniel Jensen<sup>2</sup>, Lee Atkins<sup>2</sup>, C. Roger James, FACSM<sup>2</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>Texas Tech University Health Sciences Center, Lubbock, TX. (Sponsor: C. Roger James, FACSM)

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(No relationships reported)

Variation in lap time (LTV) during a fast pace 400m walk test is a new metric thought to be an early indicator of cognitive decline in older adults. While LTV has been found to associate with executive function, no study has examined the potential for LTV to predict capacity of the brain to divide attention and meet the demand of walking and performing other tasks simultaneously. **PURPOSE:** The purpose of this study was to test the hypothesis that greater LTV would associate with larger dual-task cost during walking. **METHODS:** Fifty-two cognitively healthy (MoCA>25) women across a broad age range (30-80y) performed fast pace walking while balancing a tray (Dual1) or balancing a tray while vocalizing serial subtractions by 7's (Dual2). Task error was quantified by degrees of tray tilt and subtraction error. On a separate day, women completed a fast pace 400m walk test (40m x 10 laps) with time to complete each lap recorded. LTV was defined as standard deviation of residuals estimated from the random effects linear model where each lap time was regressed on a person-specific random intercept and random slope associated with lap. Women were categorized into tertiles based on LTV. Comparisons were made between tertiles using ANCOVA after adjusting for age, years of education, and mean lap time. **RESULTS:** Gait speed ( $p=0.57$ ) or the percent change in gait speed ( $p=0.34$ ) were not significantly different between tertiles for the Dual1 condition, but tilt angle was larger in women with greater LTV (tertiles 1 vs. 3:  $1.37\pm 0.12$  vs.  $1.94\pm 0.11$  degrees;  $p=0.006$ ). During the Dual2 condition, women with greater LTV had faster gait speed ( $p=0.02$ ), lower percent change in gait speed (tertiles 1 vs. 3:  $20.5\pm 2.8$  vs.  $9.3\pm 2.6\%$ ,  $p=0.02$ ), similar subtraction error ( $p=0.58$ ), but larger tilt angle (tertiles 1 vs. 3:  $1.24\pm 0.19$  vs.  $2.09\pm 0.17$  degrees,  $p=0.007$ ). **CONCLUSION:** Lap time variation identified women that exhibited greater difficulty balancing an object while walking suggesting that LTV may be sensitive to deficits in the ability to share neural substrate for sensorimotor function. Supported by a Women's Health Research Scholar Grant award from the Laura W. Bush Institute of Women's Health and University Medical Center in Lubbock, TX

**B-13 Free Communication/Slide - Fitness Assessment and Training**Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
Room: 103625 **Chair:** Kimberly Reich. *High Point University, Burlington, NC.*

(No relationships reported)

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**Quantifying Physical Activity Performed During Yoga**Bethany M. Forseth, Caitlyn Hauff, Ann Swartz, FACSM. *University of Wisconsin - Milwaukee, Milwaukee, WI.* (Sponsor: Ann Swartz, FACSM)

(No relationships reported)

The intensity of yoga is challenging to assess because the asanas of yoga include aerobic and anaerobic components; both of these components are measured through different methods. **PURPOSE:** The purpose of this project was to explore a method of assessing the physical activity completed during yoga. This study had two objectives: 1) Quantify characteristics of yoga (number of poses, body posture of a pose), and explore the concept of a pose rate (number of poses per minute of the routine), 2) Compare characteristics between different yoga categories to assess if the measures can differentiate between different yoga practices. **METHODS:** A content analysis was used to assess yoga routines; these routines were categorized by their primary purpose into one of the following groups: weight loss, beginner, or meditation. Researchers recorded the following characteristics from each routine: body position of each pose, number of poses, and duration of the yoga routine. An ANOVA was used to compare routine characteristics between yoga categories. **RESULTS:** Fifteen yoga routines were assessed (weight loss: 4, beginner: 5, and meditation: 6). The total number of poses completed ( $p = 0.010$ ), number of total standing poses ( $p = 0.001$ ), and percent of time in standing poses ( $p = 0.018$ ) were significantly different between the three categories, with weight loss having the highest values. Significant differences were also observed in the number of body postures completed in standing with the head up ( $p < 0.001$ ), and 'other' body positions (any body posture not explicitly

listed) ( $p = 0.033$ ). The number of poses and percentage of time spent in the body postures of supine, seated, and standing with the head down were not significantly different between the routine categories. The pose rate was not significantly different between categories. **CONCLUSIONS:** This study demonstrated that assessing certain characteristics of routines may be one way to describe activity performed during yoga. A common method to assess the activity performed during yoga will allow for easy comparisons between studies and provide a basis to better interpret results. Further research should assess if similar results are found between different yoga styles and if the number of poses completed corresponds to larger physiological or metabolic responses.

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**Practical Issues Relating to a 7 Consecutive Days Wear Protocol Using the activPAL™ in Adolescents**Yan Shi<sup>1</sup>, Wendy Yajun Huang<sup>2</sup>, Sinead Sheridan<sup>1</sup>, Stephen Heung-sang Wong, FACSM<sup>1</sup>. <sup>1</sup>The Chinese University of Hong Kong, Hong Kong, Hong Kong. <sup>2</sup>Hong Kong Baptist University, Hong Kong, Hong Kong. (Sponsor: Stephen Heung-sang Wong, FACSM)

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(No relationships reported)

The activPAL™ has been increasingly used in field-based studies as a valid measure of posture and activity. Practical issues relating to its use have been raised in adults but limited information is available in adolescents. **PURPOSE:** To examine the practical utility of a 7 consecutive days wear protocol of the activPAL™ in adolescents. **METHODS:** Six secondary schools in Hong Kong were randomly chosen for the study. 368 students (12-18 yrs; 47.6% boys) agreed to wear the activPAL™ for 7 consecutive days. The device was worn on the midpoint of the anterior aspect of the right thigh using a water-proof Tegaderm adhesive dressing. Participants were asked to log the duration of and reasons for device removal. Semi-structured interviews with two focus group were conducted to further examine practical wearing issues. Each interview (30 mins) included 6 participants, 3 of them had worn the device continuously for 7 days and the remaining 3 participants had self-reported removing the device. 14 questions were asked to seek further information on the reasons for removal and uncomfortable feelings experienced. **RESULTS:** Of the 368 log records of the participants, 8 of them (2.2%) reported that they lost the monitor while wearing it. 184 participants (50%) wore the device for 7 consecutive days without removal while the other 50% reported removal in their logs. In total, 248 accounts of removal were reported and the main reasons included automatic dropping (48%), allergic reaction (34.7%), loss of adhesiveness during water based activities (10.1%) and voluntary removal (4.4%). For automatic dropping, sweating (78.5%) was the most commonly reported reason; and for allergic reaction, 61.6% of unknown allergy, 20.9% of itch, 7.0% of red skin, 5.8% of erythema, 2.3% of pain and 2.3% of blisters were reported. Uncomfortable skin feeling related to wearing the device was commonly reported during the interviews and the majority of them claimed that they would like to wear this monitor again but without adhesive dressing. **CONCLUSIONS:** The primary practical issue related to continuous wearing of the activPAL™ among adolescents was automatic dropping caused by sweating and allergic reaction to the adhesive dressing. The use of adhesive dressing caused uncomfortableness among adolescents and reduced their compliance to wear the device.

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**Estimates Of Body Composition In Normal Weight And Overweight Adults Using The Leanscreen App**Pat R. Vehrs, FACSM, Elizabeth MacDonald. *Brigham Young University, Provo, UT.*

(No relationships reported)

The LeanScreen™ app (LS) uses photographs taken from the front and side views, touch screen technology and manufacturer algorithms to estimate circumferences of the neck, abdomen, waist, and hips. The LS app then estimates body composition using the Department of Defense (DOD) circumferences regression equation. **PURPOSE:** This study evaluated the validity and reliability of estimates of percent body fat (%BF) in adult men and women using the LS app compared to DEXA as the criterion method. **METHODS:** Height and body mass were measured on 63 males and 58 females between 18 and 50 years of age. The participants were categorized as normal weight ( $n=61$ ) or overweight ( $n=60$ ) based on BMI. A DEXA scan was performed on each subject once. To assess the within-day and between-day reliability of the LS app, an administrator took front- and side-view photographs of each subject twice on the same day and once on a second day. The LS app was used to identify landmarks of the neck, abdomen, waist, and hips on each set of photographs of each subject. The LS app provided an estimate of %BF. Estimates of %BF from the LS app were compared to %BF values obtained from DEXA. **RESULTS:** A mixed model ANOVA indicated that the LS app significantly ( $p = 0.0001$ ) underestimated DEXA %BF by an average of 3.6%BF. The difference in %BF values between the LS app and DEXA were not influenced by gender or BMI category. Regressing the %BF determined from the LS

app against DEXA resulted in an  $R^2 = 0.83$  and a  $SEE = 3.4\%BF$ . The intercept (2.84 %BF) and slope (1.035) of the regression line confirmed the significant bias. Bland-Altman analysis suggest that the bias of the LS app estimates of %BF increased with increasing body fatness. Use of the LS app to estimate %BF resulted in high intrarater (0.99) reliability within and between days. **CONCLUSIONS:** The results of this study show that the LeanScreen™ app, although highly reliable, significantly underestimated DEXA %BF. We suspect that this is related more to the DOD regression equation rather than the use of photographs and touchscreen technology.

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**Body Composition and Bone Mineral Density of NCAA Division I Football Players**

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(No relationships reported)

**Purpose:** To examine positional differences in total and regional body composition in Division I collegiate football players using dual X-ray absorptiometry (DXA). Data is from the Consortium of College Athlete Research (C-CAR) group. **Methods:** Height, weight, total and regional fat mass, lean mass and bone mineral density were measured on 467 players in the preseason (June-August). Players were categorized by their offensive or defensive position (offensive linemen [OL] and defensive linemen [DL], linebacker[LB], tight end [TE], running back [RB], wide receiver [WR], defensive back [DB], quarterback [QB], kicker/punter/long snapper [ST]). An ANOVA tested the effect of position on body composition and bone density, and the Tukey honest significant difference test compared the differences between each position. **Results:** Table 1 presents the positional comparisons. If the rows do not share a letter, the positions are significantly different ( $p < 0.05$ ). All positions were classified as overweight or obese based on body mass index [BMI ( $>25 \text{ kg/m}^2$ )], yet other than OL and DL, all positions had healthy percent body fat (13-20%) and low visceral fat mass ( $<500 \text{ g}$ ). For bone mineral density (BMD), player position had an effect on total and regional (ex. legs) BMD with OL and DL being similar to TE/LB/RB ( $p > 0.05$  for all), but higher than WR/DB/QB/ST ( $p < 0.05$ ). **Conclusions:** Position had a significant effect on body composition measures and is likely associated with on-field positional requirements. From a health perspective, while most positions had higher BMIs, the majority had relatively low body fat and visceral fat. However, OL and DL had elevated total and visceral fat which could place them at higher health risk. Compared to other methods, DXA increases the accuracy and reliability of body composition and BMD, thus improving within and between position comparisons.

Table 1: Positional Body Composition Characteristics mean ( $\pm$ SD)

	OL (n=83)	DL (n=53)	TE (n=30)	LB (n=58)	RB (n=36)	DB (n=78)	WR (n=75)	QB (n=23)	ST (n=31)
Percent Fat (%)	30.8 <sup>a</sup> (4.2)	23.5 <sup>b</sup> (7.0)	19.8 <sup>c</sup> (3.9)	18.8 <sup>c</sup> (4.9)	15.3 <sup>de</sup> (3.9)	13.3 <sup>c</sup> (3.2)	14.1 <sup>de</sup> (3.6)	17.2 <sup>cd</sup> (4.2)	19.9 <sup>c</sup> (5.5)
Total Lean Mass (kg)	89.5 <sup>a</sup> (6.5)	87.6 <sup>a</sup> (6.8)	82.2 <sup>b</sup> (6.5)	79.5 <sup>bc</sup> (5.2)	77.3 <sup>cd</sup> (6.8)	72.4 <sup>e</sup> (5.2)	71.6 <sup>e</sup> (6.5)	74.4 <sup>de</sup> (6.3)	70.4 <sup>e</sup> (6.0)
Total Fat Mass (kg)	40.1 <sup>a</sup> (7.9)	27.8 <sup>b</sup> (10.8)	20.5 <sup>c</sup> (5.3)	18.5 <sup>c</sup> (5.4)	14.1 <sup>d</sup> (4.6)	11.2 <sup>e</sup> (3.0)	11.9 <sup>e</sup> (3.7)	15.5 <sup>cd</sup> (4.4)	17.7 <sup>cd</sup> (5.8)
Trunk Lean Mass (kg)	39.5 <sup>a</sup> (3.2)	38.3 <sup>a</sup> (3.0)	37.7 <sup>ab</sup> (3.3)	35.8 <sup>bc</sup> (2.7)	34.5 <sup>cd</sup> (3.3)	32.7 <sup>e</sup> (2.5)	32.7 <sup>de</sup> (3.0)	34.4 <sup>cd</sup> (2.8)	32.9 <sup>de</sup> (2.8)
Trunk Fat Mass (kg)	21.8 <sup>a</sup> (5.1)	13.6 <sup>b</sup> (6.3)	9.9 <sup>c</sup> (3.1)	8.7 <sup>cd</sup> (3.0)	6.7 <sup>de</sup> (2.8)	4.8 <sup>e</sup> (1.5)	5.4 <sup>e</sup> (2.0)	7.5 <sup>de</sup> (2.7)	8.6 <sup>cd</sup> (3.1)
Legs Lean Mass (kg)	33.1 <sup>a</sup> (3.0)	32.7 <sup>a</sup> (3.3)	29.1 <sup>b</sup> (2.8)	28.4 <sup>b</sup> (2.3)	27.9 <sup>b</sup> (2.7)	25.8 <sup>c</sup> (2.4)	25.2 <sup>c</sup> (2.7)	25.8 <sup>c</sup> (2.9)	24.4 <sup>c</sup> (2.7)
Legs Fat Mass (kg)	13.2 <sup>a</sup> (3.1)	10.5 <sup>b</sup> (3.9)	7.5 <sup>c</sup> (1.9)	6.9 <sup>c</sup> (2.1)	5.2 <sup>d</sup> (1.8)	4.3 <sup>e</sup> (1.3)	4.3 <sup>e</sup> (1.4)	5.6 <sup>de</sup> (1.5)	6.4 <sup>cd</sup> (2.3)
Visceral Fat Mass (g)	811 <sup>a</sup> (499)	645 <sup>ab</sup> (481)	228 <sup>c</sup> (142)	241 <sup>c</sup> (184)	181 <sup>c</sup> (129)	204 <sup>c</sup> (144)	223 <sup>c</sup> (116)	248 <sup>bc</sup> (123)	331 <sup>bc</sup> (94)
Legs Fat Mass (kg)	13.2 <sup>a</sup> (3.1)	10.5 <sup>b</sup> (3.9)	7.5 <sup>c</sup> (1.9)	6.9 <sup>c</sup> (2.1)	5.2 <sup>d</sup> (1.8)	4.3 <sup>e</sup> (1.3)	4.3 <sup>e</sup> (1.4)	5.6 <sup>de</sup> (1.5)	6.4 <sup>cd</sup> (2.3)
Visceral Fat Mass (g)	811 <sup>a</sup> (499)	645 <sup>ab</sup> (481)	228 <sup>c</sup> (142)	241 <sup>c</sup> (184)	181 <sup>c</sup> (129)	204 <sup>c</sup> (144)	223 <sup>c</sup> (116)	248 <sup>bc</sup> (123)	331 <sup>bc</sup> (94)

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**Bone Mineral Density in Aesthetic and Performance Sports in Female Collegiate Athletes**

Jessica A. Insogna, Ryan ER Reid, Patrick Delisle-Houde, Charlotte D. Haugan, Ross E. Andersen, FACSM. McGill University, Montreal, QC, Canada. (Sponsor: Ross E. Andersen, FACSM)

(No relationships reported)

Bone mineral density (BMD) in female athletes is influenced by many factors including genetics, menstrual history, calcium and vitamin D levels, hormonal changes, and physical activity. Percussive activity has been shown to lead to increased BMD. Peak BMD is achieved between the ages of 16-20 in females. Females begin participation in both ice hockey and synchronized swimming during crucial bone building years, which may affect peak BMD and therefore risk of osteoporosis later in life. **PURPOSE:** To evaluate BMD in the lower limb between ice hockey and synchronized swimming female collegiate athletes. **METHODS:** 41 female collegiate athletes ( $n=22$  hockey players,  $n=19$  synchronized swimmers) received a total body and left femur iDXA scan to evaluate total and regional BMD. Average age of the athletes was  $20.30 \pm 1.77$  yrs. Average weight of the athletes was  $65.36 \pm 8.37$  kg (synchronized swimmers:  $62.62 \pm 8.45$  kg, hockey players:  $67.73 \pm 7.73$ , ( $F(1,40)=4.09$ ,  $p \leq 0.05$ ). Analysis of covariance (ANCOVA) was used to compare BMD of the legs, pelvis, femur, femoral neck, femoral shaft, trochanter, and total body while controlling for age and weight. **RESULTS:** Average body fat percentage as measured by iDXA for all athletes was  $28.55 \pm 5.97\%$ . Hockey players had higher BMD than synchronized swimmers in their legs ( $F(1,37) = 17.31$ ,  $p \leq .01$ ), pelvis ( $F(1,37) = 34.63$ ,  $p \leq .01$ ), femur ( $F(1,37) = 15.2$ ,  $p \leq .01$ ), femoral neck ( $F(1,37) = 7.30$ ,  $p \leq .01$ ), femoral shaft ( $F(1,37) = 13.77$ ,  $p \leq .01$ ), trochanter ( $F(1,37) = 25.88$ ,  $p \leq .01$ ), and total body ( $F(1,37) = 17.58$ ,  $p \leq .01$ ). **CONCLUSIONS:** Female collegiate hockey players have higher weight and age adjusted BMD than female collegiate synchronized swimmers in the lower limb and multiple sites around the femur. A lower BMD puts these female athletes at a greater risk of developing osteoporosis later in life. Exercise scientists should develop alternative land training programs that focus on bone loading exercises for female synchronized swimmers to optimize bone health at a young age.

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**A National Survey of Impact of Afterschool Physical Activities on U.S. Youth**

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**PURPOSE:** To address the worldwide childhood obesity epidemic, afterschool physical activities (PA) could play an important role. Yet, little is known about the status and impact of afterschool PA on U.S. youth. This study was to examine the impact through a national survey. **METHODS:** Data from the 2012 National Youth Fitness Survey were used for the study, in which a representative/weighted national sample of 4,647,648 youth, aged 12-15 yr. old (51.30% male) responded to the PA questionnaire and were assessed for their physical fitness, including Plank, Handgrip, Pull-ups, Leg extension, Body mass index (BMI), and Waist circumference. A descriptive statistical summary of the PA participation was created first and, then the relationships between PA participation and PA times, as well as the difference in physical fitness measures between PA participation and no participation groups, were examined. **RESULTS:** The top-5 afterschool PA for boys of this age group are basketball (19.60%), roller blading (14.50), volleyball (12.43), football (11.83), and bike riding (11.68), and for girls are roller blading (11.52), volleyball (11.37), basketball (8.49), dance (7.01), and bike riding (5.98), respectively. Although the correlation is not high, the afterschool PA participation was positively correlated with the number of PA days in the past week ( $r = .23$ ), total time of vigorous PA on a typical day (.15), total time of moderate-vigorous PA (.17), and total time walking (.17). The participation in afterschool PA was found also to have a positive impact on the physical fitness measures. **CONCLUSIONS:** Positive impact of afterschool on promoting youth's overall PA time and improving their physical fitness was confirmed. It is also interesting to find out that activities such roller blading have become popular afterschool PA for U.S. youth. Future school physical education curriculum and afterschool programs should reflect the new interest and trend of this population.

WEDNESDAY, MAY 31, 2017

Comparison of PA And None PA (M±SE)						
	Plank (s)	Handgrip (kg)	Pull-up (#)	Right Leg Extension (lb)	BMI	Waist Circumference (cm)
Yes- PA	92.08±3.16	61.11±1.03	8.50±.51	79.28±1.99	22.56±.35	79.07±.87
No- PA	76.95±3.19	57.66±9.94	5.46±.39	74.47±1.93	23.06±.35	81.08±.88

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**Instant Metabolic Power: Yet too Simplified but with High Potential**  
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*(No relationships reported)*

Instant metabolic power (IMP) to assess energy cost (W) in running tasks with variable velocity (v) has come under critique in terms of substantial underestimations. IMP is based on assumptions that W per meter running distance at constant v (Cr) is invariant of v and that acceleration and deceleration can be modelled as constant v uphill and downhill running (CrIMP), respectively. **PURPOSE:** To test the hypotheses that the observed underestimation of W via IMP is caused by a dependence of Cr on v at running speeds at and above the v corresponding to  $VO_{2max}$  ( $vVO_{2max}$ ) and the limited validity of the IMP-model to acceleration and deceleration less than  $\sim 4.4 \text{ m/s}^2$  under interval training (IT) conditions. **METHODS:** 9 males ( $25.6 \pm 2.0$  yrs,  $176.8 \pm 4.2$  cm,  $76.8 \pm 4.1$  kg) performed an incremental load test on the treadmill, 15 min constant v runs (2.5 m/s) and IT of 30 x 10 s (average  $v = vVO_{2max}$ ) with 20 s breaks on treadmill (TM) and outdoor track (OT), respectively. Total energy costs ( $W_{TOT}$ ) of all tests were calculated from respiratory gas measurements and net lactate appearance. W assessed via IMP ( $W_{IMP}$ ) for TM and OT was estimated using CrIMP: 1) as published previously using Cr of running at 2.5 m/s on TM and OT, respectively, and the previously published IMP-model ( $W_{IMP1}$ ), 2) using a modified CrIMP-model considering also acceleration and decelerations higher than  $\sim 4.4 \text{ m/s}^2$  ( $W_{IMP2}$ ), 3) considering individual dependence of Cr on v at  $v > vVO_{2max}$  ( $W_{IMP3}$ ). **RESULTS:**  $W_{TOT}$  of running at 2.5 m/s on TM ( $9210 \pm 842 \text{ J/kg}$ ) and OT ( $8926 \pm 1028 \text{ J/kg}$ ), and IT on OT ( $8970 \pm 559 \text{ J/kg}$ ) were not different but all higher ( $p < 0.05$ ) than  $W_{TOT}$  at IT on TM ( $7856 \pm 515 \text{ J/kg}$ ).  $W_{IMP1}$  (OT:  $6363 \pm 442 \text{ J/kg}$ ; TM:  $5691 \pm 367 \text{ J/kg}$ ) and  $W_{IMP2}$  (OT:  $6528 \pm 368 \text{ J/kg}$ ; TM:  $5691 \pm 367 \text{ J/kg}$ ) were lower ( $p < 0.001$ ) than the corresponding  $W_{TOT}$ .  $W_{IMP3}$  (OT:  $8731 \pm 484 \text{ J/kg}$ ; TM:  $7009 \pm 572 \text{ J/kg}$ ) matched  $W_{TOT}$  on OT but still underestimated ( $p < 0.001$ )  $W_{TOT}$  of TM conditions possibly due to neglecting W of jumping onto and of the TM. **CONCLUSIONS:** Realistic estimates of  $W_{TOT}$  via IMP require adjustments for increased Cr at high v and accelerations and decelerations higher than  $\sim 4.4 \text{ m/s}^2$ .

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**Muscle-damage Biomarkers, Hydration And Electrolytes Status Associated With Surfing Sessions Of Elite Brazilian Surfers**  
 Franz H. Burini<sup>1</sup>, Rafael Rezende<sup>1</sup>, Pedro Rodstein<sup>1</sup>, Rodrigo Manda<sup>1</sup>, Okesley Teixeira<sup>1</sup>, Salete Coelho<sup>1</sup>, Paulo Mendes<sup>2</sup>, Roberto C. Burini, FACSM<sup>1</sup>. <sup>1</sup>UNESP Medical School, Botucatu, Brazil. <sup>2</sup>SURF'Co., São Paulo, Brazil. (Sponsor: Roberto C. Burini, FACSM)  
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*(No relationships reported)*

Surfing demands multifactorial physical fitness and continuing interaction with environmental variables, such as tide, wind, wave size and swell direction. Surfing athletes should focus on performance and artistic overview of movements, specially when in competition, regarding scoring criterias. Health issues, such as metabolic and biomechanical, associated with nutritional and hydration status may modulate athletes performance and fatigue. **PURPOSE:** The purpose of this study was to describe surfing sessions on a routine training-day of elite professional surfers using Global Positioning System (GPS) data, and analyze hydration and electrolytes status, as also as muscle-damage biomarkers prior, after and 12h after sessions. **METHODS:** 6 professional male surfers ( $24 \pm 1$  yrs) were evaluated using a GPS module on a typical day of surf training session ( $3 \times 90$  sessions), for determining distance, average and maximum speed. Blood samples were collected for Hematocrit (Ht), Sodium (Na), Potassium (K), Urea and CK levels before, after sessions and 12h after resting period. **RESULTS:** Average distance during the session was  $9.1 \pm 3.5$  km, and maximum and average speed were  $38.4 \pm 0.1$  km/h and  $4.7 \pm 0.4$  km/h, respectively. Pre, post and 12h post sessions values for CK were  $223.5 \pm 49.5$ ;  $328.6 \pm 94.1$  and  $305.5 \pm 4.2$  mg/

dL. Urea values were  $26.3 \pm 2.1$ ;  $35.6 \pm 4.9$  and  $35.6 \pm 2.8$  mg/dL. Hydration variables such as Ht, Na and K were  $42.1 \pm 2.1$ ,  $40.5 \pm 2.1$ ,  $40.3 \pm 1.4\%$ ;  $140.5 \pm 0.7$ ,  $140.8 \pm 2.8$ ,  $140.3 \pm 1.4$  mEq/L and  $4.2 \pm 0.1$ ,  $3.9 \pm 0.1$ ,  $4.1 \pm 0.2$  mEq/L. **CONCLUSION:** Surfers athletic performance should be focused on a multifactorial matter. Dietary pattern, hydration and electrolytes issues may influence performance on a short-term base, specially on typical surfing contests, characterized by followed days of competition. This data suggests that athletes have considerable physical demands, and such tools may guide to improvement on health and performance.

**B-14 Free Communication/Slide - Walking Biomechanics**  
 Wednesday, May 31, 2017, 1:00 PM - 3:00 PM  
 Room: 110

634 **Chair:** D.S. Blaise Williams, III, FACSM. *Virginia Commonwealth University, Richmond, VA.*  
*(No relationships reported)*

635 May 31 1:00 PM - 1:15 PM  
**Asymmetry in Lower Extremity Biomechanics During Walking & Stair Ambulation Following Total Knee Replacement**  
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Total knee replacement (TKR) presents many challenges to patients including difficulty with activities of daily living. It has been shown that following a TKR there is a non-random evolution of joint problems that begins with the contralateral knee joint. An understanding of asymmetry in the joints following TKR may provide additional information as to why this evolution may occur. Previous research has shown that there is no differences of knee joint excursion and ground reaction force between replaced and non-replaced legs during level walking. **Purpose:** To compare asymmetry in the non-replaced and replaced limbs of TKR patients during level walking, stair ascent, and stair descent. It was hypothesized that greater asymmetry would be seen in knee joint biomechanics during the more demanding tasks of stair ambulation. **Methods:** A total of 13 TKA (65.6 yrs, 28.3 BMI & 24.5 months from TKA surgery) participants performed five trials of level walking, stair ascent and stair descent at preferred speeds. A paired samples t-test was used to detect differences in the replaced and non-replaced limb for each condition ( $p < 0.05$ ). **RESULTS:** There were no differences in first or second peak vertical ground reaction force between limbs for any of the walking conditions. There were also no differences between sagittal plane knee joint range of motion (ROM) between limbs for any conditions. The first peak knee extension moment showed asymmetry only during stair ascent. The non-replaced limb had a trend for elevated peak knee extension moment ( $1.17 \text{ Nm/kg}$ ) compared to the replaced ( $0.97 \text{ Nm/kg}$ ,  $p = 0.05$ ). No differences were seen for peak internal knee abduction moments between the limbs in any condition. **CONCLUSION:** It appears that there is very little asymmetry between the replaced and non-replaced limb following a TKR in this participant group. Only the knee extension moment during stair ascent showed any signs of asymmetry. Similar results have been shown in previous research when considering only level walking. Contrary to our hypothesis the more difficult tasks of stair ascent and descent did not create asymmetry between limbs. This participant group was highly functional as determined by their ability to ascend and descend stairs without the use of a handrail. Future studies should consider how groups with mixed recovery results may fair.

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**Walking Aid Use And Arthritis: Impact On Time Spent In Active Propulsion In Older Adults**  
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*(No relationships reported)*

Gait cycle percentage spent in active propulsion is significantly greater in those without a history of falling in the past year than those with a history of falling in the past year. **PURPOSE:** This study examined the impact of walking aid use and diagnosed arthritis on gait cycle percentage spent in active propulsion in fallers and non-fallers. **METHODS:** A total of 250 subjects over the age of 60 years (age;  $71.1 \pm 7.4$  yrs, height;  $1418.5 \pm 21.2$  cm, mass;  $57.1 \pm 6.3$  kg) were recruited from the southwest

United States, completed a brief medical history and gait analysis. Following the collection of these data, subjects were assigned to one of two groups based on having fallen (F; n=90) or having not fallen (NF; n=160) in the past year. Independent t-tests were conducted to explore group differences (walking aid, arthritis;  $\alpha = 0.05$ ) in time spent in active propulsion. For these analyses the F and NF groups were analyzed separately with percentage spent in active propulsion as the dependent variable and both walking aid use and self-reported diagnosis of arthritis were the independent variables. **RESULTS:** For walking aid use, NF not utilizing a walking aid had a significantly higher ( $p = 0.033$ ) gait cycle percentage spent in active propulsion ( $56.9\% \pm 2.6$ ) than NF who use a walking aid ( $41.4\% \pm 6.4$ ). There was also a significant difference ( $p = 0.029$ ) in gait cycle percentage spent in active propulsion for NF without a diagnosis of arthritis ( $60.6\% \pm 3.4$ ) compared to NF with a diagnosis of arthritis ( $49.9\% \pm 3.4$ ). In contrast, there were no differences among the fallers in gait cycle percentage spent in active propulsion based on walking aid use ( $48.3\% \pm 2.8$  for no walking aid;  $43.1\% \pm 6.4$  for walking aid,  $p = 0.46$ ) or arthritis diagnosis ( $52.2\% \pm 3.8$  for no arthritis diagnosis;  $43.7\% \pm 3.4$  for arthritis diagnosis,  $p = 0.09$ ). **CONCLUSIONS:** Specific to those with a history of falls, use of a walking aid or history of arthritis does not impact gait cycle percentage spent in active propulsion. However, for individuals with no history of falling in the last year, both use of walking aid and diagnosis of arthritis significantly reduces percent of the gait cycle spent in active propulsion which has been previously shown to differ between people with and without a history of falls.

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### Increasing Body Weight Alters Lower Limb Muscle Balance And Foot Control

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(No relationships reported)

Obesity is a well established risk factor for developing osteoarthritis (OA). Population-based studies in particular have consistently shown a link between obesity and knee OA. Yet many factors for diseases and conditions associated with obesity could contribute to OA initiation and/or progression. The present study examined the effects systematically increasing subject weight and the effects on quadriceps femoris muscle function and foot balance stability during walking and squatting. **Methods:** Twenty asymptomatic healthy young adults (Age =  $22 \pm 2$ ; 19 kg/m<sup>2</sup>) < BMI < 22 kg/m<sup>2</sup>) were studied. A three-dimensional gait analysis was conducted for all subjects. Plantar pressure distribution (the peak pressure of the eight plantar surface areas) and foot kinematics, surface electromyograms from the lateral and medial gastrocnemii, lateral and medial hamstrings, vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF) were recorded during squatting and self-selected speed walking. Weight increase (10, 20 and 30% of subject body weight) was achieved by placing a belly bag on the subject's body attached around the hip and to the shoulders. Principal component analysis was used to extract major features of amplitude and temporal pattern variability from the electromyograms of each muscle group (gastrocnemii, quadriceps, hamstrings separately). Analysis of variance models tested for weight load effects and interaction effects for these features ( $\alpha = 0.05$ ). **Results:** Significant weight load effects were found for features that described more prolonged activation of the gastrocnemii and quadriceps muscles during the stance phase of gait ( $P < 0.05$ ). Load increase selectively activated the VL compared to the VM during walking and the first 20 degrees of knee flexion during the squat. Load increase was also associated with increased mid-rear-foot pressure and delay in both the onset of the second wave of flexion at the knee joint and reduced range of motion of the ankle ( $P < 0.05$ ). **Conclusions:** We confirm the effects of increasing body weight on lower extremity muscle activation and foot balance control, both of which may contribute to knee OA development and progression.

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### Effect Of Excess Weight on Lower-Extremity Vertical Stiffness, Muscle Activation, And Metabolic Cost Of Walking

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(No relationships reported)

**PURPOSE:** To study the relationship between energy cost of walking (Cw), lower-extremity vertical stiffness ( $K_{vert}$ ), and muscle activation across various BMIs. **METHODS:** This study compared Cw,  $K_{vert}$ , and muscle activation between obese (OB), normal weight (NW), and NW individuals carrying a load (NWL). A sample

of 10 NW ( $24.2 \pm 1.3$  kg m<sup>-2</sup>) and 10 OB ( $33.1 \pm 2.0$  kg m<sup>-2</sup>) individuals ( $29.5 \pm 11.7$  yr, 14 females, 6 males) walked for six minutes on an instrumented treadmill at  $1.25$  m s<sup>-1</sup> while oxygen uptake, muscle activation, and lower-extremity kinetics and kinematics were measured using an indirect calorimeter, electromyography, and a 3D optical motion tracking system, respectively. **RESULTS:** Cw was 24% greater in OB ( $277.5 \pm 45.3$  J m<sup>-1</sup>) compared to NW ( $211.0 \pm 27.0$  J m<sup>-1</sup>,  $P = 0.001$ ), 23% greater in NWL ( $272.7 \pm 35.7$  J m<sup>-1</sup>) compared to NW ( $P = 0.002$ ), but similar between OB and NWL ( $P = 0.955$ ). Mass-specific Cw ( $Cw_{kg}$ ) was not statistically different between NW ( $2.99 \pm 0.24$  J m<sup>-1</sup> kg<sup>-1</sup>) and OB ( $2.85 \pm 0.18$  J m<sup>-1</sup> kg<sup>-1</sup>,  $P = 0.382$ ), NW and NWL ( $2.74 \pm 0.24$  J m<sup>-1</sup> kg<sup>-1</sup>,  $P = 0.071$ ), or OB and NWL ( $P = 0.602$ ), however a negative correlation ( $r = -0.44$ ,  $P = 0.008$ ) existed between BMI and  $Cw_{kg}$ .  $K_{vert}$  was higher in OB ( $32.7 \pm 5.2$  kN m<sup>-1</sup>) than NW ( $23.3 \pm 4.7$  kN m<sup>-1</sup>,  $P < 0.001$ ), but NWL ( $27.5 \pm 3.4$  kN m<sup>-1</sup>) was not different from either.  $K_{vert}$  per kilogram ( $P = 0.081$ ) and muscle activation ( $P > 0.05$ ) were similar across all conditions. A positive correlation existed between  $K_{vert}$  and Cw ( $r = 0.55$ ,  $P = 0.001$ ), but not when expressed per kilogram ( $r = 0.22$ ,  $P = 0.120$ ). Center of mass (COM) vertical displacement was similar between OB ( $3.3 \pm 0.4$  cm) and NW ( $3.5 \pm 0.7$  cm,  $P = 0.875$ ), OB and NWL ( $3.9 \pm 0.7$  cm,  $P = 0.076$ ), and NW and NWL ( $P = 0.194$ ). Angle of attack between the leg and ground was similar between OB ( $104 \pm 6$  deg) and NW ( $106 \pm 6$  deg,  $P = 0.731$ ) and between NW and NWL ( $110 \pm 3$  deg,  $P = 0.198$ ), but 5% lower in OB than NWL ( $P = 0.045$ ). **CONCLUSION:**  $Cw_{kg}$  decreased from the NW to NWL condition.  $K_{vert}$  was greater at higher BMIs, but per kilogram was lower in NWL than OB likely due to NWL having a greater angle of attack and COM displacement. The linear relationship between  $K_{vert}$  and Cw is likely due to the greater muscle force needed to support larger body masses. Contrary to our hypothesis,  $Cw_{kg}$  was not different between NW and OB and neither  $K_{vert}$  nor muscle activation explained the variability in  $Cw_{kg}$ .

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### Concurrent Validity Of Zeno Compared To Gaitrite With Backward Walking In Healthy Older Adults

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(No relationships reported)

Previous research has identified an age-related decline in backward walking performance measured via spatio-temporal parameters using GAITRite walkway. Moreover, it has also been shown that older adults categorized as fallers performed poorly with slower gait compared to non-fallers during backward walking. Zeno and GAITRite are both instrumented walkway systems used to assess spatio-temporal parameters of gait. The Zeno has a wider walkway than the GAITRite but is less portable for similar configurations. The GAITRite has been used extensively for measuring spatio-temporal parameters of backward gait. The Zeno has been less researched. **PURPOSE:** To determine concurrent validity of the Zeno and GAITRite walkways to assess spatio-temporal parameters of backwards walking in healthy older adults. **METHODS:** 30 healthy older adults (19 females,  $75.1 \pm 6.3$  years of age) participated in this study. Participants were 65 or older, could walk 30 feet independently, and were not at risk for falls as determined by American Geriatric Society guidelines. The participants walked backwards at a comfortable pace on both the Zeno walkway ( $16' \times 4'$ ) and GAITRite walkway ( $14' \times 2'$ ). Participants performed one practice walk and five test walks on each walkway. ICC values (2,5) were calculated using GAITRite compared to Zeno measurements for stride length, width, and velocity, step, stance, and swing time, stance and swing percent, single support time, single support percent, velocity, and cadence. A paired sample t-test was used to determine a significant difference between measurements from both the systems. **RESULTS:** The ICC values ranged from 0.665 to 0.971. Backwards walking stride width was significantly greater when walking on GAITRite ( $16.80 \pm 4.74$ cm) compared to Zeno ( $14.98 \pm 3.58$ cm;  $P < 0.001$ ). **CONCLUSION:** The validity between the GAITRite and Zeno walkway systems showed excellent correlation on most spatial measurements and moderate agreement for some temporal parameters. Differences in stride width could have been due to method of calculation or perception of participants while walking on a narrower walkway. The results indicate clinicians can use Zeno for clinical assessment of backwards gait, keeping in mind the differences in temporal measurements if compared with published GAITRite results for healthy older adults.

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### Gait Variability Among Breast Cancer Survivors During Forward And Backward Walking

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(No relationships reported)

Increase in gait variability measured using instrumented techniques has been associated with increased risk of falls in persons with Parkinson's disease, decreased

functional performance and increased fall-risk in older adults. Recently research on breast cancer survivors (BCS) has focused on estimating fall-risk in this population attributed to gait performance. However, little is known about gait variability characteristics among BCS. **PURPOSE:** To assess the differences in gait variability among BCS compared to healthy controls during forward, backward, and accelerated forward walking. **METHODS:** 13 postmenopausal BCS (mean age: 58.5±8.5 years) and 8 healthy controls (mean age: 60.8±6.1 years) participated. Participants completed 5 trials each of forward, backward, and accelerated forward walking conditions on a 16x4' Zeno walkway with a lead and follow-up distance of 1m to capture steady-state gait. Coefficient of variation (CV) was calculated as % of standard deviation over mean of 5 trials. CV of stride length, stance time, and stride width were used as dependent variables. A Group (BCS vs healthy controls) X Condition (forward, backward, accelerated forward walking) ANOVA was performed. **RESULTS:** Significant interaction for stance time showed that BCS had greater CV during forward (4.89±0.63%) and accelerated forward (6.49±0.78%) but lesser CV during backward walking (6.28±1.09%) compared to healthy controls (forward: 3.81±0.80%; accelerated forward: 4.23±1.00%; backward: 9.20±1.38%;  $P=0.018$ ). Significant group main effect indicated that BCS (7.09±3.59%) had greater stride length variability compared to healthy controls (3.59±1.32%) across all conditions ( $P=0.05$ ). Significant condition main effect was observed for stride length and stance time CV (both  $P=0.02$ ) but not stride width ( $P=0.063$ ). During forward walking, stride length (by 5%) and stance time (by 3.3%) CV were significantly less compared to backward walking (both  $P=0.004$ ). There were no other significant differences. **CONCLUSION:** Increased stance time variability during backward walking and overall greater stride length variability may be indicative of increased fall-risk among BCS. Future studies need to examine other balance tests in conjunction with these measures to determine the level of fall-risk among BCS.

641 May 31 2:30 PM - 2:45 PM  
**Upper Body Accelerations During Walking are Altered in Individuals With ACL Reconstruction**  
 Cortney N. Armitano, Steven Morrison, Daniel M. Russell. *Old Dominion University, Norfolk, VA.* (Sponsor: David P. Swain, FACSM)  
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 (No relationships reported)

One function of the trunk and neck segments is to act as a filter to dampen gait-related oscillations, so ensuring the head is stabilized. While persons with ACL reconstruction exhibit similar overall spatiotemporal gait features to healthy controls, there has been no direct assessment of whether ACL reconstruction impacts the ability of the upper body to attenuate oscillations while walking. **PURPOSE:** This study was designed to assess and compare the pattern of acceleration from the lower trunk, neck and head regions for individuals with reconstructed ACL compared to healthy controls during walking. **METHODS:** Seventeen participants with unilateral ACL reconstruction and 17 control persons matched for age, height, and weight participated in the study. Participants performed 3 trials of over-ground walking at their preferred pace (distance: 55 m). Acceleration were collected using three triaxial accelerometers attached to the head (occipital), neck (C7), and lower trunk (L3). Measures of amplitude (i.e., RMS, peak frequency power) and signal regularity (i.e., ApEn) of the acceleration data were performed. A within-subject, repeated-measures generalized linear model was used to analyze the data. **RESULTS:** Similarities were seen between both groups with regards to the general acceleration patterns in all three axes with trunk acceleration generally being of greater amplitude (both RMS and peak power) than the head ( $p<0.05$ ). However, the results also revealed that the individuals with ACL reconstruction had significantly greater peak power in the AP and ML directions at higher frequencies (3-10 Hz,  $p<0.05$ ), indicating a reduced ability to attenuate frequency signals. Further, the ACL group had an increase in ApEn values for VT direction head motion ( $p<0.05$ ), indicating a reduced ability to control head motion during gait. **CONCLUSIONS:** Both groups demonstrated a similar pattern of gait-related oscillations across the head, neck and trunk segments. However, adults with a reconstructed ACL demonstrated a reduced capacity to compensate for the higher frequency components of the gait signal, which may have led to a decline in head control. Overall, these findings indicate that previous damage to the ACL is not simply localized to the knee joint, but is widespread, impacting on upper body control as well.

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**Characterizing Shank Angular Velocity During Gait in Individuals Post-ACLR Using IMUs in Ecological Settings**  
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 (No relationships reported)

Individuals post ACL reconstruction (ACLR) exhibit decreased knee extensor moments during gait in the absence of visible gait deviations that can last up to 2 years post-

surgery. Inertial measurement unit (IMU) derived shank angular velocities (skAV) can be used to detect knee extensor moment asymmetries during gait in individuals 3 months post-ACLR; providing a clinical tool for identification of altered mechanics. These methods could be expanded to quantify gait mechanics during daily activities if skAV asymmetry can be detected during more ecological gait tasks. **PURPOSE:** To compare skAV asymmetry during ecological gait in individuals 3 months post-ACLR to controls. **METHODS:** 7 individuals (4F, 33 ± 9.6 yrs) 84 ± 20 days post-ACLR without observable gait deficits and 5 healthy controls (4F, 24 ± 2.8 yrs) performed 2-5 bouts of unconstrained walking intermixed with standing and sitting. Sagittal skAV was measured using IMU tri-axial gyroscopes (128Hz) affixed to lateral shanks bilaterally. Peak negative skAV after heel strike was identified (2<sup>nd</sup> order Butterworth filter; high pass 0.25 Hz; low pass 6 Hz) using a previously validated algorithm. skAV for each limb was averaged for 20-231 continuous steps of gait per walking bout. skAV asymmetry was calculated as the ratio between surgical/non-surgical limbs (ACLR) and dominant/non-dominant limbs (control). Independent t-test was used to compare skAV ratios between groups;  $\alpha \leq .05$ . **RESULTS:** On average, skAV ratios were 0.89 ± 0.09 and 1.00 ± 0.09 for the ACLR and control groups, respectively ( $p=0.024$ ). **CONCLUSIONS:** Consistent with previous studies, individuals after ACLR demonstrate reduced skAV in the surgical limb during loading response as evidenced by a smaller ratio compared to controls. Differences between groups during natural gait tasks performed with other daily tasks suggest that skAV asymmetries are detectable in less controlled settings. Given the capabilities of IMUs to collect and store large amounts of data, these data support the use of IMUs for assessing the quality of gait mechanics throughout the day. Understanding the extent to which individuals adopt altered loading outside of the laboratory is needed for the development of training interventions aimed at mitigating altered gait mechanics during early rehabilitation following ACLR.

**B-15 Clinical Case Slide - Lumbosacral Spine I**  
 Wednesday, May 31, 2017, 1:00 PM - 2:40 PM  
 Room: 504

643 **Chair:** Pierre Rouzier, FACSM. *University of Massachusetts, Amherst, MA.*  
 (No relationships reported)

644 **Discussant:** Jimmy D. Bowen. *Advanced Orthopedic Specialists, Cape Girardeau, MO.*  
 (No relationships reported)

645 **Discussant:** Robert C. Cantu, FACSM. *Emerson Hospital, Concord, MA.*  
 (No relationships reported)

646 May 31 1:00 PM - 1:20 PM  
**Low Back and Bilateral Posterior Hip Pain in an Adolescent Female**  
 Jasmin Mosley Gooden, Michael Fong, Marissa S. Vasquez. *Kaiser Permanente, Los Angeles, CA.* (Sponsor: Aaron Rubin, FACSM)  
 (No relationships reported)

**HISTORY:** 14-year-old female presenting with persistent low back pain of insidious onset for 1.5 years. Patient initially managed at outside hospital. Work-up included MRI lumbar that noted possible early lumbosacral facet arthritis. Pain persisted despite oral anti-inflammatory medications, functional modifications, and physical therapy. On presentation to our institution, patient was referred by primary care to rheumatology. Patient's generalized low back pain noted to progress to involve the posterior aspect of both thighs with occasional weakness of her legs, right more than left. Pain worsened with prolonged walking and sitting. No radiating pain, night time or early morning pain, nor pain nor swelling of other joints. Rheumatologist recommended Naprosyn, advanced imaging, and referral to sports medicine.

**PHYSICAL EXAMINATION:** Normal back exam; lower motor strength; muscle tone; and hip and back range of motion. No muscle atrophy. She had posterior hip tenderness in the Ischia-gluteal region that worsened with resisted hip abduction. Negative FABERE, OBER, and straight leg raise. Negative FADIR for anterior hip pain; maneuver produced tenderness in gluteus region. Femoral stretch equivocal bilaterally. Positive Trendelenberg  
**DIFFERENTIAL DIAGNOSIS.**  
 - Spondyloarthropathy  
 - Bilateral Isthiofemoral Impingement  
 - Bilateral Meralgia Paresthetica

**TEST AND RESULTS:**

EMG LE (08/10/16): normal

MRI Pelvis with/without contrast (05/08/16):

- No osteonecrosis, joint effusion, synovitis.

- Narrowed ischiofemoral interval bilaterally: 11mm on left, 10mm on right; Quadratus femoral space measured 7mm on left, 9mm on right.

- Quadratus femoris soft tissue edema, Left more than Right

X-ray hips (04/25/16): Normal alignment. No fracture.

Spina Bifida Occulta at L5.

HLA-B27; Cocci IgG/IgM; ESR; CRP; ANA within normal limits

MRI lumbar (04/17/15): facet arthritis

**FINAL WORKING DIAGNOSIS:** Bilateral Ischiofemoral Impingement.**TREATMENT AND OUTCOMES:**

1. Naprosyn - minimal improvement

2. Physical Therapy (gluteal strengthening). Tolerated home exercise program - improved anterior leg pain, but persistent posterior hip pain.

3. Ultrasound guided corticosteroid injection to right quadratus femoris and relative rest. If symptoms improve will inject left quadratus femoris in 1-2 weeks post treatment.

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**A Real Pain in the Behind**Spencer Jones. *TriHealth Orthopedics & Sports Institute, Cincinnati, OH.*

Email: spencer\_jones@trihealth.com

*(No relationships reported)***History and Presentation:**

22-year-old female presented to sports medicine clinic for acute on chronic coccyx pain. She initially sustained an injury 6 years ago when she slipped on some steps, pain resolved until 4 years ago when she slipped stepping out of a car. The pain at that time was identical to previous, with coccygeal pain when seated or supine for extended periods. X-rays were negative at the time, and her pain resolved with PT and meloxicam. She was lost to follow up for 2 years after that time, until she presented with increased pain again. No new injury, but pain feels similar. She has been unable to exercise including bike riding since the onset of her pain. She reported no ambulatory pain. She denied radicular symptoms, systemic symptoms, or bowel/bladder incontinence. PMH was unremarkable, non-smoker, no significant family history.

**Physical Examination:** Vitals were revealed and normal. No deformity of the lumbar spine, sacrum, or coccyx. She did have some mild tenderness to palpation at the sacral-coccyx joint, but range of motion was normal. Straight leg raise negative. Distal sacral plexus sensation intact. **Differential Diagnosis:** 1. Coccydynia 2. Sacroiliitis 3. Rectal abscess 4. Pilonidal cyst 5. Soft tissue mass 6. Sacral-coccyx joint dislocation 7. Occult fracture **Testing and Results:** Repeat x-ray was negative for fracture, dislocation. There was some non-specific soft tissue edema around the sacral coccyx junction which is unclear. MRI was obtained which revealed a large expansile midline mass occupying the sacrum and coccyx and extending into the anterior pelvis measuring 7.2 x 9 x 8.5 cm. Tissue sampling would confirm a chordoma. **Final Diagnosis:** Sacral chordoma **Treatment & Outcomes:** 1. NSAIDs and opioids for pain control 2. Neurosurgical consultation 3. This patient's treatment is still ongoing at time of abstract submission. Initial surgical resection was modestly successful although the size of the tumor complicated complete resection Possible complications include chronic surgical site pain, nerve damage, continue chronic coccydynia. Median survival rate for sacral chordoma is approximately 7 years

648 May 31 1:40 PM - 2:00 PM

**Rapid Return To Sport After Lumbar Epidural Steroid Injection**Lauren Geroski, James Natalie, Stephen Woods. *COPC Sports, Spine & Joint, Westerville, OH.**(No relationships reported)*

**HISTORY:** A 66-year-old healthy active adult male with acute onset lumbosacral pain with referral into left leg while putting weights down after exercising. Initial primary care evaluation was unremarkable and patient was given Naprosyn, Percocet and an XRay was ordered, showing grade 1 spondylololthesis L2-3. Pain continued and he presented one week later with continued severe pain and new left lateral leg numbness. Oral steroids and physical therapy were initiated and pain continued. Gabapentin was tried with no response. He was seen at 9 weeks and complained of pain with all activities, including sitting. MRI was ordered and he was referred to physiatrist. He was seen one week later with 6/10 severe pain in left low back radiating down the left leg into lateral foot and ankle. Activity remains limited with pain even in the seated position and ADLs affected

**PHYSICAL EXAMINATION:** Positive straight leg raise, decreased sensation left lower limb in the entire foot and lateral calf, 4/5 strength left ADF

**DIFFERENTIAL DIAGNOSIS:** Lumbar disc herniation, lumbar radiculopathy, spondylololthesis, lumbar stenosis

**TESTS AND RESULTS:** MRI Lumbar Spine without Contrast:L4-L5 broad-based left-sided disc herniation extruding inferiorly left paracentral measuring 16 x 14 x 15 mm effacing the thecal sac and displacing the left L5 nerve root

**FINAL WORKING DIAGNOSIS:** L5-S1 disc herniation with left L5 radiculopathy

**TREATMENTS AND OUTCOMES:** Symptoms persisted despite oral steroids, NSAIDs, and physical therapy, and lumbar epidural steroid injection was performed. Patient had 98% pain relief with resolution of numbness. Left ankle dorsiflexion strength that improved (5-/5), pain was only 1/10 in left lumbosacral junction. Physical therapy was restarted for 4 weeks to improve core strengthening. At 6 wks, numbness had resolved, strength had normalized, and he was back to normal activities of biking 21 miles and lifting regularly.

649 May 31 2:00 PM - 2:20 PM

**Back Injury - Cheerleading**Michael A. Stiller, Michelle A. Miller. *The Ohio State University, Columbus, OH.**(No relationships reported)*

**HISTORY:** A 15-year-old high school cheerleader sustained a back injury while cheering on her school's football team. She was performing a "toe touch" jump and upon landing, she felt a "pop" and a sharp pain posteriorly between her shoulder blades. An hour later, she developed a "pins and needles" sensation from her belly button to her toes bilaterally. The next morning, the numbness had spread to just under the ribcage and she fell when trying to stand upright from bed. She presented to the emergency room later that morning.

**PHYSICAL EXAMINATION:** Examination revealed that she was afebrile with normal vital signs. There was no tenderness on palpation over the spinous processes or the paraspinal musculature. Her neurologic exam was significant for decreased sensation to light touch at the T8 dermatome and caudally with a proprioception deficit in the great toe bilaterally. Strength was 4/5 throughout the left lower limb. The patellar reflexes were 3/4 and the Achilles were 2/4 bilaterally. She demonstrated a wide-based gait with significant loss of balance.

**DIFFERENTIAL DIAGNOSIS:**

1. Spondylololysis/spondylololthesis
2. Vertebral fracture
3. Intervertebral disc herniation
4. Transverse myelitis
5. Psychogenic

**TESTS AND RESULTS:**

ESR and CRP normal

T-spine MRI:

1. Mild age related change/disc degeneration at T7-8 and T8-9 with a small acute appearing central disc protrusion at T8-9 that abuts the adjacent spinal cord.

2. No findings to indicate transverse myelitis.

FINAL/WORKING DIAGNOSIS: T8-9 intervertebral disc herniation resulting in myelopathy.

TREATMENT AND OUTCOMES:

1. Neurosurgery consult with no surgical intervention taken. Patient admitted for continued monitoring, PT, and OT.
2. Notable lower limb strength improvement seen over the first three days, however, acute inpatient rehabilitation was needed to assure ability for safe ambulation with impaired lower limb sensation.
3. After 12 days of inpatient rehab, lower body sensation was still impaired, but patient demonstrated improved lower limb strength and was ambulating with proper technique multiple times around the unit without assistance.
4. Patient discharged with outpatient therapy and a follow-up with neurosurgery in one month with repeat spine MRI.
5. Patient instructed to not return to cheerleading until follow-up.

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**Low Back Injury and Soccer**

Aynur Demirel<sup>1</sup>, Mehmet Yorubululul<sup>2</sup>, Ozlem Ulger<sup>3</sup>.  
<sup>1</sup>Hacettepe University, Ankara, Turkey. <sup>2</sup>Acibadem Hospital, Ankara, Turkey. <sup>3</sup>Hacettepe University, Ankara, Turkey.  
 Email: aynurdemirel629@hotmail.com  
 (No relationships reported)

**Low Back Injury- Soccer**

Aynur Demirel, Mehmet Yörübulut, Özlem Ulger Hacettepe University, Ankara, Turkey

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 (sponsor: )

**HISTORY:** A 17-year-old soccer player has severe back and groin pain applied to our clinic. Two years ago he had transverse process fracture of L5 vertebrae and bone marrow edema in this level. After 8 months, he returned the sport without pain but one month ago problems repeated.

**PHYSICAL EXAMINATION:** Paravertebral and quadratus lumborum muscle spasm were palpated. Straight leg raise test, sacroiliac mobility tests were negative on both side. Sacroiliac provocation tests were positive at right side. He had pain with trunk extension and rotation. There was no strenght and sensorial deficit. Lumbar lordosis increased.

**DIFFERENTIAL DIAGNOSIS**

Facet joint syndrome  
 Fracture of lumbar vertebra (transverse or spinous procces)  
 Spondylolysis (pars interarticularis defect)

**TEST AND RESULTS**

Lumbar spine Computed Tomography:  
 -Chronic fracture at L5 level (pars interarticularis fracture)  
 Sacroiliac joint T1 and T2 weighted coronal and transverse plane MRI:  
 -Right sacroiliac joint subchondral lesion (anterosuperior side)  
 -Left facet joint effusion (L5-S1 intervertebral disc level)

**FINAL/WORKING DIAGNOSIS:**

Pars interarticularis fracture

**TREATMENT AND OUTCOMES**

- 21 sessions of physiotherapy applied to decrease muscle spasm, gain painless range of motion and functional restoration.
- During therapy, lumbar orthoses was used to stabilization.
- Physiotherapist guided lumbar stabilization exercise applied (4 months follow-up, progression started with positional and went on dynamic and resistive tasks).
- Sport related running, one leg balance and coordination, agility tasks were performed with transversus abdominus muscele contraction.
- After therapy he has painless extension and running.

**B-39 Thematic Poster - Behavioral Aspects and Correlates of Physical Activity in College Students**

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM  
 Room: 403

721 **Chair:** Janet Buckworth, FACSM. *University of Georgia, Athens, GA.*

(No relationships reported)

722 **Board #1** May 31 3:15 PM - 5:15 PM  
**The Relationship Between Fitness App Use And Physical Activity Behavior Is Mediated By Exercise Identity**

Antonio S. Santo<sup>1</sup>, Andrew Lepp<sup>2</sup>, Jacob E. Barkley<sup>2</sup>. <sup>1</sup>University of Western States, Portland, OR. <sup>2</sup>Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)  
 Email: tsanto@uws.edu

(No relationships reported)

There is evidence that cell phone use is associated with greater sedentary behavior and decreased cardiorespiratory fitness. Conversely, certain cell phone functions (e.g., listening to music, mHealth care) may promote healthy behaviors. The use of cell phone based software applications designed to monitor and/or promote exercise behavior (i.e., fitness apps) are a cell phone function which may promote physical activity. However, the relationship between fitness app use and physical activity is not well studied.

**PURPOSE:** To assess the relationship between physical activity and fitness app use and then to determine if this potential relationship was mediated by measures of exercise identity (i.e., the degree to which someone defines themselves as being an exerciser).

**METHODS:** A sample of 351 (21.0 ± 2.1 years old, n = 201 females) college students were surveyed for: weekly vigorous, moderate, walking and total physical activity and sedentary behavior via the validated International Physical Activity Questionnaire, exercise identity via the validated Exercise Identity Scale and were asked to report the number of fitness apps they had on their cell phones. Participants were then split into groups of those who use one or more (apps group, dummy coded 1, n = 207) and do not use any (no apps group, dummy coded 0, n = 144) fitness apps.

**RESULTS:** Correlation analyses revealed that exercise identity was positively associated (r ≥ 0.13, p ≤ 0.02) with all measures of physical activity except walking (r = 0.06, p = 0.31). Exercise identity was inversely associated (r = -0.20, p < 0.001) with sedentary behavior. The app group reported a greater exercise identity (4.61 ± 1.6 app, 3.44 ± 1.8 no app, r = 0.32, p < 0.001) and participated in greater vigorous (2690 ± 2775 MET min per week app, 1651 ± 2344 MET min per week no app, r = 0.19, p < 0.001) and total (6541 ± 4691 MET min per week app, 5122 ± 4381 MET min per week no app, r = 0.15, p = 0.007) physical activity than the no app group. However, when controlling for exercise identity, via partial correlation, physical activity differences between groups were rendered non-significant (r = 0.04, p = 0.50).

**CONCLUSIONS:** Differences in weekly physical activity between participants who use at least one fitness app on their cell phone versus those with no apps were mediated by exercise identity.

723 **Board #2** May 31 3:15 PM - 5:15 PM  
**Pokémon Go! Play May Promote Walking And Discourage Sedentary Behavior In College Students**

Jacob E. Barkley, Andrew Lepp, Ellen L. Glickman, FACSM.  
 Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)

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(No relationships reported)

Pokémon Go! is a downloadable video game for use on an internet-connected cellular telephone (cell phone). The game encourages the player to traverse real-world locations (e.g., neighborhoods) and tracks the player, via GPS, as they move through these locales. The purpose of the game is to find computerized characters as the player moves through the real-world locations. Because the game requires players to move through real-world locales, it may promote physical activity.

**PURPOSE:** The purpose of this study was to assess self-reported walking and sedentary behavior in young adults before and after downloading Pokémon Go!.

**METHODS:** A sample of 238 (19.5 ± 1.7 years old, n = 119 females) college students who had downloaded Pokémon Go! on their cell phone for a minimum of two weeks were surveyed for weekly walking and sedentary behavior via the International Physical Activity Questionnaire. Participants reported their walking and sedentary behavior at three time points: the week immediately preceding their download of

Pokémon Go!, the first week after downloading the game and currently. Differences in self-reported physical activity and sedentary behavior across the three time points were compared via repeated-measures analyses of variance.

**RESULTS:** There was a significant main effect of time ( $f \geq 38.4, p \leq 0.001$ ) for walking and sedentary behavior. Participants reported greater ( $t \geq 7.4, p \leq 0.001$ ) daily walking during the first week after downloading Pokémon Go! ( $206 \pm 138$  min) and currently ( $191 \pm 202$  min) versus the week before downloading ( $105 \pm 101$  min). There was no difference ( $t = 1.1, p = 0.27$ ) between the first week after downloading and current walking behavior. Participants reported greater ( $t \geq 6.5, p \leq 0.001$ ) daily sedentary behavior during the week before downloading ( $329 \pm 219$  min) versus both the first week after downloading ( $242 \pm 181$  min) and currently ( $256 \pm 152$  min). There was no difference ( $t = 1.5, p = 0.15$ ) between the first week after downloading and current sitting behavior.

**CONCLUSIONS:** Use of the popular, physically-interactive cell phone game, Pokémon go!, had favorable effects upon self-reported physical activity (96% to 82% increase) and sedentary behavior (26% to 22% decrease). Such games hold promise as technology that may promote physical activity and discourage sedentary activity.

724 Board #3 May 31 3:15 PM - 5:15 PM  
**Effects of Social Support on Physical Activity Participation in College Freshman: The HERD Study**  
 Robert Powell, Lauren Bartoldson, Jared Mattingly, Holly Cyphert. *Marshall University, Huntington, WV.*  
 Email: powellro@marshall.edu  
 (No relationships reported)

Approximately 1 in 6 college aged adults in the United States engage in no leisure time physical activity. Still, a paucity of literature exists regarding what influences physical activity participation in this age group. **PURPOSE:** To determine the effects of social support on physical activity participation in college freshman enrolled in the HERD (Higher Education Reducing Diabetes) Study at Marshall University in Huntington, West Virginia. **METHODS:** The HERD Study is a prospective, randomized study examining the effects of a freshman year, healthy lifestyle intervention on the reduction of student's risk factors for type 2 diabetes and cardiometabolic disease. Freshman students were recruited during the University's Week of Welcome activities throughout campus. Physical activity measures, cardiometabolic health parameters and other demographics were obtained at baseline. Social Support was assessed by the Social Support and Exercise Survey; a 13 item, Likert scale survey that queries about family and friends social support for exercise over the past 3 months. **RESULTS:** To date, 76 freshmen have enrolled into the HERD Study [age= 18.5±2.36 years; female=60.5% (n=46); 85.5% Caucasian (n=65); BMI= 26.5±5.85 kg/m<sup>2</sup>; VO<sub>2</sub>max=35.4±9.3 ml/kg/min]. Roughly 44% (n=33) reported engaging in regular exercise, however, of those, only 9.2% meet the recommendations of the aerobic guidelines for American adults and 26.3% meet the resistance training criteria. Those who participate in regular exercise were significantly more likely to report that friends help to: plan activities around their exercise, exercise with them, or ask them about how they (the friend) can adopt more exercise compared to their non-exercising counterparts ( $p=.026, p=.037$  and  $p=.015$ , respectively). Moreover, those who participate in regular exercise were more likely to report that their family makes plans for exercise on recreational outings compared to their non-exercising counterparts ( $p=.042$ ). **CONCLUSION:** Support from both friends and family appears to play a decisive role in the adoption and adherence to regular physical activity in late teenage years. Physical activity interventions should include strategies to promote peer social support in the college setting to enhance physical activity participation in college students.

725 Board #4 May 31 3:15 PM - 5:15 PM  
**Academic Success And One-Year Of Intramural Sports Participation By Freshmen Students**  
 Kerri L. Vasold, Lauren E. Kosowski, James M. Pivarnik, FACSM. *Michigan State University, East Lansing, MI.*  
 Email: vasoldke@msu.edu  
 (No relationships reported)

Previous research has shown small, positive relationships between academic success and overall recreational sports participation. However, few studies have focused on these relationships within intramural sports participation specifically rather than recreational sports as a whole.

**PURPOSE:** To investigate differences in cumulative grade point average (GPA) and cumulative credit difference (CD, credits attempted - credits completed) among intramural sports participants and non-participants following their first year of college. **METHODS:** Participants included first time, on campus, freshmen from the FS13 and FS14 semesters. Matched samples (n=1,796; 898 pairs) were generated based on cohort, high school GPA, race, socioeconomic status, first generation status, and gender. Intramural sports usage was obtained via an online database system (IM Leagues). All other variables were obtained from a university database, including GPA and CD. Means±SD and percentages were calculated for all variables of interest. Paired sample t-tests were used to assess differences in cumulative GPA and CD between participants and non-participants after first semester and first year time points.

**RESULTS:** First semester cumulative GPA was significantly higher ( $p$ -value<0.001) for participants ( $3.25 \pm 0.66$ ) than non-participants ( $3.09 \pm 0.80$ ). Likewise, first year cumulative GPA ( $p$ -value<0.001) was also significantly higher for participants ( $3.25 \pm 0.63$ ) than non-participants ( $3.07 \pm 0.78$ ). First semester cumulative CD was significantly lower ( $p$ -value=0.001) for intramural sports participants ( $5.53 \pm 7.00$ ) than non-participants ( $6.63 \pm 7.72$ ). Finally, first year cumulative CD ( $p$ -value<0.001) was also significantly lower for participants ( $6.09 \pm 7.13$ ) than non-participants ( $7.70 \pm 8.20$ ). **CONCLUSIONS:** Results suggest that freshmen students participating in intramural sports during their first year of college achieve higher cumulative first semester and first year GPAs, and have a lower first semester and first year cumulative CD than students who do not participate in intramural sports. Future studies should investigate intramural sports participation and academic variables beyond the first year, and also include retention as an outcome variable.

726 Board #5 May 31 3:15 PM - 5:15 PM  
**The Relationship between Physical Activity and Binge Drinking among College Students: A Qualitative Investigation**  
 Mary K. Dinger<sup>1</sup>, Danielle R. Brittain<sup>1</sup>, Heidi M. O'Mara<sup>1</sup>, Brent M. Peterson<sup>2</sup>, Kelly C. Hall<sup>1</sup>, Molly K. Hadley<sup>1</sup>, Teresa A. Sharp<sup>1</sup>. <sup>1</sup>*Colorado School of Public Health at University of Northern Colorado, Greeley, CO.* <sup>2</sup>*Biola University, La Mirada, CA.*  
 Email: mary.dinger@unco.edu  
 (No relationships reported)

An incongruous association between regular participation in physical activity (PA) and binge drinking (BD) among college students (CS) has been reported in the literature. **PURPOSE:** The purpose of this study was to qualitatively investigate the relationship between PA and BD among CS. **METHODS:** CS (18-24 years, non-varsity athletes) who were meeting the national physical activity recommendation ( $\geq 150$  minutes/week of moderate and/or vigorous PA) and reported consuming at least five or more alcoholic beverages in a single sitting within the previous 30 days were recruited to participate in the study. A trained facilitator asked open-ended questions based on the social ecological model during focus groups, separated by sex, to inquire about PA and BD experiences among CS. The sessions were audio-recorded and transcribed verbatim. Transcripts were analyzed by three researchers (first independently, then jointly) to determine emergent themes. **RESULTS:** Participants (n = 58, 19.7 ± 0.2 years, 76% Caucasian) described how PA and BD were related in their everyday lives as full-time students. Several intrapersonal, interpersonal, institutional and community factors were identified. The most frequently occurring theme among females (n = 25) was "calorie conscious." "Damage control: healthy/unhealthy" was the most frequent theme/sub-theme among males (n = 33). **CONCLUSION:** The results indicate there are multiple social ecological levels that influence PA and BD behavior in CS. Although additional research is warranted, results of this study suggest that community level factors greatly influence several intrapersonal and interpersonal level factors described by participants. It is imperative that all social ecological levels are considered when designing interventions to promote PA and reduce BD among CS.

727 Board #6 May 31 3:15 PM - 5:15 PM  
**How Is Self-efficacy Related To Components Of Health-related Fitness In Male And Female Undergraduates?**  
 Sandy T. Nguyen, Paul E. Yeatts, FACSM, Gene L. Farren, FACSM, Tsz Lun Chu, FACSM, Mitch Barton, FACSM, Scott B. Martin, FACSM. *University of North Texas, Denton, TX.*  
 (Sponsor: Dr. Scott Martin, FACSM)  
 Email: nguyensandyt@gmail.com  
 (No relationships reported)

**Introduction:** As part of Social Cognitive Theory (Bandura, 1986), self-efficacy (SE) represents the extent to which an individual believes a behavior can be successfully completed (Bandura, 1977). Previous research has found evidence that SE is an important factor for promoting exercise adherence and is related to improvements in health-related fitness (HRF; Imayama et al., 2013). However, additional research is needed to investigate how SE is related to each component of HRF (i.e., cardiorespiratory fitness, muscular strength and endurance, and body fatness) across gender.

**Purpose:** To investigate how SE is related to each component of HRF in male and female college students.

**Method:** Participants included 399 male and 327 female college students ( $M_{age} = 20.57 \pm 3.82$  years) enrolled in a physical health and wellness course. Students completed survey items assessing exercise SE (Resnick & Jenkins, 2000) and a HRF battery (FITNESSGRAM®; Cooper Institute, 2013) assessing cardiorespiratory fitness (Progressive Aerobic Cardiovascular Endurance Run [PACER]), muscular strength and endurance (curl-ups, push-ups, and handgrip strength), and body composition (body fat percentage). Separate correlation analyses were conducted by gender to examine the bivariate relations between SE and each component of HRF.

**Results:** Among males, SE was weakly correlated with curl-ups ( $r = .11, p < .05$ ) and push-ups ( $r = .14, p < .01$ ), but SE was not significantly correlated with PACER, handgrip strength, or body fat percentage ( $p > .05$ ). Among females, SE was significantly correlated with PACER ( $r = .23, p < .001$ ), push-ups ( $r = .33, p < .001$ ), handgrip ( $r = .23, p < .001$ ), and body fat percentage ( $r = .22, p < .001$ ), but SE was not significantly correlated with curl-ups ( $p > .05$ ).

**Conclusion:** Overall, SE was weakly related to each component of HRF. Compared to males, females had slightly stronger correlations between SE and each component of HRF. The lack of moderate or strong relationships between SE and HRF may be due to the focus on academic outcomes in undergraduate courses. Thus, fitness class instructors should consider making additional efforts to promote SE among their students. Techniques could include positively reinforcing small improvements in fitness, discussing ways to overcome barriers, or helping students to experience success.

728 Board #7 May 31 3:15 PM - 5:15 PM  
**Motivational and Self-Perceptions of College Students Who Exercise for Different Reasons**

James R. Whitehead, FACSM, Amanda Dufner, Jesse L. Rhoades, Tanis J. Walch. *University of ND, Grand Forks, ND.*  
 Email: james.whitehead@email.und.edu  
 (No relationships reported)

College students exercise for a variety of reasons, but specific differences in their motivations and perceptions have not been extensively studied. **PURPOSE:** The main purpose was to see if students whose primary reason for exercise is to lose fat (FATCON), gain muscle mass (MUSC), or maintain health (HLTH) had differences in their exercise motivations, social physique anxiety, and body image self-perceptions. A secondary purpose was to explore if the participants' supplement use reflected their exercise priorities. **METHODS:** Data were collected at a university Wellness Center, or from exercise classes. Participants ( $N = 216$ ) completed a packet of four questionnaires: Multidimensional Body Self Relations Questionnaire (MBSRQ), Social Physique Anxiety Scale (SPAS), The Behavioral Regulation of Exercise Questionnaire (BREQ-3), and an ad hoc Dietary Supplement Questionnaire (DSQ). **RESULTS:** MANOVA revealed a significant difference between groups ( $F(14, 350) = 4.89, p < .001$ ). Post hoc tests showed significant differences between groups on six out of seven dependent variable scales. Specifically, MUSC was significantly higher in autonomous motivation than FATCON and HLTH ( $p < .001$ ), but FATCON scores on SPAS, appearance evaluation, body areas satisfaction, overweight preoccupation, and self-weight classification were all less positive than the scores of MUSC and HLTH ( $p < .001$  to  $p < .005$ ). Supplement use was low in HLTH (11%), FATCON (15%), but higher in MUSC (49%). In addition, some of the supplements listed by MUSC were of questionable efficacy and safety. **CONCLUSIONS:** The majority of these college student exercisers were autonomously motivated, but those who exercised primarily for fat control had more negative body-related perceptions than those who exercised primarily for health, or for muscle gain reasons. Additionally, the data on supplement use indicates a need for consumer education, especially for those who report they are exercising primarily to gain muscle.

729 Board #8 May 31 3:15 PM - 5:15 PM  
**An Analysis Of Physical Activity Knowledge, Motivators, and Self-efficacy In An Undergraduate Wellness Course**

Monica M. Maldari<sup>1</sup>, Michelle Scribner-MacLean<sup>2</sup>, David J. Rice<sup>3</sup>. <sup>1</sup>Fitchburg State University, Fitchburg, MA. <sup>2</sup>University of Massachusetts Lowell, Lowell, MA. <sup>3</sup>Florida Southern College, Lakeland, FL.  
 (No relationships reported)

Research suggests that many undergraduates do not achieve the minimum recommended amounts of physical activity (PA). These findings are concerning as habits developed during college are likely to be continued into adulthood. **PURPOSE:** The purpose of this investigation was to identify changes in health-related fitness knowledge (HRFK), PA practices, self-efficacy and motivations for exercise that occurred while participants were enrolled in a conceptually-based, mandatory, health and fitness course. **METHODS:** One hundred and thirty-five students (66 females) enrolled in the course (mean  $\pm$ SD; age  $19.89 \pm 2.3$  years; BMI  $24.5 \pm 5.24$  kg/m<sup>2</sup>) completed a pre-course survey on the first day of classes and a post-course survey during the last week of classes. The survey collected demographic data and information on HRFK, PA practices, motivations, and self-efficacy for exercise. **RESULTS:** Analysis demonstrated that HRFK increased significantly ( $p < .001$ ) during enrollment in the course. Self-efficacy and BMI values were largely unchanged between pre- and post-course values. Results for PA practices noted increases in miles walked ( $p > .05$ ) and flights of stairs climbed ( $p < .05$ ) per day. Significantly more ( $p = .002$ ) male students reported muscle development, whereas significantly more ( $p = .046$ ) female students reported weight management as a motivators for exercise. Motivations shifted slightly post-course with a significant increase ( $p = .014$ )

in the number of females exercising for muscle development at the end of the course compared to beginning. Responses to Likert scale (1=Strongly Disagree, 5=Strongly Agree) questions on course outcomes revealed that most students "agreed (4)" that as a result of the course they understood physical responses to exercise training ( $M=4.3, SD=.67$ ), improved understanding of their current fitness levels ( $M=4.0, SD=.69$ ), and learned tools to design effective, individualized exercise plans ( $M=4.2, SD=.64$ ). However, most students "neither agreed nor disagreed (3)" that they exercised more at the end of the course compared to the beginning.

**CONCLUSION:** Enrollment in a conceptually-based, health and fitness course can increase HRFK over the course of the semester, however this increase in knowledge is not associated with concurrent increases in activity levels or self-efficacy.

**B-40 Thematic Poster - Distance Running Issues**

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM  
 Room: 505

730 **Chair:** Adam S. Tenforde. *Spaulding Rehabilitation Hospital, Cambridge, MA.*  
 (No relationships reported)

731 Board #1 May 31 3:15 PM - 5:15 PM  
**A 5-year Descriptive Epidemiology and Performance Study of Adolescent Recreational Marathon Runners**

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 (No relationships reported)

**PURPOSE:** To descriptively examine injuries, treatments, and performance of adolescent recreational runners who trained for a half or full marathon from 2011-12 to 2015-16. **METHODS:** Musculoskeletal injuries and medical treatments of high school recreational runners who committed to a 30-week half or full marathon training program (mean=3.5 practices/week) were recorded by physical therapists over a 5-year period. The recorded information included number of injured participants, number of injuries, injury sites, diagnosis, and number of treatment sessions. Number of participants who completed a half or a full marathon at the end of the 30-weeks of training was recorded annually for the last 5 years. Obtained information was descriptively analyzed. **RESULTS:** Throughout the 5 training seasons, a total of 448 adolescent runners (age:  $16.2 \pm 0.9$  years; 55% female  $N=247$ , 45% male  $N=201$ ) participated in the 30-week training period. During the training periods, 165 adolescent runners (36.8%) reported 225 musculoskeletal injuries (50.2%). The most common injury site was lower leg (29.9%) followed by knee and ankle/foot as the second and third most commonly injured sites (25% each). Achilles/posterior/peroneal tendonitis was the most common injury diagnosis reported (16.1%) followed by patellofemoral pain (14.7%) and shin splints (14.3%). Overall 87.1% of the injuries required 3 or fewer treatment sessions with a mean of 1.82 treatment sessions per injury. Of the 448 adolescent runners, a total of 441 adolescent runners completed either a half ( $N=62$ ) or full marathon ( $N=379$ ). The completion rate was 98.4% in this cohort following the 30-weeks of training. **CONCLUSIONS:** Despite the number of injured runners and reported injuries, most adolescent participants completed a half or full marathon following 30-weeks of training. Also, the injuries do not appear to be severe as evidenced by the low number of treatment sessions required and high percentage of students able to complete the race. Further research detailing volume of training with more precise measures of training time lost to injury is needed to more thoroughly validate these results.

732 Board #2 May 31 3:15 PM - 5:15 PM  
**Runner's Perceptions And Expectations Of Medical Coverage At Ultramarathons**

Jeff S. Lynn, Kim Keeley, Kristen Zaitz, Kelly Holzberger. *Slippery Rock University, Slippery Rock, PA.* (Sponsor: Patricia Pierce, FACSM)  
 (No relationships reported)

As the popularity of ultramarathons grows, medical directors and staff could benefit from greater understanding of runners' needs and expectations. **PURPOSE:** The purpose was to describe runners' expectations and perceptions of medical coverage at 100-mile trail races. **METHODS:** A survey was distributed via email to 230

registrants of a 100-mile trail race in the Northeast United States. Questions included expectations of medical coverage at ultramarathons as well as perceptions of coverage at prior races. **RESULTS:** One hundred sixteen runners completed the survey (98 men, 18 women; age=42±8). Ultramarathon experience ranged from 2-50+ races with runners reporting 1-20 years' experience (mean 4.6 years). Ninety-one percent (n=110) of runners reported a medical issue during prior ultramarathons. The most common were chafing (n=81; 70%), blisters (n=66; 57%), muscle cramps (n=64; 55%), blood under toenail (n=54; 47%), and GI distress (n=47; 41%). Of those who received medical care during a race, 45 of 46 were satisfied with the treatment they received. Runners thought that medical aid should be available every 10 miles (n=49; 45%) or 20 miles (n=33; 30%) and should include medical tape (n=89; 81%), sodium (n=88; 80%), Band-Aids (n=88; 80%), anti-chafe products (n=86; 78%), emergency blankets (n=82; 75%), and ice packs (n=78; 71%). Runners reported carrying few medical items with them including sodium (n=65; 57%), anti-chafe lube (n=40; 35%) anti-inflammatories (n=39; 34%), and Band-Aids (n=28; 24%). While only 4% (n=4) of respondents believed that there are no conditions under which medical personnel should stop a runner from continuing, others thought that appropriate reasons include venomous bite (n=90; 84%), seizure (n=82; 73%), head injury (n=80; 71%), altered consciousness (n=70; 63%), irregular heart beat (n=60; 54%), chest pain (n=58; 52%), or blood in urine (n=56; 50%). **CONCLUSIONS:** Based on this small sample, a large percentage of ultramarathoners suffer from non-emergent conditions, but most do not seek medical care during the race. Those who sought treatment tended to be satisfied with the care received. Medical directors should provide supplies to care for skin care but have the expertise to recognize and treat more serious issues that may require the runner to stop.

733 Board #3 May 31 3:15 PM - 5:15 PM

**Pre-Race Medical Screening and Educational Intervention Reduces Medical Complications: A SAFER Study in 153208 Runners**

Martin Peter Schweltnus, FACSM<sup>1</sup>, Karen Schwabe<sup>2</sup>, Sonja Swanevelder<sup>3</sup>, Esmé Jordaan<sup>3</sup>, Wayne Derman<sup>4</sup>. <sup>1</sup>University of Pretoria, Pretoria, South Africa. <sup>2</sup>University of Cape Town, Cape Town, South Africa. <sup>3</sup>South African Medical Research Council, Cape Town, South Africa. <sup>4</sup>Stellenbosch University, Cape Town, South Africa.

(No relationships reported)

We previously reported a high rate of medical complications (1/121 race starters) in a cohort of 65 865 runners participating in 21.1km and 56km races over a 4-year period (2008-2011) (SAFER study 1). **PURPOSE:** To determine if an online pre-race medical screening and educational intervention program reduces medical complications in distance running events. **METHODS:** An online pre-race medical screening (based on the European guidelines for pre-screening of leisure athletes participating in moderate- to high-intensity sports) and an educational intervention program was designed and introduced as part of the race registration process, in the period 2012 to 2015 at the Two Oceans Marathon races (21.1km and 56km). The incidence of medical complications (per 1000 race starters; all and serious life-threatening) during the 4-year post-intervention period (2012-2015: 87 343 race starters) was compared with the pre-intervention period (2008-2011: 65 865 race starters). **RESULTS:** Compared to the pre-intervention (baseline) period, there was a significant reduction in the incidence (per 1000 starters, 95% CI; adjusted for age group, gender and race distance) of all medical complications in all runners by 29% [pre=8.6 (7.9-9.4); post=6.1 (5.6-6.7), p<0.0001], 21.1km runners by 19% [pre=5.1 (4.4-5.9); post=4.1 (3.6-4.8), p=0.0356], and 56km runners by 39% [pre=14.6 (13.1-16.3); post=9.0 (7.9-10.1), p<0.0001]. Serious life-threatening complications were significantly reduced in all runners by 64% [pre=0.6 (0.5-0.9); post=0.2 (0.1-0.4), p=0.0003; adjusted for age group and gender]. **CONCLUSION:** A pre-race medical screening and educational intervention program significantly reduced medical complications and serious life-threatening complications among all runners in community-based mass participation distance running events. The reduction in all medical complications was significant in both the 21.1km and 56km races. Pre-race screening and educational intervention programs could be introduced to reduce medical complications during endurance running events.

734 Board #4 May 31 3:15 PM - 5:15 PM

**Two-peaked Increase of Serum Myosin Heavy Chain-α After Ironman Demonstrates Heart Muscle Cell Death**

Jörg Carlsson, Tom Danielsson, Patrick Bergman. *Linnaeus University, Kalmar, Sweden.*

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(No relationships reported)

There is an ongoing debate about the significance of cardiac troponin T (cTnT) elevation after strenuous exercise: heart muscle cell death versus physiologic mechanism of release through an intact cell membrane. While cTnT is a small molecule (37 kDa), cardiac specific myosin heavy chain-α (MHC-α) is much larger (224 kDa) and an increase after exercise could hardly be explained by passage

through an intact cardiac cell membrane. **PURPOSE:** To measure MHC-α, and other biomarkers (C-reactive protein (CRP); cTnT, creatine kinase (CK), myoglobin (MG), creatinine (C), and N-terminal pro-hormone of brain natriuretic peptide (NT-proBNP) before and after a full distance Ironman in order to answer the question of heart muscle cell death versus physiologic changes. **METHODS:** In 52 non-elite athletes (14 female, 38 male; age 41.1 ± 9.7, range 24-70 years; all completed the race) biomarkers were measured by standard laboratory methods 7 days before, directly after, and day 1, 4 and 6 after the race. MHC-α was measured with a commercially available ELISA with no cross reactivity with other myosins. **RESULTS:** The course of MHC-α concentration [μg/L] was 1.33 ± 0.53 (before), 2.57 ± 0.78 (directly after), 1.51 ± 0.53 (day 1), 2.74 ± 0.55 (day 4) and 1.83 ± 0.76 (day 6). Other biomarkers showed a one-peaked increase with maximal values either directly after the race or at day 1: cTnT 76 ± 80 ng/L (12-440; reference <15), NT-proBNP 776 ± 684 ng/L (92-4700; ref. < 300), CK 68 ± 55 μkat/L (5-280; ref. < 1.9), MG 2088 ± 2350 μg/L (130-17000; ref. < 72), and creatinine 100 ± 20 μmol/L (74-161; ref. < 100), CRP 49 ± 23 mg/L (15-119; ref. < 5). There was a significant correlation between MHC-α and NT-proBNP (R=0.48; p<0.001) but neither between MHC-α and cTnT (R=0.13; p=0.36) nor MHC-α and myoglobin (R=0.18; p=0.2). **CONCLUSION:** An Ironman leads to remarkable disturbances in biomarkers as e.g. cTnT was in the range of myocardial infarction in 100% of women and 97% of men. This is to our best knowledge the first investigation of MHC-α after strenuous exercise and its two-peaked increase most likely represents first release from the cytosolic pool and later from cell necrosis including the contractile apparatus. However, many questions remain, not at least why MHC-α baseline levels are as high as 1.33 ± 0.53 μg/L.

735 Board #5 May 31 3:15 PM - 5:15 PM

**Are Clinical Symptoms Of Running Overuse Injuries Associated With Thermographic Response? A Proof-of-concept Study.**

Jessica S. Siplon<sup>1</sup>, Angela S. Gisselman<sup>2</sup>, Steve Tumilty<sup>2</sup>, James M. Smoliga<sup>1</sup>. <sup>1</sup>High Point University, High Point, NC. <sup>2</sup>University of Otago, Dunedin, New Zealand. (Sponsor: Gerald Zavorsky, FACSM)

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(No relationships reported)

Medical infrared thermography (MIT), a non-radiating imaging technology, detects changes in skin temperature. Musculoskeletal injuries result in blood flow changes which may produce patterns of associated changes in skin temperature that can be visually detected by MIT.

**PURPOSE:** To determine if clinical symptoms of distal lower extremity overuse injuries in runners are associated with visually detectable changes in MIT.

**METHODS:** 29 competitive distance runners (age 18-25y, running >25 miles per week) enrolled and participated. Once weekly, runners reported to lab for MIT photos of bilateral lower limbs taken with an infrared camera. Prior to MIT, runners acclimatized to lab conditions for 15 minutes and the camera was calibrated to the room temperature and humidity. A modified Oslo Sports Trauma Research Centre (OSTRC) overuse injury questionnaire was used for athlete-reported musculoskeletal symptoms and problems. MIT photos and OSTRC scores were obtained on a weekly basis for 8 weeks. Runners' photos were grouped into those with no reports of any lower extremity problems (Controls: OSTRC = 0, n=5); and those with reports of significant lower extremity problems (Injured: OSTRC >50, n=7). Photos from each group were placed into an online viewer and evaluated by 7 blinded clinicians. For the injured group, a photo from the week of the highest reported OSTRC score was paired with a baseline (OSTRC <25) photo. For the control group, two uninjured photos were paired. The reference photo for each pair was labeled. The order of photos (control vs. injured) was randomized and reviewers were not provided the number of included injured runners. Clinicians visually inspected 12 image pairs and decided whether or not the photo suggested a lower extremity problem existed. Diagnostic accuracy statistics were computed for each evaluator.

**RESULTS:** The median (interquartile range) for the seven evaluators were: sensitivity=0.43 (0.29), specificity=0.60 (0.2), positive likelihood ratio=1.43 (0.0), negative likelihood ratio=0.71 (0.18).

**CONCLUSIONS:** Low diagnostic accuracy and considerable inter-rater variability suggests evaluator training of MIT interpretation is necessary to accurately confirm or disconfirm presence of injury based on MIT findings.

736 Board #6 May 31 3:15 PM - 5:15 PM  
**Hematological Changes in Elite Collegiate Cross Country Runners Residing at Moderate Altitude: A Retrospective Analysis**  
 Kalee L. Morris<sup>1</sup>, Jesse A. Goodrich<sup>1</sup>, Sourav Poddar<sup>2</sup>, Luke Widstrom<sup>2</sup>, Miguel Rueda<sup>1</sup>, William Byrnes<sup>1</sup>. <sup>1</sup>University of Colorado Boulder, Boulder, CO. <sup>2</sup>University of Colorado Denver, Denver, CO.  
 (No relationships reported)

**PURPOSE:** This study assessed selected seasonal hematological changes in elite male and female collegiate cross-country (XC) runners residing at a moderate altitude (1655 m). **METHODS:** Previously collected de-identified data from 29 members of the University of Colorado's XC team (12 males, 17 females) were analyzed for this project. The data was part of the regularly scheduled monitoring of these athletes through the CU Sports Medicine program. This program involves blood samples being taken following a rest day, after an overnight fast, at five time points across the year, (August, October, January, April, and August of the new season). Hematological parameters measured included red blood cell count (RBC), hemoglobin concentration (Hb), hematocrit (Hct), mean corpuscular volume (MCV), red cell distribution width (RDW) and serum ferritin. A linear mixed model was used to assess changes over time, significance set at  $p < .05$ . For variables that violated the assumptions of the linear mixed model (ferritin), non-parametric analysis was used. **RESULTS:** Males (M) and females (F) had significantly different baseline values for Hct (%) (M:  $46.5 \pm .8$  versus F:  $43.0 \pm .6$ ) and Hb (gm/dL) (M:  $16.3 \pm .3$  versus F:  $14.6 \pm .2$ ), although they exhibited the same pattern of change across the season. Overall, Hct increased from baseline at the October time point (+5.4%) before returning to near baseline levels for the remainder of the season. Hb had a similar trend, being higher at the October time point (+2.2%,  $p = 0.083$ ) before returning to near baseline levels. MCV (Aug1-  $90.4 \pm .6$ , Aug2-  $92.4 \pm .6$ ) and RDW (Aug1-  $12.7 \pm .1$ , Aug2-  $12.5 \pm .1$ ) were the only two variables whose two August time points were significantly different. Serum ferritin (ng/mL) was stable over all five time points for males (average of all time points: 56.5), whereas females demonstrated significantly lower values in January (49.2), (average of all time points excluding January: 56.9). **CONCLUSION:** These results suggest seasonal hematological changes occur in elite collegiate XC runners. These changes could be the result of adaptations associated with alterations in training, nutrition and/or altitude exposure. Future studies should directly assess the contribution of these parameters to the observed changes and determine the impact of these changes on performance.

737 Board #7 May 31 3:15 PM - 5:15 PM  
**Fluid Replacement Knowledge and Sources of Hydration in High School Cross-Country Runners**  
 Mitchell J. Rauh, FACSM<sup>1</sup>, Erin E. Menefee<sup>1</sup>, Diane N. Lawrence<sup>2</sup>, Robert G. Bowers<sup>3</sup>, Michael J. Buono, FACSM<sup>1</sup>. <sup>1</sup>San Diego State University, San Diego, CA. <sup>2</sup>Mt. Carmel High School, San Diego, CA. <sup>3</sup>Rancho Bernardo High School, San Diego, CA.  
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 (No relationships reported)

Cross-country is a popular interscholastic sport with a growing number of participants annually. As most training and competitions take place during summer and fall, the risk of dehydration may be increased. Unlike other fall high school sports, knowledge about hydration and fluid intake have not been reported in cross-country runners. **PURPOSE:** To assess fluid replacement knowledge and sources of hydration in high school cross-country runners. **METHODS:** Runners were recruited from high school cross-country teams in San Diego. Each runner completed a questionnaire that assessed fluid replacement knowledge and sources of hydration. **RESULTS:** Overall, 148 runners (80 girls, 68 boys) participated in the study. Less than a quarter (23%) of runners correctly indicated that thirst is not a timely indicator of when to drink fluids. Most runners correctly indicated that monitoring urine color is an effective way to determine if hydrated (89.9%), dehydration decreases performance in endurance events (92.6%), dehydration increases risk of heat-related illness (95.9%), running in hot or humid conditions affects hydration (96.6%), runners should begin each training session or competitive event well-hydrated (98.6%), fluid replacement during running should prevent dehydration of greater than 2% of body weight (89.9%), and during recovery runners should rehydrate within a 2 hour period after running (93.9%). Girls (96.2%) were more likely to report that monitoring urine color is an effective way to determine hydration level than boys (83.8%) ( $p=0.02$ ). Runners in the 9th grader (83.7%) were less likely than 10th (88.4%), 11th (100.0%), and 12th (96.6%) graders to report that monitoring urine color is an effective method to determine if dehydrated ( $p=0.02$ ). **CONCLUSIONS:** Most high school cross-country runners indicated a high knowledge of fluid intake and sources of hydration. However, improving runners' knowledge to hydrate regardless of thirst appears warranted. The data suggest that boys and younger runners may need increased education on how urine color indicates safe/unsafe hydration levels.

**B-41 Thematic Poster - Macronutrient Metabolism in Athletes**  
 Wednesday, May 31, 2017, 3:15 PM - 5:15 PM  
 Room: 304

738 **Chair:** Craig Sale, FACSM. Nottingham Trent University, Nottingham, United Kingdom.  
 (No relationships reported)

739 Board #1 May 31 3:15 PM - 5:15 PM  
**Exercise Mode Combined with Essential Amino Acid and Carbohydrate Supplementation Differentially Regulate Skeletal Muscle microRNA**  
 Lee M. Margolis, Holly L. McClung, Nancy E. Murphy, Stefan M. Pasiakos, FACSM. United States Army Research Institute of Environmental Medicine, Natick, MA. (Sponsor: Stefan M Pasiakos, FACSM)  
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 (No relationships reported)

Skeletal muscle microRNAs (myomiR) have been implicated in modulating intracellular regulation of muscle protein synthesis by negative inhibition of the mTORC1 pathway. The acute effects of endurance exercise mode and recovery essential amino acid and carbohydrate (EAA+CHO) nutrition on myomiR expression are not well defined. **PURPOSE:** Determine the effects of endurance exercise mode, with or without EAA+CHO ingestion on myomiR expression. **METHODS:** Twenty five adults (mean  $\pm$  SD;  $22 \pm 2$  y,  $82 \pm 11$  kg,  $VO_{2peak} 4.0 \pm 0.5$  L $\cdot$ min<sup>-1</sup>) performed 90 min of metabolically-matched ( $2.2 \pm 0.1$  VO<sub>2</sub> L $\cdot$ min<sup>-1</sup>) load carriage (LC; performed on a treadmill wearing a vest equal to 30% of individual body mass; load carried  $24 \pm 3$  kg) or cycle ergometry (CE) exercise, during which EAA+CHO (10 g EAA and 46 g CHO) or non-nutritive control (CON) drinks were consumed. Expressions of myomiR were determined using RT-qPCR in muscle samples obtained at rest (PRE), immediately post-exercise (POST) and after 3-hr recovery (REC). **RESULTS:** Relative to PRE, POST and REC expressions of miR-1-3p, miR-206, miR-208a-5 and miR-499 were lower ( $P < 0.05$ ) for LC compared to CE, regardless of dietary treatment. Independent of exercise mode, miR-1-3p and miR-208a-5p expression were lower ( $P < 0.05$ ) after ingesting EAA+CHO compared to CON. Expression of miR-206 was highest for CE+CON than any other treatment (exercise-by-drink,  $P < 0.05$ ). **CONCLUSIONS:** These data show that myomiR expression is differentially regulated by endurance exercise mode and EAA+CHO nutrition. Weight bearing exercise downregulates myomiR expression, whereas myomiR expression appears to be upregulated after non-weight bearing exercise. Consuming EAA+CHO attenuated the increase in myomiR expression with non-weight bearing exercise, yet the suppression of myomiR expression with feeding was more pronounced when EAA+CHO were consumed during weight bearing exercise. These findings suggest that combining weight bearing exercise with protein and carbohydrate supplementation may facilitate muscle anabolic adaptations to exercise by lowering mTORC1 inhibition.

740 Board #2 May 31 3:15 PM - 5:15 PM  
**Fructose and Sucrose Ingestion Increase Exogenous Carbohydrate Oxidation Rates During Exercise in Trained Cyclists**  
 Jorn Trommelen<sup>1</sup>, Cas J. Fuchs<sup>1</sup>, Milou Beelen<sup>1</sup>, Kaatje Lenaerts<sup>1</sup>, Asker E. Jeukendrup, FACSM<sup>2</sup>, Naomi M. Cermak<sup>1</sup>, Luc J.C. van Loon<sup>1</sup>. <sup>1</sup>Maastricht University, Maastricht, Netherlands. <sup>2</sup>Loughborough University, Loughborough, United Kingdom. (Sponsor: Janice Lee Thompson, FACSM)  
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 (No relationships reported)

Peak exogenous carbohydrate oxidation rates typically reach  $\sim 1$  g $\cdot$ min<sup>-1</sup> during exercise when ample glucose or glucose polymers are ingested. Fructose co-ingestion has been shown to further increase exogenous carbohydrate oxidation rates. **PURPOSE:** To determine the impact of fructose co-ingestion provided either as a monosaccharide or as part of the disaccharide sucrose on exogenous carbohydrate oxidation rates during prolonged exercise in trained cyclists. **METHODS:** Ten trained male cyclists ( $VO_{2peak}$ :  $65 \pm 2$  mL $\cdot$ kg<sup>-1</sup> BM min<sup>-1</sup>) cycled on 4 different occasions for 180 min at 50% Wmax and consumed a carbohydrate solution providing 1.8 g $\cdot$ min<sup>-1</sup> of glucose (GLU), 1.2 g $\cdot$ min<sup>-1</sup> glucose + 0.6 g $\cdot$ kg<sup>-1</sup> fructose (GLU+FRU), 0.6 g $\cdot$ min<sup>-1</sup> glucose + 1.2 g $\cdot$ min<sup>-1</sup> sucrose (GLU+SUC), or water (WAT). Breath samples were collected to determine the <sup>13</sup>C/<sup>12</sup>C ratio in expired air and combined with indirect calorimetry (VO<sub>2</sub> and VCO<sub>2</sub>) to calculate oxidation rates of total fat, total carbohydrate, and exogenous carbohydrates. Repeated measures ANOVA with treatment as within-subject factor was used to determine differences in exogenous carbohydrate oxidation rates between treatments.

**RESULTS:** Peak exogenous carbohydrate oxidation rates did not differ between GLU+FRU and GLU+SUC (1.40±0.06 vs 1.29±0.07 g·min<sup>-1</sup>, respectively,  $P=1.000$ ), but were 46±8% higher when compared to GLU (0.96±0.06 g·min<sup>-1</sup>;  $P<0.05$ ). In line, exogenous carbohydrate oxidation rates during the latter 120 min of exercise were 46±8% higher in GLU+FRU or GLU+SUC compared with GLU (1.19±0.12, 1.13±0.21, and 0.82±0.16 g·min<sup>-1</sup>, respectively,  $P<0.05$ ).

**CONCLUSION:** Fructose co-ingestion (0.6 g·min<sup>-1</sup>) with glucose (1.2 g·min<sup>-1</sup>) provided either as monosaccharide or as sucrose strongly increases exogenous carbohydrate oxidation rates during prolonged exercise in trained cyclists.

**Funding:** Knowledge Centre Sugar and Nutrition, Utrecht, the Netherlands and Sugar Nutrition UK, London, United Kingdom.

741 Board #3 May 31 3:15 PM - 5:15 PM  
**Multiple-transportable Carbohydrate Has Minimal Impact On Long-distance Triathlon Race Performance**

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 (No relationships reported)

**PURPOSE:** In the laboratory, the ingestion of multiple-transportable carbohydrates (fructose, glucose) in beverages at high rates (>1.3 g·min<sup>-1</sup>) enhances exogenous carbohydrate oxidation, fluid absorption, gut comfort, and performance, relative to single carbohydrate equivalents. In competition, however, endurance athletes prefer to ingest carbohydrate in a solid-gel-drink format but whether multiple-transportable carbohydrates in the mixed format also enhance competition performance is unknown. The objective of the study was to determine the effect of multiple- vs. single-transportable carbohydrate on triathlon race performance when ingested in the common format of bars, gels and drinks.

**METHODS:** A double-blind randomized controlled trial was conducted within two sanctioned half-ironman triathlon races held 3 weeks apart in 74 well-trained male triathletes (18-60 y; >2 y competition experience). Carbohydrate was ingested before (94 g) and during the race from bars (25%), gels (35%) and drink (40%) comprising a 2:1 glucose/maltodextrin:fructose ratio vs isocaloric placebo glucose/maltodextrin only. Ingestion was apportioned by unit-distance covered during the cycle (2.5 g·km<sup>-1</sup>) and run (7.8 g·km<sup>-1</sup>) averaging 78.6 g·h<sup>-1</sup> (SD 6.6). Post-race 0-10 unit Likert-type scales were completed to assess gut comfort and energy.

**RESULTS:** The trial returned low dropout rate (9%), high compliance and sensitivity (typical error 2.2%), but the effect of the multiple-transportable carbohydrate on overall performance time (-0.6%, 95%CI -1.8%, 0.7%), swim, bike, and run times, and on nausea, gut comfort and perceived energy was of trivial-small magnitude without statistical significance. Within-subject covariate adjustment for pre-exercise body weight, heat stress, and within-race change in body weight had negligible impact on outcomes.

**CONCLUSION:** Multiple-transportable carbohydrate ingested in the common bar-gel-drink format provided negligible benefit to long-distance triathlon performance. The experience of the large sample intervention study showed that in-competition clinical trials offer ecological validity, and high throughput rate, compliance, and sensitivity for evaluation of health and performance interventions in athletes. Funding: Nestec Ltd, Switzerland.

742 Board #4 May 31 3:15 PM - 5:15 PM  
**Alterations in Exogenous Carbohydrate, Liver and Muscle Glycogen Oxidation with Different Doses of Glucose and Fructose ingestion during Prolonged Cycling**

Andy J. King<sup>1</sup>, John P. O'Hara<sup>1</sup>, Douglas Morrison<sup>2</sup>, Tom Preston<sup>2</sup>, Roderick FGJ King<sup>1</sup>. <sup>1</sup>Leeds Beckett University, Leeds, United Kingdom. <sup>2</sup>Scottish Universities Environmental Research Centre, Glasgow, United Kingdom.  
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 (No relationships reported)

**PURPOSE:** To investigate the effect of three CHO doses on fuel selection during exercise, in particular exogenous and endogenous (liver and muscle) CHO oxidation.

**METHODS:** Eleven trained male cyclists ( $\dot{V}O_{2max}$ : 60.0 ± 4.3 ml/kg/min) cycled on 4 occasions at 60%  $\dot{V}O_{2max}$  for 3 hours after an overnight fast. From 15 min into exercise and every 15 min thereafter, either 80 g·h<sup>-1</sup> (LOW), 90 g·h<sup>-1</sup> (MED), 100 g·h<sup>-1</sup> (HIGH) of GF (all 2:1 ratio) or a placebo (PLA) was ingested in a double-blind randomised order. The formulations contained <sup>13</sup>C isotope tracers and were designed to span the reported saturation levels for SGLT1 and GLUT5. Total, exogenous, endogenous (muscle and liver) CHO oxidation, and total fat oxidation were computed using indirect calorimetry and isotope ratio mass spectrometry.

**RESULTS:** Total CHO oxidation was elevated, and total fat oxidation suppressed in all CHO conditions relative to PLA (CHO range 94.0-125.0 g higher, Fat 29.7-34.3 g lower; both  $ES > 1.05$ ). Exogenous oxidation in the final hour was greatest in HIGH (91.1 g·h<sup>-1</sup>), a moderate effect to LOW (81.6 g·h<sup>-1</sup>,  $ES = 0.64$ ,  $P = 0.10$ ) and MED (82.9

g·h<sup>-1</sup>,  $ES = 0.70$ ,  $P = 0.39$ ) a moderate increase from the second hour in all conditions ( $ES = 1.38-2.00$ ,  $P < 0.014$ ). However, increasing GF dose beyond intestinal saturation increased muscle glycogen utilisation in the final hour (101.6 ± 16.6 g·h<sup>-1</sup> in HIGH; 6.2, -23.5 to 11.1 g·h<sup>-1</sup> higher [95% CI] vs. LOW,  $ES = 0.47$ ,  $P = 0.61$  & 16.1, 0.9 to 31.4 g·h<sup>-1</sup> [95% CI] higher vs. MED,  $ES = 0.68$ ,  $P = 0.16$ ), and second hour ( $ES = 0.51$  & 0.48,  $P > 0.05$ ). A small, non-significant reduction was seen in liver glycogen oxidation with HIGH in the last hour compared with LOW (-2.6, -5.6 to 0.4 g·h<sup>-1</sup>,  $ES = 0.40$ ) and MED (-2.6, -6.8 to 1.6 g·h<sup>-1</sup>,  $ES = 0.42$ ).

**CONCLUSIONS:** Increasing CHO ingestion beyond previously reported saturation rates produces higher exogenous oxidation, but results in an increased reliance on muscle glycogen. Ingestion of 90 g·h<sup>-1</sup> GF can attenuate the rate of muscle glycogen oxidation by the end of 3 hours prolonged exercise, but recommendations should remain in the region of 80 to 90 g·h<sup>-1</sup>.

743 Board #5 May 31 3:15 PM - 5:15 PM  
**Glucose Regulation Following A Short And Long Bout Of High-intensity Functional Training**

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 (No relationships reported)

Glucose regulation is a fundamental process of metabolic function, and is acutely altered by physical activity. Importantly, exercise intensity and duration have been shown to affect glucose regulation differently. High-Intensity Functional Training (HIFT) is a form of exercise performed using combinations of various modalities and durations. Though HIFT is of a high-intensity nature, it is unknown if different durations of HIFT will influence glucose regulation differently.

**PURPOSE:** To determine the effect of a Short (< 5 min) and Long (15 min) bout of HIFT on plasma glucose and insulin concentration.

**METHODS:** Ten apparently healthy males (28.11 ± 5.09 yrs) participated in this study. Two HIFT sessions (SHORT and LONG) were performed in a crossover fashion. The SHORT bout consisted of 30 power clean-and-jerk lifts (61 kg) for time, while the LONG bout was a 15-min circuit of 250 m row, 20 kettle bell swings (24 kg), and 15 dumbbell (16 kg) squat presses performed for 15 min. Blood plasma was collected at four different time points: PRE, POST, 1HR, and 3HR in order to examine glucose (GLU) and insulin (INS) responses.

**RESULTS:** A repeated measures ANOVA showed no trial dependent difference between the SHORT and LONG bouts of HIFT in GLU ( $p = 0.109$ ) or INS ( $p = 0.504$ ). A time effect was observed in both bouts only at the POST time point for both GLU; Short: 83.9 ± 16 mg/dL vs. 110.3 ± 18 mg/dL ( $p < 0.001$ ), Long: 84.5 ± 11 mg/dL vs. 124.6 ± 19 mg/dL and INS; Short: 7.9 ± 4 mU/L vs. 16.1 ± 7 mU/L, Long: 9.1 ± 7.8 mU/L vs. 13.7 ± 7.3 mU/L ( $p < 0.05$ ).

**CONCLUSIONS:** This study demonstrated that the SHORT and LONG bouts of HIFT elicited similar glucose and insulin responses. Duration of the HIFT bouts may not be a determining factor in glucose regulation in healthy individuals. Further research is necessary to better understand the relationship of varying durations of HIFT on glucose regulation.

744 Board #6 May 31 3:15 PM - 5:15 PM  
**Metabolic Effects of Acute Blood Flow Restricted Exercise: Glucose & Insulin**

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 (No relationships reported)

Blood flow restricted exercise (BFRE) has gained a lot of attention as of late due to its ability to increase muscle mass and strength during low intensity exercise. BFRE results in ischemia, which has been shown to cause a shift to a greater reliance on glucose metabolism. Although the metabolic effect of traditional exercise is well studied, there is a lack of research on the metabolic effects of BFRE. **PURPOSE:** Investigate the blood glucose and insulin response to a single bout of blood flow restricted exercise 12, 36, and 48 hours after completion. **METHODS:** 8 healthy men (22±2 yrs), of above average  $\dot{V}O_{2max}$  (46.2±13.4ml/kg/min), and average body fat percentage (17.4±3.2) performed two separate trials of treadmill walking (CON & BFRE) at 50±5% of their predetermined  $\dot{V}O_{2max}$  until 200 kcal were expended. For the BFRE trial, pressure cuffs were applied to the most proximal portion of the thigh and inflated to 200 mmHg. Subjects walked in 10-minute increments, interspersed with 2 minutes of passive recovery where the pressure cuffs were deflated. Blood samples were taken at baseline, immediately after exercise, 12 hours, 36 hours, and 48 hours post exercise bout. All values were reported in standard±mean deviation. A 2x3 Repeated Measures ANOVA, a One-way ANOVA, and a Tukey's HSD post hoc test were utilized to evaluate differences from pre to post. **RESULTS:** Minimal differences were found in the glycemic response post exercise between BFRE and CON (95.6±2.8, 99.9±14.1, 102.6±14.8, 104.6±8.2, and 96.8±4.8) vs (97.0±3.9, 93.1±8.1, 96.2±6.5,

92.8±6.2, 93.7±4.7). However, BFRE resulted in significantly lower insulin levels than CON at immediately, 12, 36, and 60 hours post exercise (18.4±7.3, 12.1±6.9, 12.2±7.8, 11.8±5.8, and 12.7±6.0) vs (17.6±7.9, 18.3±8.4, 16.5±8.7, 15.8±6.9, and 18.5±9.4).

**CONCLUSION:** In this small sample of apparently healthy above average aerobic fitness and average body fat men, treadmill walking to expend 200 kcal in conjunction with BFRE resulted in significant less insulin needed to elicit the same glycemic response post exercise than CON.

Research was funded in part by Sigma Xi Grant in Aide, Provosts Undergraduate Research Fund, and the College of Health Sciences and Professions Student Research Award.

745 Board #7 May 31 3:15 PM - 5:15 PM

### Body Composition, Substrate Utilization, Thermoregulation, And Performance In Male Runners After 3-week High Fat Diet

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(No relationships reported)

**PURPOSE:** This study examined physiological and performance effects of a 3-week high fat, low carbohydrate diet (HFLC) in trained runners.

**METHODS:** Middle-aged, recreationally competitive ( $\text{VO}_2 = 48.5 \pm 4.5$  ml/kg/min) male runners ( $n = 8$ ;  $39.5 \pm 9.9$  y; completed 5 sets of 10 min runs separated by 2 min of rest in a controlled, hot environment (29 °C and 60 % relative humidity). The first 7 min of each stage were run at a sub-marathon pace with the last 3 min of each stage matching the runner's goal pace for 5-km, 10-km, half-marathon, marathon, and sub-marathon race pace (1% grade). Indirect calorimetry variables were collected during each race distance pace. Runners rested for 20 min before a challenging outdoor 5-km time trial (5TT). Runners followed their habitual high carbohydrate (HC) for the first phase of the study followed by 3 weeks of HFLC ( $\geq 70\%$  kcal from fat;  $< 50$  g/day carbohydrates).

**RESULTS:** Pre- and post-exercise ketones increased by  $\sim 0.5$  mmol for HFLC. Sum of 7-site skinfold thickness and body mass decreased ( $p < 0.01$ ) by  $\sim 13$  mm and 2.5 kg for HFLC respectively. Mean RER was lower ( $p < 0.01$ ) by 0.08-0.10 at all paces for HFLC. Mean fat oxidation was predicted to be non-existent at 5-km pace and  $< 0.3$  g/min at all other paces for HC, while ranging from 0.32-0.81 g/min for HFLC. Absolute  $\text{VO}_2$  was higher for HFLC or neared statistical significance at all paces slower than 5-km. Rectal temperature was higher in HFLC after the first 10 min bout, but did not differ at any other time point. Total sweat losses and heart rate for each pace did not differ between treatments. Five runners completed their 5TT faster after HFLC, 1 remained unchanged and 2 were slower following HFLC. Mean finishing time was  $\sim 30$ -s faster for HFLC, but there was no statistical difference ( $p = 0.25$ ; HFLC = 23.45  $\pm$  2.25; HC = 23.92  $\pm$  2.58 min).

**CONCLUSIONS:** Transitioning to a HFLC resulted in positive fat oxidation adaptations and may even improve late exercise, high intensity endurance performance for well-trained but recreational runners. Anecdotally, non-responders to HFLC may be identified by lack of cessation in training impairment that is almost always experienced in the first 2 weeks during transition to HFLC. In contrast to the runners with improved times, continued difficulties noted in training logs were only noted in runners with lack of 5TT improvement.

### B-42 Thematic Poster - Muscle Activation during Sport and Exercise

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM  
Room: 101

746 Chair: Ajit Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*

(No relationships reported)

747 Board #1 May 31 3:15 PM - 5:15 PM

### Relationship Between Passive Hip Range of Motion And Hip Muscle Activation During Landing

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Passive hip range of motion (ROM) is theorized to influence activation of the hip musculature during dynamic activity. A decrease in the activation of the hip musculature may lead to landing biomechanics that increase the risk of knee injuries.

Understanding the relationship between passive hip ROM and hip muscle activation during landing is needed to identify individuals at risk for knee injuries. **PURPOSE:** To examine the relationship between transverse plane hip passive ROM and hip muscle activation during a landing task. **METHODS:** Twenty female Division 1 soccer players (19.2±0.9yrs, 167.2±5.7cm, 65.9±6.6kg) volunteered to participate. Passive hip internal (HIR) and external (HER) ROM of the left limb was measured with participants prone and the knee flexed to 90 degrees using a digital inclinometer by a single examiner (ICC>0.87). The average of three HIR and HER ROM measures was used for analysis. Surface electromyography (sEMG) was used to assess activation of the gluteus medius (GMED) and gluteus maximus (GMAX) during 3 trials of a drop vertical jump (DVJ) task from a 31cm high box. The average root mean square amplitude (RMS) of the sEMG signal of the GMED and GMAX 150ms following initial contact across three DVJ trials was normalized to the peak RMS amplitude across three maximal voluntary isometric contractions (%MVIC). Pearson's Product Moment Correlations were calculated to determine the relationship between passive hip ROM and muscle activation during the DVJ ( $p < 0.05$ ). **RESULTS:** Greater HIR ROM (39.9±11.1 degrees) was correlated with less GMAX activation during the DVJ task (RMS=0.61±0.40%MVIC,  $R = -0.53$ ,  $P = 0.02$ ). HIR ROM was not correlated with GMED activation during the DVJ task (RMS=0.24±0.12%MVIC,  $R = -0.38$ ,  $P = 0.10$ ). HER ROM (30.6±8.1 degrees) was not correlated to GMAX ( $R = 0.10$ ,  $P = 0.69$ ) or GMED activation ( $R = 0.21$ ,  $P = 0.37$ ) during the DVJ task. **CONCLUSIONS:** Greater HIR ROM potentially influences the length-tension relationship of the GMAX, decreasing its ability to effectively activate during dynamic activities and increasing the risk of knee injuries. Ongoing work is needed to examine whether the effects of hip ROM on muscle activation contribute to landing biomechanics known to increase risk of knee injuries.

748 Board #2 May 31 3:15 PM - 5:15 PM

### Shoe Cushioning Reduces Impact And Muscle Activation During Landings From Unexpected, But Not Self-initiated, Drops

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(No relationships reported)

The drop jump, regarded as "an active landing from a self-initiated drop" (self-initiated drop landing, SIDL), is an effective training modality to develop explosive strength. Contrarily, "a landing from an unexpected drop" (unexpected drop landing, UDL), which is mostly unanticipated, has been proposed to generate potentially hazardous alterations to impact absorption. To date, few rigorous scientific studies have been conducted to understand the impact mechanics and muscle activation characteristics of these two landing tasks and the role of shoe properties.

**PURPOSE:** To investigate the shoe effects on impact biomechanics and muscular responses during drop landings.

**METHODS:** Twelve male collegiate basketball players performed bipedal landings from self-initiated and unexpected drops (SIDL and UDL) from a 60-cm height wearing highly-cushioned basketball shoes (Bball) and minimally cushioned control shoes (CC). Sagittal plane kinematics, ground reaction forces (GRF), accelerations of the shoe heel-cup, and electromyography (EMG) of the tibialis anterior (TA), lateral gastrocnemius, rectus femoris (RF), vastus lateralis (VL), and biceps femoris (BF) were collected simultaneously.

**RESULTS:** In SIDL, no significant differences were observed in peak vertical GRF, peak heel acceleration, or normalized EMG amplitude (root mean square,  $\text{EMG}_{\text{RMS}}$ ) for all muscles during either the pre- or post-activation phase between the two shoe conditions. In UDL, however, both peak vertical GRF (4.1±0.7 vs. 4.7±0.8 BW,  $p < 0.05$ ) and heel acceleration (29±7 vs. 36±8 g,  $p < 0.05$ ) were lower in Bball compared to CC. Furthermore, the  $\text{EMG}_{\text{RMS}}$  of TA (17±6 vs. 24±8%,  $p < 0.05$ ), RF (21±3 vs. 28±7%,  $p < 0.05$ ), VL (28±5 vs. 35±4%,  $p < 0.05$ ), and BF (9±4 vs. 14±5%,  $p < 0.05$ ) muscles showed a decrease in Bball compared to CC within the 50 ms after contact. **CONCLUSION:** These observations suggest that shoe cushioning may make only a limited contribution to reducing landing impact forces provided that neuromuscular adjustments occur properly during landings from self-initiated drops. However, in the situation when relevant muscles are not activated on purpose, as in landings from unexpected drops, wearing a highly-cushioned shoe decreases peak impact and muscle post-activation.

Supported by NSFC grant (81302131).

749 Board #3 May 31 3:15 PM - 5:15 PM

**Muscle Activation Patterns during a Novel Lateral Lunge Jump Reaction Task**Michelle A. Aube, Jeffrey B. Taylor, Audrey E. Westbrook, Anh-Dung Nguyen, Kevin R. Ford, FACSM. *High Point University, High Point, NC.* (Sponsor: Dr. Kevin Ford, FACSM)  
Email: aubem14@highpoint.edu*(No relationships reported)*

Muscular activation and recruitment patterns of the hamstrings and quadriceps may play an important role in knee joint stabilization with unanticipated reactions during sport.

**PURPOSE:** To examine lower limb muscle activation during a lateral lunge jump reaction task.

**METHODS:** Female soccer players participated in the study (n=10, age: 15±1yrs, height: 162.3±4.6cm, mass: 54.5±4.5kg). While wearing standardized cleats, each participant was instrumented with reflective markers for motion analysis. Surface EMG sensors were placed on the semimembranosus (MH), biceps femoris (LH), vastus lateralis (LQ), and vastus medialis (MQ). While standing in a ready position (feet shoulder width apart, knees slightly bent) on force platforms covered with artificial turf, a visual cue of an arrow pointing either left or right was projected on a screen in front of the participant, at which time they were to lunge jump laterally in the correct direction as quick and far as possible. Right directed lunge trials were analyzed. Muscle onset time was defined as greater than SSD above the resting threshold prior to the visual cue. Peak root mean square EMG amplitudes of the left leg were calculated and normalized to maximum amplitude (%) during a cutting task. Reaction time (Rt) was defined as the difference between the visual cue popup and left toe off from the force platform. Paired t-tests (p<0.05) were used to determine differences in muscle onset time and amplitude during the task. Stepwise linear regression was utilized to determine significant predictor variables for Rt.

**RESULTS:** Rt from visual cue to toe off was 0.99±0.10s. There was a significant difference (p=0.039) between LH (0.40±0.12s) and LQ (0.47±0.11s) onset times with no significant difference (p=0.2) between MH (0.42±0.09s) and MQ (0.48±0.10s) onset times. Differences were not found between peak EMG amplitude (LH: 67.6±24.9%, LQ: 80.9±8.2%, p=0.16; MH: 66.3±24.1%, MQ: 79.2±14.9%, p=0.18). Stepwise linear regression indicated that the single predictor variable of Rt was LQ onset time (R<sup>2</sup>=0.616, F(1,8)=12.81, p=0.007).

**CONCLUSION:** Earlier hamstrings activation may provide increased co-activation during an unanticipated reaction requiring a rapid lunge jump. However, quicker quadriceps activation is strongly correlated with improved reaction time performance.

750 Board #4 May 31 3:15 PM - 5:15 PM

**Changes in Lower Extremity Muscle Activation After Different Types of Exercise**Lindsay Slater, Joe Hart, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: Joe Hart, FACSM)*(No relationships reported)*

Muscle activation changes after exercise due to muscular fatigue. Muscular fatigue is often induced using standard exercises such as treadmill incline walking and squats, however exercise that simulates sport including high-speed movements, changes in direction, and decision-making may elicit different muscle activation adaptations.

**Purpose:** Compare muscle activation patterns before and after two exercise protocols.

**Methods:** 14 healthy volunteers (10F/4M, 168.3±10.0cm, 66.7±12.5kg, 19.3±0.9 yrs) completed two exercise protocols within 14 days. One exercise protocol (Control) included 30 minutes of incline walking intermixed with brief periods of squat jumps and lateral hops. The second exercise protocol (Sport) included 30 minutes of walking and running intervals intermixed with brief periods of sprinting forcing subjects to respond in random directions. EMG electrodes were placed on the vastus lateralis, vastus medialis, and gluteus medius of the dominant leg using standard EMG placement procedures. Data were recorded while walking at 1.3m/s before and immediately after exercise intervention. Normalized EMG data (MVIC) for 5 strides were reduced to 101 points from heel strike to ipsilateral heel strike to represent 0-100% of the gait cycle. Means and 90% confidence intervals were calculated for each muscle before and after exercise. Areas in which the confidence intervals for EMG activity across the entire gait cycle did not overlap for 3 or more consecutive points were considered statistically significant differences. Cohen's *d* effect sizes and 90% confidence intervals were calculated for portions of gait with significant differences. **Results:** Vastus medialis activation increased during walking gait after both Control (74-78%, *d* = 38.2±9.5) and Sport exercise (73-76%, *d* = 15.0±3.6). Gluteus medius activation only increased after Sport exercise (76-84%, *d* = 7.5±2.0). There were no changes in vastus lateralis after either exercise. **Conclusion:** Both exercise protocols increased vastus medialis activation, however only Sport exercise increased gluteus medius activation, demonstrating that different types of exercise may elicit different EMG activity responses. These differences should be considered when designing exercise protocols for muscle activation testing.

751 Board #5 May 31 3:15 PM - 5:15 PM

**Influence of Force Application Strategies on Muscle Activation and Plantar Pressure during Maximal Ergometer Rowing**Rena Jackson<sup>1</sup>, Will Wu<sup>1</sup>, Mimi Nakajima<sup>1</sup>, Tiffany Vargas<sup>1</sup>, James Becker<sup>2</sup>. <sup>1</sup>*California State University Long Beach, Long Beach, CA.* <sup>2</sup>*Montana State University, Bozeman, MT.**(No relationships reported)*

The rowing stroke begins with the feet generation force against the foot stretcher. It has been suggested that force application at the foot stretcher can be a limiting factor to rowing performance, however it is unknown how different strategies of applying force underneath the feet influence muscle activation and force-time profiles.

**PURPOSE:** To determine how different strategies of applying force underneath the feet influences muscle activation and force-time profiles during maximal ergometer rowing. **METHODS:** Seven collegiate rowers (5-female, 2-male) completed two trials of ten maximal strokes. Trial conditions consisted of instructional cues: "Push through the balls of your feet", "Push through the heels of your feet". EMG of the erector-spinal (ES), lastissimus-dorsi (LD), gluteus-maximum (GM), and rectus-femoris (RF) were bilaterally recorded, sampling at 1500Hz. Pressure distribution under both feet was recorded while using a wireless in-shoe plantar-pressure system sampling at 500Hz. Peak force and impulse were calculated in a custom MATLAB program for the total foot, heel, and forefoot regions, under both conditions. Timing of muscle activation, duration, and integrals (iEMG) of drive activation were calculated for the middle 5 strokes. Paired t tests were used to compare dependent variables between the conditions. **RESULTS:** Six participants produced significantly higher peak forces (517.6±109.8N, *p*<0.012, *d*=1.57) and impulses (359.3±57.2N, *p*<0.007, *d*=1.80) when pushing through the balls than when pushing through the heels. Three participants displayed the opposite pattern. EMG analysis did not reveal significant differences in onset, duration, or integration of muscle activation between conditions. **CONCLUSIONS:** Rowers in this study can be separated into two groups based on their ability to produce force and generate impulse: those more effective at pushing through the balls of the feet, at those more effective at pushing through the heels. Future research may want to examine performance, strength, and flexibility parameters to determine whether this difference is a beneficial or detrimental adaptation. If certain strategies are associated with variables that determine successful performance, then coaches may use this information to improve rowing performance.

752 Board #6 May 31 3:15 PM - 5:15 PM

**Electromyographic Activation Of Quadriceps In Single And Multi-joint Exercises**Jessica F. Perle, Danilo S. Felipe, Tamires F. da Silva, Fabiano F. da Silva, Wonder P. Higino, Elisângela Silva, Wagner Z. de Freitas, Daniela G.M. Bueno, Dênis B. da Silva, Renato A. de Souza. *IFSULDEMINAS, Muzambinho, Brazil.**(No relationships reported)*

Resistance training (RT) is a form of physical activity that is designed to improve muscular fitness. Considering the need to adequately prescribe RT, a better understanding about the effects of mono and multi-joint exercises is required, mainly using electromyographic (EMG) findings. **PURPOSE:** to compare EMG activation of quadriceps in mono-joint and open kinetic chain versus and multi-joint closed kinetic chain exercises. **METHODS:** Ten healthy male (25.3 ± 3.7) and with no previous experience with RT were recruited. This study was conducted as a cross-over design; i.e., the subjects were randomly assigned either to mono-joint (n = 5; seated knee extension machine) or multi-joint (n = 5; back squat at knee joint angle of 90°) for the 1(st) trial and 15 days later the subjects were switched conditions for the 2(nd) trial. Surface electromyography was used to measure muscle activation of the vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF) using Root Mean Square (RMS) signal normalized by peak during dynamic contraction. A 12-RM test was used in order to promote some standardized load for both experimental situations. For statistical analysis a two-way ANOVA was performed (muscle and treatment effects). **RESULTS:** RF showed a lower (p<0.05) EMG activation than VL and VM in multi-joint exercise (26.81 ± 7.84% versus 33.43 ± 5.49% and 33.27 ± 4.96, respectively). In another way, RF showed a higher (p<0.05) EMG activation than VL and VM in mono-joint exercise (41.17 ± 5.08% versus 37.87 ± 4.94% and 37.12 ± 3.79%). Mono-joint exercise increased ~34% the EMG activation of RF than multi-joint exercise. There are no significant differences between the vastus (p>0.05). **CONCLUSION:** A mono-joint and open kinetic chain exercise promoted higher RF-EMG activation and not altered vastus-EMG activation when compared with a multi-joint and closed kinetic chain exercise. These findings suggest that EMG pattern may be muscle-dependent even within the same muscle group as the quadriceps.

753 Board #7 May 31 3:15 PM - 5:15 PM

**Activation Of Knee Extensor Muscles During Rapid Force Development In Men And Women**

Minhyuk Kwon, Jose D. Delgadillo, Jonathon W. Senefeld, Christopher W. Sundberg, Sandra K. Hunter, FACSM. *Marquette University, MILWAUKEE, WI.* (Sponsor: Sandra K. Hunter, FACSM)  
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(No relationships reported)

Adequacy of activation during rapid voluntary contractions is limited in young and old adults and can be shown by comparing the voluntary rate of force development (RFD) and electrically evoked RFD. Nonetheless, it is unknown whether the activation of rapid voluntary contractions differs between young men and women.

**PURPOSE:** The purpose of this study was to compare the maximal RFD of young men and women during electrically evoked isometric contractions and rapid voluntary contractions with the knee extensor muscles across a range of torques.

**METHODS:** Eight young adults (18-26 years; 4 men, 4 women) consented to sets of single and double pulse (10 ms interval) stimulations of the femoral nerve at maximal intensities followed by rapid voluntary isometric knee extensions at target torques matched to the electrically evoked torques. For the rapid voluntary isometric contractions, subjects were instructed to kick as fast as possible rather than as accurately as possible. Voluntary target torques ranged between 10-40% of maximal voluntary contraction (MVC) and were set to match the electrically evoked torques. Maximal RFD for each trial (voluntary and electrically evoked) was calculated as the peak values of the first derivative of the torque signal.

**RESULTS:** Torques (between 10-40% MVC) were similar for the electrically evoked and voluntary contractions ( $F_{1,6} = 0.54, P = 0.49$ ) for both the men ( $25.0 \pm 0.6\%MVC$  vs.  $26.4 \pm 0.7\%MVC$ ) and women ( $26.0 \pm 2.0\%MVC$  vs.  $26.5 \pm 2.7\%MVC$ ). Although torques were similar, RFD from electrically evoked contractions in men ( $514.8 \pm 30.4\% MVC \cdot s^{-1}$ ) and women ( $475.1 \pm 78.0\%MVC \cdot s^{-1}$ ) was 36% greater than the voluntary contractions (men;  $330.2 \pm 18.8$  vs. women;  $305.9 \pm 21.2\%MVC \cdot s^{-1}$ ;  $F_{1,6} = 23.1, P = 0.003$ ). The linear association between relative torque (%MVC) and electrically evoked RFD ( $R^2 = 0.85, b = 0.92, P < 0.001$ ) was larger and steeper than the association with voluntary RFD ( $R^2 = 0.72, b = 0.85, P < 0.001$ ) indicating that the difference in RFD between the electrically evoked and voluntary contractions increased at the higher forces.

**CONCLUSIONS:** Young men and women had marked reductions in the ability to voluntarily generate isometric knee extension torque rapidly compared with electrically evoked contractions that were independent of the central nervous system. Supported by NIA R01 AG048262 to SKH

754 Board #8 May 31 3:15 PM - 5:15 PM

**Proximal Joint Muscle Activation During Cutting In Chronic Ankle Instability Patients Following a Rehabilitation Intervention**

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Sensorimotor deficits due to ankle sprains often result in altered lower extremity muscle activation during cutting. Interventions focusing on the ankle and hip could enhance muscle activation and subsequent sensorimotor function in patients with chronic ankle instability (CAI).

**PURPOSE:** To examine the effect of a 6-week ankle and hip intervention program on vastus lateralis (VL), medial hamstring (MH), gluteus medius (GM), and gluteus maximus (GX) activation during cutting in patients with CAI.

**METHODS:** 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ( $\alpha = .05$ ) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed.

**RESULTS:** Figure 1. The rehab intervention resulted in up to (i) 28% less VL activation at 0-20% of stance, (ii) 31% more MH activation at 43-100% of stance, (iii) 14% less GX activation at 83-100% of stance. No changes were detected in GM activation over time.

**CONCLUSIONS:** Relative to the control group, reduced proximal joint muscle activation in CAI patients in the rehab group may be due to altered knee and hip positions. A less flexed position of the knee and hip often leads to less knee and hip extensor moments, which potentially could result in reduced VL and GX muscle activation.

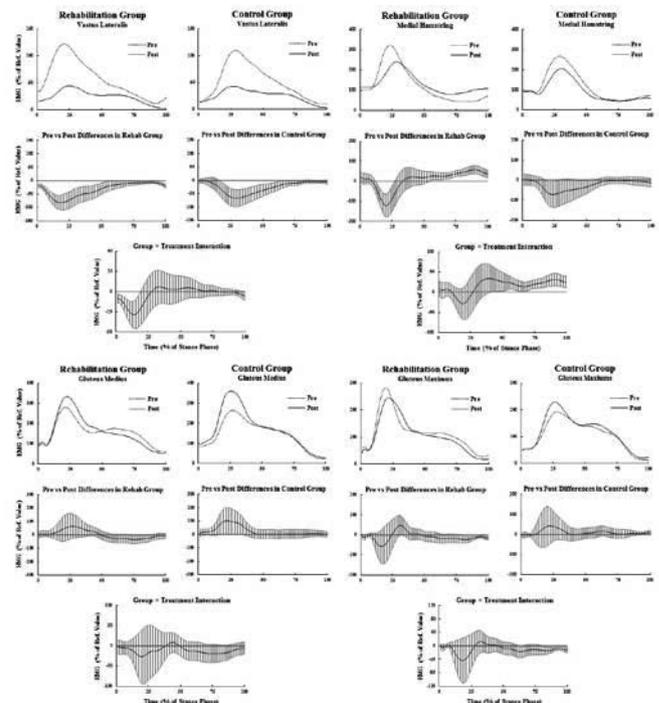


Figure 1. Grand ensembles for proximal joints muscle activation during the stance phase of a cutting task. A group x treatment interaction was defined subtracting "Pre vs Post Differences in Rehab Group" from "Pre vs Post Differences in Control Group". When 95% confidence intervals (shaded area) did not overlap the zero (horizontal red line), significant differences existed.

**B-43 Thematic Poster - Running**

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM  
Room: 404

755 **Chair:** Andy Bosak. *Liberty University, Lynchburg, VA.*  
(No relationships reported)

756 Board #1 May 31 3:15 PM - 5:15 PM

**Energy Expenditure During Treadmill Walking and Running: Accuracy of the 100 Kcal Per Mile Estimate**

Brian B. Parr, Andrew G. Hatchett, Lianna R. Epstein, Rachael L. Herring, Harli R. Eggenberger. *University of South Carolina Aiken, Aiken, SC.* (Sponsor: Michael J. Turner, FACSM)  
Email: brianp@usca.edu  
(No relationships reported)

Walking and running are widely used modes of exercise to improve fitness and promote weight loss. The energy expended during walking or running can be measured in a lab or estimated based on speed, grade, and body weight. However, these assessments are not easily completed by the general population, so a crude estimate of energy expenditure (EE) of 100 kcal•mile<sup>-1</sup> is commonly used. Although the equations for estimating EE at a given walking or running speed have been validated, the accuracy of the 100 kcal•mile<sup>-1</sup> value has not been evaluated.

**PURPOSE:** The purpose of this study was to determine the accuracy of the 100 kcal•mile<sup>-1</sup> estimate across a wide range of walking and running speeds.

**METHODS:** A sample of 21 subjects (age 23.6±8.8 y) walked or ran one mile at a self-selected speed on a motorized treadmill while VO<sub>2</sub> was measured. The EE was calculated from VO<sub>2</sub> measured after subjects achieved steady-state. The significance of differences in measured EE and the 100 kcal•mile<sup>-1</sup> estimate were determined using t-tests.

**RESULTS:** There were no significant differences between the measured EE and the 100 kcal•mile<sup>-1</sup> estimate (108.6±31.5 vs. 100±0 kcal•mile<sup>-1</sup>, p=0.22) across both running and walking speeds (range: 72.4-187.6 m•min<sup>-1</sup>). There were also no significant differences between the actual and estimated EE at walking speeds (95.6±12.6 m•min<sup>-1</sup>; 100.1±23.1 vs. 100±0 kcal•mile<sup>-1</sup>, p=0.98) or running speeds (158.8±19.4 m•min<sup>-1</sup>; 115.0±36.2 vs. 100±0 kcal•mile<sup>-1</sup>, p=0.18). However, the measured EE during running was significantly higher (p=0.03) than during walking.

**CONCLUSION:** The widely used EE estimate of 100 kcal•mile<sup>-1</sup> appears to be accurate across a wide range of walking and running speeds. While the measured EE during running was significantly higher than during walking, neither was significantly different from the 100 kcal•mile<sup>-1</sup> estimate. This suggests that this value may be useful for estimating EE for fitness or weight loss purposes in a general population.

757 Board #2 May 31 3:15 PM - 5:15 PM

**The Effect Of Acute Body Mass Reduction On Metabolism And Endurance Running Performance**

Elias Zacharogiannis<sup>1</sup>, Giorgos Paradisis<sup>1</sup>, Stamatis Magos<sup>1</sup>, Isidoros Plavoukos<sup>1</sup>, Fotini Dagli<sup>1</sup>, Theofilos Piliandis<sup>1</sup>, Maria Maridaki<sup>1</sup>, Angeliki Zacharogianni<sup>2</sup>. <sup>1</sup>National and Kapodistrian University of Athens, Athens, Greece. <sup>2</sup>Leeds Beckett University, Leeds, United Kingdom.  
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(No relationships reported)

Reduced body mass and/or relative fat mass is expected to improve endurance running performance, by lowering energy cost of running and allowing the runner to maintain higher mean race velocity using identical %VO<sub>2</sub>max. The majority of studies during the last 40 years have been centered mainly on the effect of adding external load on energy cost of walking and running. **PURPOSE:** The purpose of this study was to examine the effect 5 and 10% reduction of inactive body mass on metabolic responses and 3km running performance.

**METHODS:** Eleven trained (8 male, 3 female) club level runners (mean ± sd body mass, height, %fat, peakVO<sub>2</sub> and vVO<sub>2</sub>max, 65.71 ± 12.07 kg, 174.59 ± 8.32 cm, 12.54 ± 3.55%, 56.30 ± 4.57 ml.kg<sup>-1</sup>.min<sup>-1</sup> and 17.1 ± 1.4 km.h<sup>-1</sup> respectively) participated in a series of 4 maximal trials 4-6 days apart. During the first trial, the subjects completed an exhaustive incremental peakVO<sub>2</sub> test on the treadmill. On the second visit they completed a 3 km race time trial on the treadmill running with normal body mass (BM). During the last two laboratory visits, the subjects completed two 3km race trials in random order on the treadmill while body mass (a rope through a system of pulleys lifted the runner with the calculated body weight throughout striding phases while not interfering with running technique) was reduced 5 (5%BM) or 10% (10%BM). Repeated Anova was used for the statistical analysis.

**RESULTS:** Mean (±sd) 3km performance time was lowered (improved) during 5%BM (663.5 ± 76.05 s) and 10%BM (648.9 ± 74.9 s) trials (p<0.05) compared with BM (684.9 ± 74.8 s). The 5 and 10% reduction in body mass induced a mean 3.1 and 5.2% improvement in 3km race performance accordingly. Every kg reduction of inactive body mass improved 1.4% running endurance performance. Mean values of the Rate of perceived exertion, heart rate, VO<sub>2</sub> ml.min<sup>-1</sup>, RQ, Blood lactate and Volume of expired air were not different between time trials and peak VO<sub>2</sub>max test (p>0.05).

**CONCLUSIONS:** The results of the present study showed that the reduction of 5 and 10% of inactive body mass may improve significantly 3km performance time without noticeable effects on metabolic parameters and are supportive of the notion that one way to maximize further running performance is to reduce inactive body mass.

758 Board #3 May 31 3:15 PM - 5:15 PM

**Comparison Of RPE And Energy Expenditure Between Circuit Weight Training And Treadmill Running**

Christi Brewer, Breann Booher, Nathaniel Lawton, Wendy Repovich, FACSM. Eastern Washington University, Cheney, WA. (Sponsor: Wendy Repovich, FACSM)  
(No relationships reported)

Due to the fact circuit weight training (CWT) maximizes exercise density by minimizing rest intervals, individuals with limited time to exercise may rely on CWT to meet caloric expenditure recommendations for the prevention of weight gain.

Exercise density may lead to an inaccurate perception of energy expenditure (EE). **PURPOSE:** To compare acute EE indices and RPE between traditional CWT and an equivalent bout of treadmill running (T). **METHODS:** College-aged males (n=9) regularly engaged in running and resistance training volunteered. CWT session was performed first and consisted of 10 resistance training stations performed for 30 sec each at 40%IRM for 20 min. HR (Polar monitor) and EE (Cosmed K4 b2) were monitored continuously, and RPE (0-10) was assessed every fourth station. A 20 min T session occurred 2 days later at the average HR maintained during CWT. A dependent samples t-test was used to determine significant differences between RPE, total EE (TEE, kcal), rate of EE (REE, kcal/min), and relative rate of EE (RREE, kcal/kg/min). Pearson's correlation was used to assess the relationship between EE and RPE. **RESULTS:** The average HR elicited by CWT was 58% HRR, a value within ACSM recommendations for aerobic conditioning. There was no significant association between RPE and EE indices for either CWT or T.

Exercise	RPE (0 – 10 scale)	TEE (kcal)	REE (kcal min <sup>-1</sup> )	RREE (kcal kg <sup>-1</sup> min <sup>-1</sup> )
CWT	6.0 ± 1.1*	168.19 ± 16.42*	8.49 ± 0.90*	0.10 ± 0.02*
T	4.1 ± 0.6	244.20 ± 44.80	12.21 ± 2.24	0.15 ± 0.02

\*p&lt;0.001

**CONCLUSIONS:** CWT elicited an average HR suitable for aerobic conditioning. At equivalent HRs, CWT resulted in a significantly higher RPE but significantly lower EE. It is imperative for participants engaged in CWT to understand that although CWT results in HR values within an aerobic training zone and feels more strenuous than T, it is not associated with greater acute energy expenditure than steady-state treadmill running.

ACSM May 30 – June 3, 2017

759 Board #4 May 31 3:15 PM - 5:15 PM

**Effect of Wearing Lower-Body Compression Garment Following Downhill Running on Running Economy**

Sahiro Mizuno<sup>1</sup>, Yoshifumi Tsuchiya<sup>2</sup>, Kazushige Goto<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Kusatsu, Japan. <sup>2</sup>Atomic Bomb Disease Institute, Nagasaki, Japan. (Sponsor: Robert R. Kraemer, FACSM)  
Email: librae.librae@gmail.com  
(No relationships reported)

Accumulating evidences suggest that wearing lower-body compression garment (CG) after exercise facilitates recovery of muscular strengths. However, efficacy of wearing CG during post-exercise period on endurance capacity has not been fully determined.

**PURPOSE:** To examine effect of wearing lower-body CG for 24 h following downhill running on running economy. **METHODS:** Ten male subjects (170.2 ± 4.1 cm, 63.7 ± 4.1 kg, VO<sub>2</sub>max; 52.4 ± 6.1 ml/kg/min) completed 2 trials, with either wearing lower-body CG or placebo garment (CON) during 24 h of post-exercise period. At least 3 months period was provided between the two trials. The exercise consisted of 30 min of downhill running (slope: -10%) at 70% of VO<sub>2</sub>max. Time course changes in jump height and score of muscle soreness were evaluated before exercise and during post-exercise period. Blood samples were also collected to determine serum creatine kinase (CK) and hsCRP concentrations. Running economy (RE) was assessed at 24 h following exercise under three different running velocities (70%, 80% and 90% of VO<sub>2</sub>max). P < 0.05 was considered to be statistically significant. **RESULTS:** Jump height significantly decreased immediately after exercise in both trials, while the CG trials showed significantly higher values at 24 h following exercise compared with the CON trial (P = 0.0008). Although serum CK and hsCRP concentrations significantly elevated during post-exercise period, the responses were similar between trials. For the RE, no significant difference was observed between two trials. However, there was a relatively large inter-individual variation for efficacy of CG on RE (ΔVO<sub>2</sub> range: -7.1% to 12.2%), and we have divided all subjects into two different groups [improved RE (n = 5), decreased RE (n = 5)]. No significant difference between the groups was observed for jump performance or score of muscle soreness at 24 h after the exercise, while improved RE group showed significantly higher serum CK and hsCRP concentrations compared with impaired RE group (P = 0.005 for CK, P = 0.04 for hsCRP). **CONCLUSION:** Wearing lower-body CG during 24 h of post-exercise period did not improve RE. However, relatively large inter-individual variation existed for efficacy of the CG, and wearing CG during post-exercise period might promote recovery of RE under situation with severe muscle damage.

760 Board #5 May 31 3:15 PM - 5:15 PM

**Novel Field Test To Identify Critical Velocity During Non-linear Running: Physiological Profile, Reliability, And Validation**

Eric M. Bradley, Bradley W. Wilkins, Brett S. Kirby. Nike Inc, Beaverton, OR. (Sponsor: Larry Kenney, FACSM)  
(No relationships reported)

**PURPOSE:** Athletes and coaches have interest in identifying specific work rates and related physiology discriminating sustainable vs unsustainable exercise intensity. A threshold intensity for running, termed Critical Velocity (CV), is the boundary between stable metabolism and progressively disturbed metabolism (& ensuing fatigue). We aimed to develop a simple short duration field test (Critical Velocity Shuttle Test, CVST), to accurately and reliably identify CV during intermittent non-linear running. Further, we tested the hypothesis that CV during dynamic non-linear running is distinctly different (i.e. lower) than linear running.

**METHODS:** Young healthy adults performed a custom designed 7 minute shuttle test consisting of intermittent dynamic non-linear sprint running. Each sprint covered 30 feet out and back, with rest time between maximal efforts of 15 secs for the first 3 mins, 10 secs for the next 2 mins and no rest for the final 2 mins. The CVST was performed twice over the course of 2 weeks to examine test reliability (N=6). In addition, two separate validation trials inclusive of 5% above or below shuttle test end velocity (EV; N=8) were conducted where blood lactate was measured every 4 mins until exhaustion. To compare CV during linear and non-linear running, 10 subjects completed 3 'linear' time trial efforts (1.6, 2.4, 5KM) and the CVST.

**RESULTS:** Average total distance and shuttle test EV were not significantly different between visits (visit 1 = 864±9m and 3.23m/s±0.05 vs visit 2 = 900±13m and 3.21m/s±0.06, respectively). All subjects who ran 5% above shuttle test end velocity fatigued prior to 20 mins and displayed unstable blood lactate, whereas a stable lactate profile was observed for all running 5% below EV. Non-linear running CV obtained from the CVST was significantly lower than linear running CV (Δ -17±2%), highlighting the importance of modality for threshold determination.

**CONCLUSIONS:** Collectively, the CVST provides a repeatable and accurate estimate of critical work rate for dynamic intermittent non-linear running activity. Accordingly, the CVST could be employed by coaches and athletes to better understand the physiological impact and rate to fatigue of their chosen work rates during competition.

Denver, Colorado

761 Board #6 May 31 3:15 PM - 5:15 PM  
**New Running Shoe Reduces the Energetic Cost of Running**  
 Wouter Hoogkamer<sup>1</sup>, Shalaya Kipp<sup>1</sup>, Jesse H. Frank<sup>1</sup>, Emily Farina<sup>2</sup>, Geng Luo<sup>2</sup>, Rodger Kram<sup>1</sup>. <sup>1</sup>University of Colorado, Boulder, Boulder, CO. <sup>2</sup>Nike, Inc., Portland, OR. (Sponsor: Ray Browning, FACSM)  
 Email: wouter.hoogkamer@colorado.edu  
 (No relationships reported)

Running shoe features (low mass, cushioning, midsole bending stiffness) have been shown to individually reduce the energetic cost of running. Recently, energetic cost has been directly linked to time-trial performance.

**PURPOSE:** To quantify the energetic cost of running in three marathon racing shoes: a prototype and two shoes currently available to runners. **METHODS:** 18 sub-elite runners (sub-31 min 10km at altitude or equivalent; altitude  $\dot{V}O_{2max}$ :  $72.1 \pm 3.4$  ml  $O_2$ /kg/min) ran six 5 min trials (3 shoes  $\times$  2 replicates) in: a prototype shoe (NP), and two established marathon shoes (NS6) and (AB2), all equilibrated to 250g/shoe (the mass of AB2, size 10) during three separate sessions - 14, 16 and 18 km/hr. The order of the shoe conditions within a session and the session speed order were pseudo-randomized, mirrored and counterbalanced. The NP shoe has a novel, lightweight and highly resilient midsole and a carbon fiber plate that stiffens the shoe in longitudinal bending. We measured submaximal  $\dot{V}O_2$  and  $\dot{V}CO_2$  during min 3-5 and averaged metabolic rate (W/kg) for the 2 trials in each shoe model. Blood [La] measured after the last trial of each session and RER indicated running energetics were at steady-state ( $<3.0$  mmol/L and  $<0.91$ , respectively). We compared the 3 shoes over 3 speeds using a two-way ANOVA with repeated measures. **RESULTS:** A significant main effect for shoe ( $P < 0.0001$ ) indicated the NP shoes required  $4.0 \pm 1.3\%$  (mean  $\pm$  SD) less energy than the NS6 and AB2 shoes (NP vs. NS6:  $P < 0.0001$ ; NP vs. AB2:  $P < 0.0001$ ), which had similar metabolic costs (NS6 vs. AB2:  $P = 0.34$ ): NP  $16.45 \pm 0.89$ , NS6  $17.16 \pm 0.92$  and AB2  $17.14 \pm 0.97$  W/kg averaged across 3 speeds. Although the shoe  $\times$  speed interaction effect was significant ( $P = 0.0005$ ), post-hoc analyses suggest that relative percent differences between shoes were similar at the 3 running speeds (all  $P > 0.56$ ). **CONCLUSIONS:** The new shoe reduces the cost of running by 4.0% as compared to two other established marathon racing shoes.

This study was supported by Nike Inc. EF and GL are employees of Nike Inc., RK is a paid consultant to Nike Inc.

762 Board #7 May 31 3:15 PM - 5:15 PM  
**Metabolic Cost Of Overground, Motorized Treadmill And Non-motorized Treadmill Running**  
 Douglas G. Whyte, Paul J. Tofari, Stuart J. Cormack, Robert B. Edwards. Australian Catholic University, Melbourne, Australia.  
 Email: doug.whyte@acu.edu.au  
 (No relationships reported)

Non-motorized treadmills (NMT) are becoming an increasingly popular tool for both athletic training and laboratory investigations. However, very little is known about how the physiological response to running on a NMT compares with that of running on either a motorized treadmill (MOT) or overground (OVR).

**PURPOSE:** To compare the metabolic cost of running on a NMT, MOT and OVR. **METHODS:** Fourteen runners ( $\dot{V}O_{2max}$ ,  $57 \pm 4$  mL  $kg^{-1} \cdot min^{-1}$ ; female,  $n=7$ ) completed three experimental sessions. Each session consisted of 5  $\times$  6 min bouts of running at progressively higher speeds, separated by 6 min rest. Running speeds ranged from 9-15 km  $h^{-1}$  for females and 10.5-16.5 km  $h^{-1}$  for males. Participants completed the NMT (Woodway Curve 3), MOT (HP Cosmos) and OVR sessions in a crossover manner. OVR sessions were performed around an indoor 144 m oval and pacing maintained using evenly spaced timing lights. Pacing during the NMT was achieved by participants matching a line reflecting their current speed with the required speed on a projected display. Oxygen consumption ( $\dot{V}O_2$ ) and heart rate (HR) during the last 2 min of each bout were determined using a portable metabolic cart (K4B2, Cosmed) and compared between conditions using a magnitude based statistical approach.

**RESULTS:** Each runner successfully completed all of the 6 min running bouts in the MOT and OVR trials. However, only 1 runner (male) completed the entire NMT trial, and only 6 of 14 runners could maintain the penultimate speed on the NMT. There was an *important* difference in the average  $\% \dot{V}O_{2max}$  used when running on the NMT compared to OVR (mean  $\pm$  90% CI,  $22 \pm 2\%$ ; ES  $\pm$  90% CI,  $1.87 \pm 0.15$ ) and MOT ( $16 \pm 2\%$ ; ES  $1.50 \pm 0.15$ ). Similarly, there was an *important* difference in HR when running on the NMT compared to OVR ( $25 \pm 2$  beats  $min^{-1}$ , ES  $1.35 \pm 0.13$ ) and MOT ( $22 \pm 2$  beats  $min^{-1}$ ; ES  $1.23 \pm 0.14$ ). While there was an *important* difference in  $\% \dot{V}O_{2max}$  between MOT and OVR trials ( $5 \pm 1\%$ ; ES  $0.33 \pm 0.08$ ) the difference in HR was *trivial* ( $2 \pm 1$  beats  $min^{-1}$ ; ES  $0.10 \pm 0.04$ ).

**CONCLUSIONS:** Steady state submaximal running on a NMT imposes a markedly higher physiological demand than running on either a MOT or OVR. This increased metabolic cost needs to be considered when designing training programs for or interpreting data obtained from a NMT.

763 Board #8 May 31 3:15 PM - 5:15 PM  
**Assessing the Relationship Between Body Composition and 50-km Running Performance**  
 Jonathan Houck, Andy Bosak, Christopher Carver, Austin Smith, Matthew Sokoloski. Liberty University, Lynchburg, VA. (Sponsor: James Schoffstall, FACSM)  
 Email: jhouck@liberty.edu  
 (No relationships reported)

Interest in ultramarathon participation and research has grown substantially over the past decade, with one of the main focus in research being race performance. Previous studies have focused on body composition in relation to race performance at distances ranging from 5-km to multi-day adventure races. However, no previous studies have assessed body composition and performance measures at the 50-km distance. **PURPOSE:** To investigate the relationship that may exist between body fat percentage (BF%) and body mass index (BMI) with race finishing time and position in ultramarathon runners who competed in a mountainous 50-km race. **METHODS:** Forty-six ultramarathon runners (male = 31, female = 15; BF%:  $19.75 \pm 5.64$ ; BMI:  $23.7 \pm 2.58$ ) participated in this study and were given a preliminary screening questionnaire on-site during packet pick-up on the day prior to the 50-km race. The participants' height was calculated using a leveled measuring tape. Weight and body composition measurements were taken using a bioelectrical impedance analysis (BIA) system. Finishing times and positions were collected from the race website four days after the event. Pearson correlations were calculated to determine if a correlation existed between overall race finish time/position and BMI and BF%. **RESULTS:** All forty-six participants completed the 50-km race ( $22967.37 \pm 3001.1$  seconds). Significant correlations were noted between race finish time and BF% ( $r = .548$ ,  $p = 0.00$ ) and race position and BF% ( $r = .532$ ,  $p = 0.00$ ). There were no significant correlations between overall race finish time and BMI ( $r = 0.036$ ) or race position and BMI ( $r = 0.004$ ). **CONCLUSION:** BF% measurements may be more accurate in loosely predicting potential overall finish time and position as compared to using BMI calculations. The results suggest that a runner with a lower body fat percentage may finish with a faster time and therefore better order of finish as compared to a runner with a higher body fat percentage. Future studies may focus on the potential change in body composition and its impact on race performance in male and/or female ultramarathon runners.

**B-44 Free Communication/Slide - Immunology**  
 Wednesday, May 31, 2017, 3:15 PM - 4:45 PM  
 Room: 104

764 **Chair:** Jonathan P. Little. University of British Columbia Okanagan, Kelowna, BC, Canada.  
 (No relationships reported)

765 May 31 3:15 PM - 3:30 PM  
**Effects Of Acute Eccentric Exercise On Primary Antibody Responses To Ovalbumin Vaccination In Aged Mice.**  
 YI SUN, Jeffrey A. Woods, FACSM. UNIVERSITY OF ILLINOIS, URBANA, IL. (Sponsor: Jeffrey Woods, FACSM)  
 Email: yisun6@illinois.edu  
 (No relationships reported)

Several studies have suggested that acute eccentric exercise can enhance vaccination responses in humans. However, the underlying mechanisms have remained understudied. We have shown that acute eccentric exercise does not improve the antibody responses to ovalbumin (OVA) vaccination in young mice. Thus, we replicated the study in an immunosenescence animal model, where there is reduced vaccine efficacy.

**PURPOSE:** To determine the effects of acute eccentric exercise on the primary antibody response to vaccination in aged mice. **METHODS:** C57BL/6 male mice, aged 27 months ( $n=16$ ) were randomized into either eccentric exercise (ECC,  $n=8$ ) or sedentary (SED,  $n=8$ ) groups. For the ECC group, mice were exercised at 17m/min at -20% grade for 45 min on a treadmill. SED mice remained in their home cages. All mice were inoculated in the gastrocnemius with 25  $\mu$ g of OVA and 200  $\mu$ g aluminum hydroxide (a suboptimal dosage based on titration experiments) in 50  $\mu$ l sterile saline immediately after the exercise. Blood was collected prior to, and one, two and four weeks after vaccination. ELISA was performed to analyze anti-OVA IgG. At three weeks post exercise, all mice were injected with 100  $\mu$ g OVA dissolved in 10  $\mu$ l PBS into the dorsal side of the right ear to determine the delayed-type hypersensitivity (DTH) response. The left ear received 10  $\mu$ l PBS alone as a control. Ear thickness was measured immediately before, 24 h and 48 h after intradermal injection. The measurements were performed in triplicate, where

researchers were blinded to treatment. Maximum ear swelling occurred at 24 hours post injection. Results were expressed as the difference between the right and left ear thickness.

**RESULTS:** We found a significant time main effect ( $p < 0.001$ ) indicating a significant increase in anti-OVA IgG at one, two and four weeks relative to pre-immunization. However, there were no significant time x treatment ( $p = 0.652$ ) nor treatment main effects ( $p = 0.764$ ). There was a significant difference between ECC and SED groups in ear DTH at 24h post injection ( $p = 0.028$ ), indicating eccentric exercise increased the DTH response.

**CONCLUSION:** Acute eccentric exercise immediately before vaccination improved the DTH (i.e. cell-mediated immune), but not the antibody, response to vaccination in aged mice.

766 May 31 3:30 PM - 3:45 PM

### Voluntary Wheel Running and Response to Vaccinia Virus Infection and Inoculation in Mice

Brandt D. Pence<sup>1</sup>, Melissa R. Ryerson<sup>2</sup>, Ariana G. Bravo-Cruz<sup>2</sup>, Jeffrey A. Woods, FACSM<sup>2</sup>, Joanna L. Shisler<sup>2</sup>. <sup>1</sup>University of Memphis, Memphis, TN. <sup>2</sup>University of Illinois Urbana-Champaign, Urbana, IL.  
Email: bdpence@memphis.edu  
(No relationships reported)

**PURPOSE:** Exercise has been shown to improve immune responses to viral infections and vaccines in several mouse models. However, previous pathogen studies have primarily used infections limited to the respiratory tract. Additionally, previous studies have utilized forced treadmill exercise paradigms, and voluntary wheel running (VWR) has been shown to have differential effects on the immune system in non-infection models. We examined whether VWR could improve morbidity and mortality to a 50% lethal dose of vaccinia virus (VACV), a systemic pathogen commonly used to examine immune responses. Additionally, we examined whether VWR could improve antibody response to a replication-deficient strain of VACV, mimicking a vaccination. **METHODS:** Male C57Bl/6J mice underwent 8 weeks of VWR or remained sedentary, then were infected intranasally with  $10^{7.5}$  PFU VACV strain WR. Mice were followed 14 days for mortality, and body weights and food intakes were recorded daily. In a similar manner, mice in the vaccination study ran or were sedentary for 8 weeks, then were given  $10^6$  PFU of replication-deficient VACV strain MVA intraperitoneally. Blood was collected under anesthesia from the retro-orbital sinus prior to MVA inoculation and at 1, 2, and 4 weeks post-inoculation, and anti-VACV IgG titer was determined by enzyme-linked immunosorbent assay. **RESULTS:** VWR did not improve mortality due to VACV infection ( $p = 0.26$ ), although fewer VWR mice (4/10) died compared to sedentary (SED, 6/10). VWR did not prevent body weight loss due to infection compared to SED ( $p = 0.20$ ), although VWR mice loss slightly less weight (4%) compared to SED through the first 6 days post-infection. Food intake, the reduction of which is a marker of sickness behavior, was significantly reduced in SED post-infection compared to VWR ( $p = 0.05$ ). In the vaccination experiment, VWR mice developed a greater IgG antibody response, although this was not significant ( $p = 0.22$ ). **CONCLUSIONS:** VWR did not protect against mortality to VACV or prevent infection-induced weight loss, and VWR did not enhance antibody responses. However, there were non-significant trends towards VWR-related improvements in these outcomes, and post-infection food intake was improved by VWR. Funded by ACSM Research Endowment Grant to BDP.

767 May 31 3:45 PM - 4:00 PM

### Effect of Exercise Training on Inflammatory Markers in Overweight and Obese Boys and Girls

Huimin Yan<sup>1</sup>, Terry E. Jones<sup>2</sup>, Morgan M. Pearce<sup>2</sup>, Kristen A. Lattimore<sup>2</sup>, Gabriel S. Dubis<sup>2</sup>, Patricia Brophy<sup>2</sup>, Robert C. Hickner, FACSM<sup>3</sup>. <sup>1</sup>University of Massachusetts Boston, Boston, MA. <sup>2</sup>East Carolina University, Greenville, NC. <sup>3</sup>Florida State University, Tallahassee, FL.  
Email: huimin.yan@umb.edu  
(No relationships reported)

**PURPOSE:** The aim of the present study was to examine the effect of exercise training on inflammatory markers in overweight and obese pre-pubertal boys and girls. **METHODS:** Forty-six overweight and obese children (age range 9-11 yr old, mean Tanner stage 1.2) volunteered for the study and were randomized to no-exercise control (CON, 6 boys and 7 girls) and exercise training (EX, 14 boys and 19 girls) groups for 16 weeks. Serum monocyte chemoattractant protein-1 (MCP-1), interleukin 6 (IL-6) and tumor necrosis factor (TNF-alpha) were measured as markers of inflammation before and after the intervention.

**RESULTS:** There was no difference between boys and girls in age ( $9.1 \pm 0.6$  and  $9.3 \pm 0.5$  yr) or BMI percentile ( $94 \pm 1$  and  $97 \pm 1\%$ ) before the intervention. After the intervention, a significant increase in fitness (time to exhaustion for incremental treadmill test,  $p < 0.05$ ) was observed in the EX ( $81 \pm 13$  sec) but not in CON ( $12 \pm 22$  sec). There was no effect of exercise training on MCP-1, IL-6 or TNF-alpha; however,

percent changes in these pro-inflammatory markers were significantly decreased in girls, while the percent change values were significantly increased in boys, regardless of intervention group (significant main effect of sex,  $p < 0.05$ , table 1). There was no correlation between changes in body weight and inflammatory markers.

**CONCLUSION:** There was a decrease in inflammatory markers over 16 weeks in girls, but not in boys, that is not due to exercise training. These data indicate previous findings that exercise training, in the absence of weight loss, do not affect inflammatory markers may be sex (and perhaps age) specific.

Table 1. Inflammatory markers and changes in body weight in boys and girls before and after the intervention.

	Boys		Girls	
	EX	CON	EX	CON
Baseline MCP-1 (pg/uL)	256±17	258±26	249±15	276±24
Baseline IL-6 (pg/mL)	0.9±0.6	0.7±1.0	1.9±0.5	1.3±0.9
Baseline TNF-alpha (pg/uL)	4.4±0.3	3.4±0.5	4.1±0.3	4.2±0.5
Percent change MCP-1 (%) #	12±5	7±8	-4±5	-6±8
Percent change IL-6 (%) #	52±23	55±35	-12±20	-2±33
Percent change TNF-alpha (%) #	0±5	8±7	-8±7	-13±7
Change in weight (kg) *	2.3±0.5	0.4±0.8	2.0±0.4	2.8±0.6

\* Significant sex by group interaction

# Significant main effect of sex

Supported by NIH RO1DK071081

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### Interval Walking Training Reduces T Cell CCR5 in Individuals with Type 2 Diabetes

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(No relationships reported)

Recent evidence implicates chemokine (C-C motif) ligand 5 (CCL5, also known as RANTES) and its receptor CCR5 in mediating T cell infiltration into adipose and other tissues, which contributes to chronic low-grade inflammation in obesity and type 2 diabetes (T2D). Exercise may relieve obesity-related inflammation but the effects of interval training on T-cell migration and tissue infiltration in T2D are unknown. **PURPOSE:** To examine the impact of interval walking training (IWT) versus continuous walking training (CWT) on circulating RANTES along with T cell and adipose tissue CCR5 in patients with T2D. **METHODS:** Participants with T2D were randomized to control (n=8), IWT (n=12) or CWT (n=12). Training groups were prescribed five 60-minute sessions per week of free-living training with intensity monitored with an accelerometer and heart rate monitor. Fasting blood samples and subcutaneous abdominal adipose tissue biopsies were obtained before and 6 days after completion of the 16-week intervention period. Plasma RANTES was measured by ELISA. Peripheral blood mononuclear cells (PBMCs) were isolated for subsequent measurement of CD8+ T cell CCR5 surface protein expression using flow cytometry. mRNA expression of RANTES, CCR5 and CD8 were measured in subcutaneous adipose tissue biopsy samples by qPCR. **RESULTS:** Training duration and mean intensity were well-matched between IWT and CWT. A significant group X time interaction ( $p < 0.05$ ) was detected for CD8+ T cell CCR5 surface protein expression, with post-hoc tests revealing a reduction of ~20% after IWT ( $p < 0.05$ ) with no changes seen in CWT or control. Plasma RANTES concentration and adipose tissue mRNA expression of RANTES, CCR5 and CD8 were not altered in IWT, CWT, or control groups following the intervention period (all  $p > 0.05$ ). **CONCLUSIONS:** Sixteen weeks of IWT, previously shown to benefit physical fitness, insulin sensitivity, body composition, and glycemic control in patients with T2D, resulted in lower CD8+ T cell CCR5 protein expression. These findings suggest lower migratory potential for circulating T cells but future research is needed to determine if IWT influences infiltration of T cells into adipose and other tissues. JPL is funded by a CIHR New Investigator Award (MSH-141890)

769 May 31 4:15 PM - 4:30 PM

**Increase in Natural Killer Cells with an Activated Phenotype During Recovery from Acute Dynamic Exercise**Emily C. LaVoy, Priti Gupta. *University of Houston, Houston, TX.*

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(No relationships reported)

Acute dynamic exercise enhances Natural Killer (NK) cell cytotoxicity against HLA-expressing tumor target cells. This enhanced killing capacity of NK cells occurs during recovery from exercise. A preferential redeployment of NK cells with an activated phenotype has been proposed as one mechanism to explain increased function. However, NK cells frequently co-express activating and inhibitory molecules, complicating interpretation of earlier results that have failed to fully characterize the mobilized cells. **PURPOSE:** To thoroughly investigate changes in NK cell phenotype due to acute dynamic exercise. **METHODS:** 12 physically active adults accustomed to cycling exercise cycled for 30 minutes at 115% of lactate threshold power. Blood collected pre-, post-, and 1h post-exercise was analyzed using 10 parameter flow cytometry to identify NK cell subsets present at each time point. NK cytotoxicity against the HLA-expressing U266 tumor cell line was assessed following a 4h incubation using a flow-based assay. Differences in NK cell cytotoxicity and NK cell subset proportions between the three time points were assessed using maximum likelihood linear mixed models. **RESULTS:** Similar to earlier reports, NK cell cytotoxicity per cell against U266 tumor cells was highest 1h post exercise ( $0.36 \pm .08$  1H Post vs  $0.26 \pm .05$  Pre). The proportion of NK cells expressing the activating receptor NKG2C was increased 1h post exercise ( $5.1 \pm 1.6$  vs  $4.3 \pm 1.6$  %;  $p < 0.05$ ), as were cells co-expressing NKG2A ( $2.0 \pm 0.5$  vs  $1.5 \pm 0.5$ ;  $p < 0.05$ ). The co-expression of CD158a or CD158b (inhibitory KIRs) by the NKG2C+ NK cells did not differ from pre-exercise at 1h post exercise ( $p > 0.05$ ). Finally, NK cells expressing the late differentiation marker CD57 were at their lowest proportion 1h post exercise ( $31.6 \pm 6.7$  vs  $37.2 \pm 6.7$  %;  $p < 0.05$ ). **CONCLUSIONS:** Enhanced NK cell cytotoxicity against HLA-expressing tumor target cells 1h following exercise corresponded to changes in NK cell phenotype towards expression of activating receptors (NKG2C), and away from inhibitory receptors (CD158a, CD158b) and markers of late differentiation. These data lend support to the growing idea that acute exercise may be used clinically to enrich the blood of cytotoxic NK cells for immunotherapy.

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**Maximal Exercise Alters The Inflammatory Phenotype Of Mononuclear Cells And Response To Ex Vivo Lps Stimulation**Aaron Slusher, Amanda B. Mischo, Tiffany M. Zúñiga, Edmund O. Acevedo, FACSM. *Virginia Commonwealth University, Richmond, VA.* (Sponsor: Dr. Edmund O. Acevedo, FACSM)

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(No relationships reported)

Monocytes express the CD14 receptor involved in LPS ligation to TLR4 and subsequent production of anti-inflammatory (IL-6 and IL-10) and pro-inflammatory (TNF- $\alpha$ ) cytokines. However, under pro-inflammatory conditions, there is an increased proportion of monocytes expressing the CD16 receptor, which amplifies TLR4-mediated TNF- $\alpha$  production. **PURPOSE:** We therefore examined the hypothesis that decreased proportions of classical monocytes (CD14+/CD16-) and TLR4 expression following maximal exercise would be accompanied by reduced CD14 expression. Conversely, the mobilization of pro-inflammatory monocytes (CD14+/CD16+) expressing elevated TLR4 would exhibit increased CD14 and CD16 expression. Concomitantly, LPS-stimulated ex vivo production of IL-6 and IL-10 would be attenuated, while TNF- $\alpha$  would be enhanced post exercise. **METHODS:** Human mononuclear cells ( $n = 25$ ) were isolated prior to and following exercise to assess CD14, CD16, and TLR4 expression by flow cytometry. **RESULTS:** Exercise reduced the proportion of classical monocytes and increased pro-inflammatory monocytes. In addition, TLR4 expression decreased to a greater extent on classical compared to pro-inflammatory monocytes. However, while CD14 expression was reduced on all monocytes, CD16 expression tended to increase on pro-inflammatory monocytes. LPS-stimulated production of IL-6 and IL-10 was also significantly decreased, while TNF- $\alpha$  significantly increased. **CONCLUSIONS:** Exercise shifts monocytes towards a pro-inflammatory phenotype, raising additional questions regarding the anti-inflammatory impact of chronic exercise and the mechanisms involved monocyte immune function.

**B-45 Free Communication/Slide - School-oriented Interventions**

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM

Room: 103

771 **Chair:** Russell R. Pate, FACSM. *University of South Carolina, Columbia, SC.*

(No relationships reported)

772 May 31 3:15 PM - 3:30 PM

**Influence Of A School-based Physical Activity Intervention On Scholastic Performance - The Champs Study-DK**Anna Bugge<sup>1</sup>, Sören Möller<sup>2</sup>, Jakob Tarp<sup>1</sup>, Rodrigo A. Lima<sup>3</sup>, Charles H. Hillman<sup>4</sup>, Anne K. Gejl<sup>1</sup>, Heidi Klakk<sup>1</sup>, Niels Wedderkopp<sup>1</sup>. <sup>1</sup>University of Southern Denmark, Odense, Denmark. <sup>2</sup>Odense University Hospital, Odense, Denmark. <sup>3</sup>Ministry of Education of Brazil, Brasilia, Brazil. <sup>4</sup>Northeastern University, Boston, MA.

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(No relationships reported)

Despite the known benefits of physical activity on physical, cognitive and mental health, there is a trend in many countries to decrease physical activity opportunities for children and adolescents during the school day. **PURPOSE:** To investigate the influence of a school-based intervention with a tripling of physical education (PE) lessons from two (90 min) to six lessons per week (270 min) added to the normal curriculum on scholastic performance in school-aged children. **METHODS:** This study is a part of the CHAMPS study-DK, a quasi-experimental study that began in 2008. The intervention group consisted of six schools and four matched schools served as the control group (mean age at baseline = 8.4 years). Academic performance was extracted from the Danish national test system from 2010 to 2014 (Math and Danish were measured at 3<sup>rd</sup> and 6<sup>th</sup>, and 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup> grade, respectively). Participants for this investigation include 1,888 students, participating in at least one national test of scholastic performance. Mean of three different domains (Danish: language understanding, decoding, and text comprehension, and Math: algebra, geometry, and basic mathematics skills) were obtained as the test results (from 0-100 points). Mother's educational status was used as an indicator of socioeconomic status (SES). Linear mixed models were applied to test for differences between Groups. **RESULTS:** No significant differences were observed between groups in any of the academic performance tests (control group reference); Danish 2<sup>nd</sup> grade  $\beta = -1.34$  (95% CI -9.90, 7.22), 4<sup>th</sup> grade  $\beta = 0.22$  (95% CI -6.12, 6.56), 6<sup>th</sup> grade  $\beta = 1.03$  (95% CI -5.02, 7.08) and all grades combined  $\beta = 0.28$  (95% CI -5.74, 6.31) and Math 3<sup>rd</sup> grade  $\beta = -2.87$  (95% CI -9.65, 3.90) and both grades combined  $\beta = -1.28$  (95% CI -8.10, 5.71). Across groups girls performed significantly better in Danish, whereas boys performed better in Math (all  $p < 0.05$ ). **CONCLUSIONS:** No significant differences were observed between intervention and control schools for scholastic performance, which may be interpreted as a positive result, given that a tripling of PE did not result in a cost to scholastic performance. Such findings suggest that increasing physical activity opportunities during the school day does not detract from academic goals, although making the school days longer.

773 May 31 3:30 PM - 3:45 PM

**Evaluation of Kaiser Permanente Colorado's Thriving Schools Initiative**Cheryl Kelly<sup>1</sup>, Timothy K. Behrens, FACSM<sup>2</sup>, Elizabeth Tucker<sup>3</sup>, Dick Carpenter<sup>3</sup>, Carmen Luna<sup>1</sup>, Julaine Field<sup>3</sup>.<sup>1</sup>Kaiser Permanente Colorado, Denver, CO. <sup>2</sup>Northern Arizona University, Flagstaff, CO. <sup>3</sup>University of Colorado Colorado Springs, Colorado Springs, CO.

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(No relationships reported)

**Purpose:** To evaluate the Kaiser Permanente Thriving Schools Initiative, a program designed to increase physical activity (PA) in Colorado public schools. **Methods:** This cross-site evaluation examined 27 public school districts funded to incorporate PA into the school day, operationalized as classroom PA (CPA), before and after school PA (BAPA), and PA occurring in physical education classes or recess (PERPA). All data were collected during the 2014-15 academic year using an online data management system. CPA were collected by asking randomly selected teachers in each school to report classroom PA during a one-week period, 2-3 times each semester. Programming for BAPA was reported by each district's health coordinator and included day<sup>-1</sup> offered, min<sup>-d<sup>-1</sup></sup> offered, and number of students participating. PERPA schedules were collected for each school and entered into an aggregate database containing all PA. Mean minutes of PA<sup>-d<sup>-1</sup></sup> was calculated using the sum of CPA, BAPA, and PERPA

divided by the number of school days. Descriptive and inferential statistics were calculated. **Results:** Most districts (76%) provided  $\geq 30 \text{ min} \cdot \text{d}^{-1}$  ( $42.9 \pm 27.6 \text{ min} \cdot \text{d}^{-1}$ ) of PA, though only 36% provided  $60 \text{ min} \cdot \text{d}^{-1}$ . There were no significant differences in the likelihood of achieving mandated PA minutes based on school characteristics. Most PA minutes were offered in PERPA (66.8%). In fact, schools that reported more minutes in these two types of PA were significantly more likely to achieve mandated PA minutes. Schools with greater percentages of free and reduced lunch eligible students reported significantly fewer min  $\cdot \text{d}^{-1}$  spent on PA in classrooms, PE, recess, and in total. Finally, coefficients for PE, recess, and total minutes indicate schools with greater percentages of minority students tend to report a greater number min  $\cdot \text{d}^{-1}$  in said activities. **Conclusion:** These findings support increased efforts for PA promotion in public schools, though additional research is needed to identify best practices for implementing school-based PA promotion.

774 May 31 3:45 PM - 4:00 PM  
**Effectiveness Of A Preschool-Based Exercise Intervention On Physical Activity, Motor Performance, Body-Mass-Index And Blood Pressure: A Cluster-Randomized Controlled Trial**

Claudia Hacke<sup>1</sup>, Sascha Ketelhut<sup>2</sup>, Ulrike Wendt<sup>3</sup>, Götze Müller<sup>3</sup>, Claudia Schlesner<sup>3</sup>, Kerstin Ketelhut<sup>4</sup>. <sup>1</sup>University Medical Center Hamburg-Eppendorf, Hamburg, Germany. <sup>2</sup>Martin-Luther-University Halle-Wittenberg, Halle, Germany. <sup>3</sup>University Heart Center Hamburg, Hamburg, Germany. <sup>4</sup>Medical School Berlin, Berlin, Germany. (Sponsor: Reinhard G. Ketelhut, FACSOM)  
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**PURPOSE:** Beneficial effects of physical activity interventions on health are well described for adults and adolescents. However, the impact in early childhood is understudied. The present study set out to investigate the effectiveness of an exercise intervention on activity level, motor performance, BMI and peripheral and central blood pressure (BP) in 3-6 years old preschoolers, with emphasis on social background.

**METHODS:** A 6-months cluster-randomized controlled trial including a 45min/biweekly supervised exercise program was conducted in 3 intervention and 2 control daycare centers in Hamburg, Germany. A total of 135 children (IG=92, CG=43; 4.8±0.8 years) completed the trial with baseline and follow-up data on BMI, activity level (time during leisure-time and in organized sports) and motor performance (z-scores of 4 test items assessing flexibility, coordination, power, speed). Peripheral and central BP were measured with a brachial cuff-based oscillometric device. Maternal education (high vs. low) was used as an indicator for social background. We applied linear mixed models with random intercepts for daycare center to evaluate differences in mean change adjusted for baseline value of the outcome, age, sex and height.

**RESULTS:** No significant differences in mean change, comparing the intervention to the control group, could be detected on weekly activity level (-24.7 min; 95%CI: -55.9,6.4), motor performance (-0.1; -0.7,0.6), BMI-percentile (1.3; -14.9,17.6), pBP (1.0 mm Hg; -1.9,3.9/1.7 mm Hg; -0.5,4.0) or cBP (1.8 mm Hg; -1.7,5.2/1.8 mm Hg; -0.4,4.1). However, subgroup analyses revealed a stronger intervention effect in children of low vs. high social status in terms of a lower increase in systolic pBP (-3.5 mm Hg; -6.9, -0.1; P=0.045) and cBP (-3.7 mm Hg; -6.5, -0.9; P=0.010), whereas BP change did not differ within the control group.

**CONCLUSION:** In preschool children, we found no evidence for effectiveness of a 6-months multifaceted exercise program on physical activity, motor performance, BMI or BP. However, the results of this study indicate that children from lower social backgrounds benefit more from early exercise-promoting interventions. Implementation fidelity, intervention period and sample size are key issues that should be addressed in further trials to provide definitive evidence.

775 May 31 4:00 PM - 4:15 PM  
**Relationship Between School Physical Environment And Sedentary Time Among Children In Puerto Rico**  
 Maria Enid Santiago-Rodriguez<sup>1</sup>, Marcos A. Amalbert-Birriel<sup>2</sup>, Farah A. Ramirez-Marrero, FACSOM<sup>2</sup>. <sup>1</sup>University of Illinois at Chicago, Chicago, IL. <sup>2</sup>University of Puerto Rico, Rio Piedras Campus, San Juan, PR.  
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Sedentary time increases the risk of obesity and other hypokinetic diseases. The school's physical environment (SPE) can influence during school sedentary time (DSST) in children. The association between SPE and DSST has not been clearly established in this population. **PURPOSE:** To evaluate DSST and the potential influence of SPE in DSST among children in Puerto Rico. **METHODS:** Fifty-four

girls and 48 boys (age=7.9 ± 0.7 yrs, range=7-9 yrs) wore an accelerometer during 7 consecutive week-days over the right hip area. A filter was created to determine DSST for those children who wore the accelerometer during at least 3 weekdays. The SPE was evaluated taking into consideration the physical education class, recess time, and use of facilities that promoted PA. Time in physical education and recess was provided by the school's administration. To determine the use of facilities, a score was generated based on self-reported activities during school, and the time spent in each activity. Correlation analyses were conducted to test the relationship between: 1) physical education class (min/wk) and DSST (hr/wk); 2) recess time (min/wk) and DSST (hr/wk); and 3), use of school facilities (score) and DSST (hr/wk). **RESULTS:** DSST was different by gender (girls: 4.3 ± 0.5 hr/wk, boys: 4.4 ± 0.3 hr/wk; p = 0.01) and type of school (private: 4.3 ± 0.4 hr/wk; public: 4.6 ± 0.2 hr/wk; p = 0.04). No relationship was observed between DSST and time in physical education (r = -0.15, p > 0.05), or use of facilities that promoted PA (p = 0.001, p > 0.05). However, a direct association between DSST and recess time was observed (p = 0.34, p < 0.01). **CONCLUSION:** Although the average DSST was very low in this group of children, more recess time was associated with more DSST. More research is needed to confirm these observations, and the importance of school interventions to discourage sedentary time during recess time. Funded by University of PR-FIPI Institutional Grant.

776 May 31 4:15 PM - 4:30 PM  
**The Association Between Perceived Athletic Competence And Physical Activity: Implications For Low-income Schoolchildren**

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**PURPOSE:** Addressing athletic competence (AC) may shape children's physical activity (PA) behaviors through participation in organized and unorganized PA, but these opportunities may be limited in low-income children. We aimed to assess the association between children's perceived AC and daily moderate-to-vigorous PA (MVPA) and whether socioeconomic status (SES) modifies this relationship. **METHODS:** Schoolchildren (n=1157; grades 3-4) were recruited from 24 schools in Massachusetts communities to participate in the Fueling Learning through Exercise study. Demographic data were collected by parent report. Free or reduced price lunch (FRPL) eligibility was used as an indicator of SES. Seven-day accelerometry (Actigraph GT3X+) was used to measure MVPA. Measured height and weight were used to derive weight status category. The AC domain (6 items, scored 1-4) from the Harter Self-Perception Profile for Children was used to assess perceived AC, and categorized by tertiles into low, moderate, and high. The association between AC and MVPA were examined using mixed effects models adjusting for sex, race, grade, FRPL, weight status category, accelerometer wear time, and controlling for school-level clustering.

**RESULTS:** Of those participants with valid accelerometer wear time of  $\geq 3$  days and  $\geq 10 \text{ hr/day}$  (n=1054, 44% male, 8.7±0.7 years), 81% did not meet the 60-min MVPA recommendation (44.9±20.1 min/day). AC scores differed by sex (high AC=37% male vs. 31% female; p<0.05) and FRPL eligibility (high AC=42% non-FRPL eligible vs. 28% FRPL eligible; p<0.001). A significant interaction between FRPL eligibility and AC was found (p<0.01). Non-FRPL eligible children who reported either moderate AC ( $\beta=4.0 \text{ mins/day}$ ; 95% CI: 1.1, 6.8; p<0.01) or high AC ( $\beta=9.4 \text{ mins/day}$ ; 95% CI: 6.0, 12.9; p<0.001) were more likely to engage in more minutes of MVPA compared to children who reported low AC. This association between AC and MVPA did not exist for FRPL-eligible children (p>0.05).

**CONCLUSION:** Self-reported AC was positively associated with MVPA, but not for low-income children. These findings suggest that AC may not correlate with greater engagement in PA behaviors among low-income children. Further research is warranted to assess which social and environmental factors affect the association between AC and MVPA.

777 May 31 4:30 PM - 4:45 PM  
**Effects Of Interrupting Prolonged Sitting With Activity On Appetite Sensations In Elementary School-age Children**

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**BACKGROUND:** Short and long term exposure to prolonged sitting is associated with excess food intake and weight gain in children. Interrupting prolonged sitting with low-intensity activity does not alter subjective appetite sensations or food intake

in children. However, it is unclear whether activity performed at a higher intensity will alter appetite sensations in children. **PURPOSE:** The purpose of this study is to examine the acute effects of interrupting prolonged sitting with intermittent activity performed at varying intensities on hunger, satiety, and prospective food consumption (PFC) in elementary school-age children. **METHODS:** Using a randomized crossover design, thirty-nine children (ages 7-11 years; 18 male, 21 female; 33% overweight/obese and 59% non-white), completed four experimental conditions: 8 hours of sitting interrupted with 20, 2-minute low-intensity (L), moderate-intensity (M), or high-intensity (H) activity breaks or 20, 2-minute sedentary (S) screen time breaks. Exercise intensity for the L, M, and H conditions corresponded with 25%, 50%, and 75% of heart rate reserve, respectively. Hunger, satiety, and PFC, were assessed using the Visual Analog Scale at four time points (post-breakfast, pre-lunch, post-lunch, and pre-dinner) throughout each experimental condition. **RESULTS:** Satiety sensations tended to be lower during the L and H conditions compared to the S condition (S: 5.3±0.3, L: 4.8±0.3, M: 5.2±0.39, H: 4.7±0.4, p=0.05). There were no significant differences across conditions for hunger (S: 4.6±0.3, L: 4.6±0.3, M: 4.6±0.3, H: 4.7±0.3, p=0.99) and PFC (S: 4.5±0.3, L: 4.4±0.3, M: 4.5±0.3, H: 4.7±0.3, p=0.63). There were no significant differences between post-breakfast vs. post-lunch scores (p>0.05), and pre-lunch vs. pre-dinner scores (p>0.05). **CONCLUSIONS:** These data suggest interrupting prolonged sitting with moderate-intensity activity may be an effective strategy to increase physical activity energy expenditure without triggering increases in hunger and PFC or reductions in satiety. Future studies should examine the long-term effects of interrupting prolonged sitting with activity on appetite sensations, food intake, and weight outcomes in elementary school-age children.

778 May 31 4:45 PM - 5:00 PM

**The Fueling Learning Through Exercise (FLEX) Study: Short-term Findings On Sedentary Time In Lower-income Schoolchildren**

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**PURPOSE:** Throughout the elementary school years school-time moderate-to-vigorous physical activity (MVPA) tends to decrease while sedentary time (SED) increases, contributing independent effects on health outcomes. There is insufficient research on how physical activity (PA) programming may impact SED in children. Our objective was to determine whether two innovative school-based PA programs impact school SED in children and if program reach differed by sex, race/ethnicity, and weight status. **METHODS:** Eighteen schools from lower-income Massachusetts school districts were enrolled in the Fueling Learning through Exercise Study (FLEX) and randomized to 100 Mile Club (100MC; walking/running program), Just Move (JM; active classroom breaks), or a Control group. Third- and fourth-grade children (n=883) were recruited and measured at baseline (Fall 2015) and short-term follow-up (Spring 2016) for height/weight and 7-day accelerometry (ActigraphGT3x). Demographic information was obtained by parent questionnaire. PA program effects on SED were examined using mixed-effects models adjusting for child sex, race/ethnicity, free or reduced-price lunch (FRPL) eligibility, weight status, accelerometer wear time, average daily temperature, and controlling for school-level clustering. **RESULTS:** 793 children (8.7 ± 0.7 years, 44% male, 65% non-white, 53% FRPL, 41% overweight/obese) had valid accelerometer wear-time (3 days, 310 hrs/day) at both study visits. At baseline, few children achieved the recommended 30 minutes of school-time MVPA (9%; 18.1 ± 7.9 min) and children were sedentary for 59.7% (233 ± 43 min) of their school day. There was a significant effect of program on SED (p=0.041) with Control and JM increasing in SED (6.2 [95%CI: 2.7, 9.5], p<0.001 and 4.3 [95%CI: 0.9, 7.7] mins/day, p=0.012 respectively) while 100MC did not change (p=0.88). There were no differences in program effects by sex (p=0.58), race/ethnicity (p=0.08), or weight status (p=0.19). **CONCLUSIONS:** Short-term follow-up of program implementation during a two-year PA intervention demonstrates a potential effect of 100MC on mitigating an increase in SED that may occur over the elementary school years. Longer-term findings will demonstrate whether the effects of PA programming on SED are sustained.

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**Comparison of Moderate-to-Vigorous Physical Activity Between In-school and an Afterschool Program among Urban Underserved Children**

Ryan McVann, Marlo P. Dell'Aquila, Madison Burke, Zi Yan, Kevin Finn, Kyle McInnis, FACSM. Merrimack College, North Andover, MA.  
(No relationships reported)

With the elimination of physical education and recess, the opportunities for children to be physically active in schools has declined. Therefore, afterschool programs have been identified as ideal settings where children (5-14 years) can accumulate a significant portion of their total daily, recommended level of moderate-to-vigorous physical activity (MVPA). **PURPOSE:** The first purpose of this pilot study was to quantify the level of in-school MVPA in underserved elementary school settings. A second purpose of the study was to quantify the level of MVPA achieved through a structured afterschool program that integrates physical activity with a STEM (Science, Technology, Engineering, and Mathematics) learning component. **METHODS:** Participants were 13 children (female n=5, age= 9.36, SD=0.83) enrolled in an afterschool program offered at a YMCA located in an urban community. All participants wore accelerometers to track their MVPA during the school day (6 hours and 15 minutes) and while participating in the structured afterschool program (30 minutes) called *Active Science*. During the program, the participants completed thirty minutes of physical activity followed by a science lesson delivered through the *Active Science* Mobile App. Physical activity levels were monitored for five consecutive days (Monday-Friday) during the in-school and afterschool environments. **RESULTS:** Participants mean in school and afterschool MVPA were M=14.5+2.60, M=16.87+3.6 minutes, respectively. T-test showed a significant difference between these two settings t(12)= 16.29, p<.05. The 6-hour school day contributed to approximately 24% of the recommended daily physical activity, while the 30-minute afterschool program contributed to 28% of the daily-recommended MVPA time. **CONCLUSION:** A guided and well-structured afterschool physical activity program can significantly impact MVPA levels in children. The results of this study are well aligned with national recommendations that endorse innovative strategies to incorporate movement into afterschool programs to improve physical activity levels in children.

**B-46 Clinical Case Slide - Foot and Ankle I**

Wednesday, May 31, 2017, 3:15 PM - 4:55 PM  
Room: 504

780 **Chair:** Melody Hrubes. Schwab Rehabilitation Hospital, Chicago, IL.  
(No relationships reported)

781 **Discussant:** Aaron Lee. MacNeal Hospital, Berwyn, IL.  
(No relationships reported)

782 **Discussant:** Benjamin Hasan. Northwest Community Hospital Medicine Group, Arlington Heights, IL.  
(No relationships reported)

783 May 31 3:15 PM - 3:35 PM  
**Recurrent Medial Heel Pain In An Elite Triathlete: Location, Location, Location.**  
Jason L. Zaremski, FACSM<sup>1</sup>, Dustin Nabhan<sup>2</sup>. <sup>1</sup>University of Florida, Gainesville, FL. <sup>2</sup>United States Olympic Committee, Colorado Springs, CO.  
Email: zaremjl@ortho.ufl.edu  
(No relationships reported)

**Case History** We present a 25 year old female elite triathlete with nine months of left medial calcaneal discomfort associated with running. Her symptoms are described as aching in the medial inferior calcaneus. She denies swelling, sensory changes, discoloration, or burning. Previously she was diagnosed at an outside institution with plantar fasciitis as well as impingement of the first branch of the lateral plantar nerve. She was treated with a diagnostic lidocaine injection, as well as a cortisone injection without relief. **Physical examination** The patient was tender to palpation posterior and inferior to the medial malleolus. Tapping at that location created mild pain and sensation of radiation of pain inferiorly but there was no electrical or burning sensation. Range of motion, strength, and light touch of the ankle was normal. There was a negative Tinel's sign at the Fibular Head. A calcaneal squeeze test created medial sided calcaneal pain only. The patient had negative slump and straight leg raise tests. **Differential Diagnosis** Impingement of the First Branch of the Lateral Plantar

Nerve Posterior Tibial Nerve Impingement Stress Reaction/Fracture of Calcaneus Fat Pad Syndrome Plantar Fasciitis **Tests and Results** Previous MRI's of the foot and ankle as well as lumbar spine were negative. A reported electromyographic and nerve conduction study was negative for lumbar radiculopathy but without evaluation of calcaneal nerves. Given the entire clinical picture, we proceeded with a lidocaine challenge with ultrasound guidance at the location at the bifurcation of posterior tibial to calcaneal nerves. She received complete relief of pain within five minutes.

**Working Diagnosis** Posterior Tibial Nerve Impingement at Level of Bifurcation of Calcaneal Nerves

**Treatment & Outcomes** Given the positive Lidocaine challenge, the decision was made to proceed with hydro-dissection at the level of posterior tibial nerve bifurcation of medial and lateral calcaneal nerves. In plane short axis hydrodissection technique with 1% plain Lidocaine and Triamcinolone was performed. The patient had complete relief of pain at 5 minutes, 24 hours, 72 hours, and 90 days post procedure. The patient has returned to training without restriction with hopes of competing for a spot on the next Olympic Team.

784 May 31 3:35 PM - 3:55 PM

### Foot Pain - Recreational Skier

Kelly L. Roberts Lane, FACSM. *Fix It physical therapy, Mahtomedi, MN.*  
Email: kelly@fixitpt.com  
(No relationships reported)

**HISTORY:** 35 yo slipped down her back deck steps 1/25/16. She experienced severe pain and inability to stand on her R foot with immediate swelling and minimal bruising on day 1. She was evaluated at an Orthopedic Clinic, where X-ray showed a talar avulsion fx. She was given a cast boot and instructed to follow-up in 4 wk. She saw me at the physical therapy clinic 7 days post fx with complaints of severe pain and inability to weight-bear on booted R foot. The boot was not fitted correctly with the front piece missing and the air bladder not inflated. The boot fit was corrected and she left for Colorado. She returned 2 wk later with continued severe pain.

**PHYSICAL EXAMINATION:** Examination 3 wk post talar avulsion fracture revealed severe tenderness with palpation R foot, significant bruising and severe R lower leg, ankle, and foot swelling. Her R foot skin was cool to touch compared to the L and had a mottled appearance. She had painful and severe tightness with R calcaneal and forefoot varus and valgus PROM and R dorsiflexion PROM. She had limited ability to wiggle her toes, but no complaints of numbness or tingling. **DIFFERENTIAL DIAGNOSIS:** 1. Additional Fracture 2. Ligament Tear 3. Complex Regional Pain Syndrome **TEST AND RESULTS:** MRI of R ankle/foot 2/23/16: Avulsion fragment along the talar head, No acute ligament injury, impaction of plantar aspect of talus with extensive marrow edema talar head and neck, calcaneus contusion **FINAL WORKING DIAGNOSIS:** Complex Regional Pain Syndrome post avulsion/impaction fx of the talar head complicated by the ill-fitting cast boot **TREATMENT AND OUTCOMES:** 1. Discontinuation of boot 8 wk post fx 2. Knee walker for 10 wk 3. Gabapentin 900 mg / day 4. Facilitation of joint movement to improve gross ankle/foot movement and decrease pain response 5. Fracture fully healed 11 wk post fracture 6. Slow return to activity over 6 mo - dance, paddle boarding, Pilates 7. CRPS sx resolved over 9 mo post fx

785 May 31 3:55 PM - 4:15 PM

### Tarsal Dysostosis in the Adolescent Athlete

Bhavesh B. Joshi. *Millcreek Community Hospital, Erie, PA.*  
(Sponsor: Patrick F Leary, DO FACSM, FACSM)  
Email: bhavesh.joshi.bbj22@gmail.com  
(No relationships reported)

Articular Dysostosis is a rare musculoskeletal condition due to an abnormal bridging of two bones by cartilage, bone, or fibrous tissue. This abnormality changes the intrinsic physiologic motion of those two bones and surrounding structures. The most common site involves the talus, calcaneus, and navicular bones- known as Tarsal Dysostosis or Tarsal Coalition (TC). The condition has been linked to a gene mutation that can affect both feet in fifty percent of cases. TC typically presents in the adolescent patient after beginning athletic activities.

A 12-year old male with no significant medical history presented to the Sports Medicine office complaining of worsening left non-traumatic foot pain for over one years time. The patient had been participating in high school football and sustained an inversion ankle injury. On physical exam tenderness to palpation at the proximal dorsal surface of his left foot was elicited. Osteopathic exam of the foot and ankle was noted for Pes planus with fallen arch and the inability to induce medial arch, Hammer toes, and hallux valgus deformities of the foot. The patient was empirically started on a rehabilitation program consisting of foam rolling exercises of the lower quarter, increase flexibility, ankle and foot intrinsic exercises, ambulation with a non-inflating walking boot. With only minimal clinical improvement, magnetic resonance imaging (MRI) was ordered revealing bony contusions in the talus, calcaneus, and navicular bones. He was referred to Shriners Hospitals for Children and underwent a resection of the left calcaneonavicular coalition. He has since has returned to pain-free athletics after completing rehabilitation and therapy.

Current literature indicates that Tarsal Dysostosis affects up to 1% of the population. It is a diagnosis found primarily in children and young adolescents during the ages of 8-16 when the ossification process of bones initiates. The disease is caused by mutations in the NOG gene. This gene is responsible for the noggin protein, which plays an important role in proper bone and joint development. The diagnosis of tarsal coalition begins with clinical suspicion and key physical exam findings of pain in an adolescent with decreases in foot range of motion, as well as pain into the hind-foot.

786 May 31 4:15 PM - 4:35 PM

### Ciprofloxacin Induced Achilles Tendinopathy

Igor Prus<sup>1</sup>, Kenneth Bielak, FACSM<sup>1</sup>, Rebecca Morgan<sup>2</sup>.  
<sup>1</sup>University of Tennessee Graduate School of Medicine, Knoxville, TN. <sup>2</sup>University of Tennessee, Knoxville, TN.  
(Sponsor: Kenneth Bielak, FACSM)  
(No relationships reported)

**HISTORY:** 26 year old college graduate student with past medical history of a kidney stone had painful urination and increased frequency over several days. He was seen by internist at student health center, prescribed Ciprofloxacin for 14 days for acute bacterial prostatitis. Two months later he developed right Achilles tendon pain which had started insidiously upon awakening one morning, with no inciting event except for taking Ciprofloxacin 6 weeks earlier. **PHYSICAL EXAMINATION:** Swelling of the of posterior ankle noted. Tenderness to palpation at the insertion site of a tight Achilles tendon was appreciated. **DIFFERENTIAL DIAGNOSIS:** 1. Ciprofloxacin induced Achilles tendinopathy 2. Idiopathic Achilles tendinopathy 3. Posttraumatic Achilles tendinopathy **TEST AND RESULTS:** 1. Ankle ultrasonography: Thickening and swelling of Achilles tendon. 2. Ankle X-ray: No bony abnormalities. **FINAL WORKING DIAGNOSIS:** Ciprofloxacin Induced Achilles Tendinopathy **TREATMENT AND OUTCOMES:** 1. Walking boot 2. NSAIDs 3. Physical therapy. Patient has recovered after six month of treatment.

787 May 31 4:35 PM - 4:55 PM

### Ankle Pain and Swelling - Tennis.

Gabriel Carpio-Bracho, Poonam Thaker, Anthony Rizzo, Brian Donohue. *Presence Resurrection Medical Center, Chicago, IL.*  
(No relationships reported)

**HISTORY:** 19 yo F D3 collegiate tennis player presented to the athletic training room for evaluation of b/l ankle pain on 9/12/2016. Pain began 2 months prior, while at home in Germany, starting in the left ankle, progressing to the right ankle a few weeks later with accompanying swelling, numbness & weakness. Denied any trauma or acute injury. Initial evaluation in Germany consisted of serum blood analysis and joint aspiration without joint fluid analysis. She returned to school & began a course of PT with the athletic training staff, with improvement in the numbness and weakness, but continued to have intermittent ankle pain and swelling. She denied taking any medications or herbal supplements. History of "allergic" reactions to many medications, which vary from blisters on her body to GI upset. At the time of initial presentation ROS neg. **PHYSICAL EXAMINATION:** Ankle: mild non pitting edema b/l. No erythema, ecchymosis, or deformity. Full A/PROM. Pain with passive and active dorsiflexion, plantar flexion, eversion, and inversion b/l. TTP over anterior and inferior aspect of lateral malleoli b/l, Achilles' insertion b/l. Anterior drawer negative b/l. Altered gait due to pain. Normal arches. Toe walk elicited pain, heel walk was painless. Strength 5/5 b/l in ankle and foot. DTR 2+ at Achilles' tendon b/l. Sensation intact b/l in all fields. **DIFFERENTIAL DIAGNOSIS:** 1. Systemic Lupus Erythematosus (SLE) 2. Drug Induced Lupus 3. Rheumatoid Arthritis 4. Seronegative Spondyloarthropathy 5. Lyme Disease 6. Synovitis/Tenosynovitis 7. Stress fracture / Stress reaction 8. Hypercholesterolemic Arthritis **TEST AND RESULTS:** Initial labs: **Chol 202, TG 178, LDL 110, CBC** (WBC = 9.5, Hb = 12.4, **Plt = 473**), CMP wnl. ASO neg, Fe wnl, Uric acid = 3.1, CRP = 5; CCP, Lyme neg. MRI = synovitis & edema around talar joint. Otherwise normal. F/u Labs: **ESR = 26; Anti-histone = 1.3 (weak positive);** CRP, CCP, ANA, dsDNA, Smith Ab, RNP Ab, SSA, SSB, SCL70, myeloperoxidase Ab, Anti-Centromere Ab, Lyme neg **FINAL WORKING DIAGNOSIS:** Early Lupus or drug induced lupus **TREATMENT AND OUTCOMES:** She was prescribed prednisone but preferred nonpharmacologic therapy. Continue PT, repeat labs. F/u in 2 wks: Symptoms improved. Work up ongoing. Continues to have occasional foot and ankle pain without functional limitation. Final diagnosis pending

**B-47 Clinical Case Slide - Lumbosacral Spine II**

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM  
Room: 401

788 **Chair:** Sherrie L. Ballantine-Talmadge. *CU Sports Medicine and Performance Center, Boulder, CO.*

(No relationships reported)

789 **Discussant:** Samuel K. Chu. *Rehabilitation Institute of Chicago, Chicago, IL.*

(No relationships reported)

790 **Discussant:** John P. Batson, FACS. *Lowcountry Spine and Sport, Hilton Head Island, SC.*

(No relationships reported)

791 May 31 3:15 PM - 3:35 PM  
**Loss Of Forward Flexion And Lumbar Back Pain In A 7yo Male.**

Danielle M. Magrini. *Children's Hospital of Philadelphia, Philadelphia, PA.*

(No relationships reported)

**HISTORY:** A 7 year old male comes into the office with low back pain which is worse with activity. Mother states that there is no specific injury or mechanism just progressive pain over the last 2-3 months prior to this visit. He was seen by an OSH where he obtained X-rays and was prescribed physical therapy. Pain began to progress despite PT and now he is unable to bend over and touch his toes. There is no numbness, tingling, or overt weakness in the lower extremity. He does have an occasional radicular pain into the left leg. No recent infections, fever, or change in bowel or bladder habits.

**PHYSICAL EXAMINATION:** Inspection: stiff gait otherwise reciprocal and non-antalgic; able to walk on toes and heels. No swelling, erythema or superficial skin stigmata in the lower lumbar spine Palpation: midline tenderness to palpation over the L2-L4 vertebrae. Mild paraspinal tenderness left greater than right. ROM: unable to forward flex at the waist; decreased ROM in extension, lateral side bending and rotation. Special tests: + 2 patellar and achilles reflexes; sensation intact throughout. Negative straight leg raise. Unable to bring knees into chest. **DIFFERENTIAL**

**DIAGNOSIS:** Tumor, ABC, muscle strain, infection

**TEST AND RESULTS:** Xray of lumbar spine-shows obliteration of the left L3 pedicle, + winking owl sign. MRI L spine- L3 vertebral body severe compression deformity on the left, essentially vertebral plana appearance, bulging/extraneous extension of enhancing tissue involving the left vertebral body, pedicle, and posterior elements extending into paraspinal tissues. Findings may represent Langerhans cell histiocytosis or other neoplasm. CT needle guided biopsy-confirmed LCH Skeletal survey- no other bony involvement **FINAL WORKING DIAGNOSIS:** Bone tumor of L3 pedicle. Possible LCH

**TREATMENT AND OUTCOMES:** - Symptomatic treatment including-TSLO brace and activity modifications - close monitoring and followup - no chemo or radiation secondary to focal disease.

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**Back Injury - Mountain Biking**

Cory Mitchell, Lauren Simon, FACS. *Loma Linda University, Loma Linda, CA.* (Sponsor: Lauren Simon, FACS)

(No relationships reported)

**HISTORY:** A 31-year-old recreational mountain biker presented with a one-month history of 5/10 low back pain. During a weekend excursion, he rode off of a 15 foot drop and landed flexed forward at the waist on his bike with his tailbone landing directly on the rear tire. He experienced immediate low back pain without radiation, numbness or tingling in the legs, or loss of bowel and bladder control. He was able to complete his ride and walk to his car. He continued to have low back soreness (2-4/10) particularly when sitting upright in a chair that limited his normal 5x/week exercise routine.

**PHYSICAL EXAMINATION:** Examination revealed tenderness to palpation off of the midline bilaterally at L3-L4. He was nontender over the sciatic notches with very mild lumbar paraspinal muscle spasm at L2-L4. Forward flexion was 90% of the floor. He exhibited full extension and lateral bend. L1-S1 sensation was intact. Normal squat, heel and toe walk with 5/5 EHL strength bilaterally. He had negative straight leg raises supine and seated. Achilles and Patellar reflexes were 2 and 2+.

**DIFFERENTIAL DIAGNOSIS:** 1. Lumbar Compression Fracture 2. Lumbar Paraspinal Muscle Sprain 3. Lumbar Disc Injury 4. Lumbar Isthmic Spondylolisthesis

**TEST AND RESULTS:** Lumbar spine AP and lateral radiographs: -No evidence of acute fracture or dislocation. No significant degenerative changes. -Partial fusion of the anterior aspects of the vertebral bodies of T12 and L1, possibly congenital. Lumbar spine MRI without contrast: -Partial fusion of T12 and L1 vertebral body. -Degenerative disc disease at L4-L5 with central annular tear of the disc.

**FINAL WORKING DIAGNOSIS:** Central annular tear of the L4-L5 disc

**TREATMENT AND OUTCOMES:** 1. Rest and activity modification for 7 months. 2. Core strengthening physical therapy program for 8 weeks. 3. Negative radiographs rule out compression fracture with continued symptoms 9 months post injury. 4. Return to 65% capacity mountain biking with new onset low back weakness and radiation of pain into left buttock/testicle. Continued to deny red flag symptoms. 5. MRI revealed an annular tear of the L4-L5 disc. 6. Return to physical therapy for core strengthening program. Pain decreased to only upon awakening after 12 of 16 sessions. Gradual return to activity will be implemented with continued pain free progress with physical therapy.

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**Back Pain in a Tennis Player**

Renu Gautam, George Pujalte, FACS. *Mayo Clinic Florida, Jacksonville, FL.* (Sponsor: George Pujalte, FACS)

Email: gautam.renu@mayo.edu

(No relationships reported)

**HISTORY:**

A 51-year-old female with a history of rhabdomyosarcoma and breast cancer presented with sudden, sharp, constant, 10/10 pain on the left lower back, radiating to her left hip and thigh. She had numbness and tingling over her left anterior thigh. The pain decreased when supine or standing, but increased with sitting. The pain was worse at night and in the early morning. Methylprednisolone and opioids provided little relief. No history of trauma. She had done light rowing machine workout the previous day. Rest of review of systems negative.

**PHYSICAL EXAMINATION:**

Back inspection showed no deformities, step offs, nor erythema. Level shoulders and iliac crests. Able to rise from a seated position. Gait was normal; toe and heel-walking, normal. Normal and pain-free lumbar spine range of motion (ROM). Negative straight leg raise test. No tenderness. Full ROM of left hip and knee. Mild left hip flexion weakness. Stinchfield negative. Decreased L2-L3 light touch sensation. Anterior thigh tingling reproduced with palpation inferomedial to left anterior superior iliac spine.

**DIFFERENTIAL DIAGNOSIS:**

- Lumbrosacral plexopathy
- Meralgia Paresthetica
- Lumbrosacral plexitis
- Paraneoplastic syndrome
- Lumbar radiculopathy

**TEST AND RESULTS:**

X-rays: Straightening of normal lumbar lordosis. Lower lumbar facet joint osteoarthritis. Normal lumbar vertebral body heights and intervertebral disc spaces. EMG: Nerve conduction normal. Fibrillation potentials and mildly polyphasic motor unit potentials in the left L2 innervated muscles. MRI: Foraminal/extracanalicular disc extrusion on the left at L2-L3 compressing and superiorly shifting L2 nerve root and dorsal root ganglion with associated left L2 radiculopathy. No pathologic contrast enhancement or metastatic disease.

**FINAL WORKING DIAGNOSIS:** L2-L3 radiculopathy

**TREATMENT AND OUTCOMES:**

1. Physical therapy (PT) with mild improvement in symptoms
2. Epidural steroid injection with minimal relief
3. Continued PT; tried acupuncture and chiropractic treatments. Improved strength and decreased pain; continued numbness
4. Gabapentin with minimal improvement
5. Neurosurgery recommended microdiscectomy, patient declined
6. Continued nonsteroidal anti-inflammatory drugs. Advanced tennis skills slowly, introducing serving 10-15/session at mild to moderate level.

794 May 31 4:15 PM - 4:35 PM

**Low Back Injury - Football: Complexities of In-Season Decision Making**

Luke Widstrom, Sourav Poddar. *CU School of Medicine, Aurora, CO.* (Sponsor: John Hill, FACS)

(No relationships reported)

**HISTORY:** A 23 year old division I football player presented for recurrent back pain after two separate injuries at practice. He has a prior history of left sided low back pain and spasm which responded well to mobilization treatments. However, during a power lifting session he felt increased pain with radiation down the left leg with extension maneuvers. At a subsequent practice, he rotated to grab a ball and noted significant right sided low back pain.

**PHYSICAL EXAMINATION:** Full flexion, extension, sidebending, and rotation at waist  
Bilateral lumbar paravertebrals are tight and TTP, worse on left. Left SI region TTP. Spinous processes are non-tender.  
Full sensation in bilateral LE L2-S1 dermatomes  
5/5 strength in bilateral LE L3-S1 myotomes  
2+ patellar and achilles reflexes bilaterally. No clonus.  
SLR equivocal left, negative right. Slump test positive left, negative right. Stork test with mild discomfort left, negative right. **DIFFERENTIAL DIAGNOSIS:** 1. Lumbar radiculopathy 2. Lumbar paraspinal strain 3. Spondylolysis 4. Spondylolisthesis 5. Degenerative disc disease

**TEST AND RESULTS: XR L-spine, AP/Lat/Flexion/Extension views:** Negative **MRI L-spine:** 1. Stress fracture with nondisplaced fracture of anterior pedicle on left and pars interarticularis on right of L4. Early stress injury without fracture at the pedicle and pars interarticularis of L5.  
2. Left paracentral protrusion compressing left S1 nerve root at L5-S1.

**CT scan L-spine:** Bilateral posterior element fractures at L4 vertebral body level, involving right lamina and pars interarticularis and left pedicle. No evidence of spondylolisthesis.

**FINAL WORKING DIAGNOSIS:** Left L4 pedicle fracture. Right L4 pars fracture. Bilateral L5 pars and pedicle stress reactions. L5-S1 disc protrusion with left S1 nerve root compression.

**TREATMENT AND OUTCOMES:** 1. L4-L5 and L5-S1 transforaminal epidural steroid injections: Complete resolution of leg pain.  
2. Restricted from practice, weight lifting, and extension activities for 4 weeks with LSO brace.  
3. Returned to running at 4 weeks, progressed to non-contact drills without pain.  
4. Progressed to full contact practice and game play at 8 weeks without pain.  
5. Plan for surgical fixation with screws at end of season with 3 to 6 month recovery.  
6. If any setbacks, will be withheld from football and plan for earlier surgery.

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### Back Pain in a High School Soccer Player

Laura M. Nilan, Greg Canty. *Children's Mercy, Kansas City, MO.*

Email: [lmnilan@cmh.edu](mailto:lmnilan@cmh.edu)

(No relationships reported)

**History:** A 16 year-old male soccer player presenting to primary care sports medicine with 2 months of low back pain that was first noticed after a throw-in during a game. The patient has previously been evaluated by a pediatric orthopedic spine surgeon and was noted to have scoliosis and mild kyphosis but no other diagnosis. On further history he recalled intermittent low back pain prior to the injury, but it has become much more consistent since the injury. He has not had any numbness, tingling, weakness or incontinence. Upon further review of systems he has crampy, loose stools daily for over 2 months. Stool studies by his primary care provider have been negative so far. He denies any recent fevers. He has started probiotics and cholestyramine. **Physical Exam:** Well-developed young man in no distress. Spine with a mild thoracolumbar scoliosis, mild kyphosis. Pain with both forward bend and lumbar extension. Stork test revealed mild discomfort. No pain on palpation over the lumbar spine. Negative figure 4. Popliteal angle 120 degrees. No SI joint tenderness. Nonantalgic gait. Normal deep tendon reflexes.

**Differential Diagnosis**

1. Spondylolysis
2. Disc Herniation
3. Muscle strain
4. Scoliosis
5. Infection
6. Inflammatory bowel disease

**Test and Results:**

-Spine radiographs show a mild scoliotic curve but no signs of spondylolysis or listhesis

-No clear indications for MRI

-Labs:

CBC-

WBC 7.02 (4.5-11)

HBG 14.8 (13.5-17.5)

Platelet 296 (150-450)

BMP Normal

ESR-33 (0-15)

CRP 2.3 (0-1)

**Final Diagnosis**

1. Crohn's Disease

**Treatment**

1. Gastroenterology consultation. He had an extensive work-up including a colonoscopy which showed inflammation of the terminal ileum consistent with Crohn's disease. GI has tried multiple immunomodulators including steroids, vedolizumab, ciprofloxacin, vancomycin and infliximab. He remains difficult to control and is being considered for a fecal transplant.  
2. He has continued to participate in soccer

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796 May 31 4:55 PM - 5:15 PM

### Sacral Stress Fracture in a Collegiate Distance Runner

Samuel F. Carlson, Ward McCracken, Suzanne Hecht, FACSM.  
*University of Minnesota - Twin Cities, Minneapolis, MN.*

(Sponsor: Suzanne Hecht, FACSM)

(No relationships reported)

**HISTORY:** A 20-year-old male NCAA D1 distance runner presented with gradual onset of left low back pain present for two weeks without acute injury. He was running 60 miles per week and had been running seven days a week for an extended period of time. The pain was notably aggravated the week prior to presentation while practicing hurdles. He has no history of stress fractures. He endorsed mild radiation of the pain to the lateral buttock and hip, but not further down the thigh. He experienced no numbness or tingling.

**PHYSICAL EXAMINATION:** FROM of the lumbar spine, but with painful F/E. Negative SLR and Slump. 5/5 strength throughout LE b/l. Reflexes 2+ b/l. TTP over L SIJ and sacrum. The left sided pain was reproduced with single leg hopping, worse on the left than the right. He had a non-antalgic gait.

**DIFFERENTIAL DIAGNOSIS:**

1. Lumbago with Radiculopathy
2. Sacroiliac Joint Dysfunction
3. Sacral Stress Injury

**TEST AND RESULTS:**

XR Lumbar Spine

- negative

MRI of the Lumbar spine and pelvis

- Non-displaced fracture of the left sacrum predominantly at the S1 vertebral level, with subtle extension to the S2 vertebral level

DEXA Hip/Pelvis/Spine

- Z score L1-4 = -1.4

Laboratory Testing

- normal range for all labs including Vitamin D, Calcium, Testosterone Free and Total, BMP, PTH, Ferritin, CBC, LH, FSH, TSH, and free T3 & T4

**FINAL/WORKING DIAGNOSES:**

- 1) Left grade 4 sacral stress fracture
- 2) Low bone mineral density for an athlete

**TREATMENT AND OUTCOMES:**

1. Initial treatment – stop high impact activity and running, cross-train, and counselled regarding appropriate calcium intake
2. At 8 weeks, started return to run program under team's ATC
3. At 4 months, returned to regular training, running up to 5 days per week
4. At 5 months, began to have discomfort in the left lower back. Repeat MRI showed resolution of previous fracture, but now showed marrow edema involving the right peripheral aspect of S5, most consistent with stress reaction. This area is asymptomatic to the patient and he has no TTP at either site.
5. Presently, working with formal PT and returned to reduced volume running.

## B-48 Clinical Case Slide - Shoulder IV

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM

Room: 402

797 **Chair:** Dina C. Janse van Rensburg, FACSM. *University of Pretoria, Pretoria, South Africa.*

(No relationships reported)

798 **Discussant:** Wayne Franklin Sease, FACSM. *Steadman Hawkins Clinic of the Carolinas, Greer, SC.*

(No relationships reported)

799 **Discussant:** Andrea Arruda. *São Paulo, Brazil.*

(No relationships reported)

800 May 31 3:15 PM - 3:35 PM

### An Unusual Cause Of Arm Pain - Lacrosse

Brady J. Bowen, Deborah I. Light, Alexander Gozman, Hamish A. Kerr, FACSM. *Albany Medical Center, Albany, NY.* (Sponsor: Hamish A. Kerr, FACSM)

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(No relationships reported)

**HISTORY:**

A 17-year-old female presented with 2 days of right arm pain. The day after lacrosse practice, she awoke with a dull ache, swelling and redness starting at the elbow then progressing to the shoulder, worse with movement and improved with elevation.

Denver, Colorado

She denied recent trauma, shortness of breath, cough, paresthesias or arm weakness. There was no recent immobilization or travel, no illness or history of similar symptoms.

Past medical, surgical and birth history were unremarkable. She denied tobacco use or known allergies. She was started on levonogestrel-ethinyl estradiol four months ago. Her Father had a remote post-surgical deep vein thrombosis.

**PHYSICAL EXAMINATION:**

Vitals: Temp 36.7, BP 112/64, HR 58, RR 16, 99 % O2 on room air  
Well-appearing female in no apparent distress. Normal heart sounds. Lungs were clear, abdomen was benign. Pulses were intact and bilaterally symmetric throughout. Good muscle tone and bulk. The right arm was swollen from the elbow to the shoulder with mild erythema and warmth. Moderate tenderness to palpation of the elbow and shoulder, worse on the medial brachium. Elbow and shoulder range of motion was full but painful, limiting provocative maneuvers. Adson's test and costoclavicular compression tests were negative. Reflexes were 2+ throughout.

**DIFFERENTIAL DIAGNOSIS:**

1. Undisclosed trauma or non-accidental injury
2. Septic or reactive arthritis
3. Cellulitis or bursitis
4. Upper extremity DVT
5. Thoracic outlet syndrome or overuse injury

**TESTS AND RESULTS:**

- CBC, CMP, PTT, INR unremarkable
- Hypercoagulable work up pending
- Chest x-ray: No cervical rib or acute pathology
- Venous Doppler: Extensive right subclavian and axillary vein DVT
- Venogram: subacute thrombosis of the axillary and subclavian veins likely due to stenosis at the level of the first rib and medial clavicle

**FINAL/WORKING DIAGNOSES:**

Paget Von Schroetter Syndrome

**TREATMENT AND OUTCOME:**

1. Initial anticoagulation with Enoxaparin
2. Thrombectomy with heparin and tPA infusion
3. Repeat thrombectomy and balloon venoplasty for residual stenosis
4. Discharged on Apixaban
5. Right thoracic outlet decompression with anterior scalenectomy and balloon venoplasty
6. Hypercoagulable work up was negative
7. Three months oral anticoagulation with Apixaban
8. Held from contact sports for the duration of anticoagulation

801 May 31 3:35 PM - 3:55 PM

**Unusual Cause of Periscapular Pain**

Kimberly Sikule, John H. Stevenson. *UMass Worcester, Worcester, MA.*

(No relationships reported)

**HISTORY:** 38 yo female recreational athlete presents with left posterior shoulder pain which has gradual worsened over the past 4 months. Denies any previous trauma, injury to the area. It 8/10 sharp quality pain localized to posterior scapula with radiation to the neck. Denies any numbness, tingling, weakness, instability or crepitus. Symptoms are worse with activity. She tried PT and has modified her activities. On 1/29/2016 she underwent an ultrasound guided injection into the subscapular bursa. On 4/29/2016 she reports symptoms had resolved. On 7/29/2016 she reported her symptoms returned with a feeling of crunching under the shoulder blade. Underwent a second injection into the subscapular bursitis, MRI was obtained and she restarted physical therapy home exercise program.

**PHYSICAL EXAMINATION:**

GEN: Alert, oriented x 3  
EYES: emo  
RESP: normal respiratory effort  
SKIN: intact no signs of infection  
NEURO: sensation to light touch intact. CN 2-12 intact.  
MSK: Neck: full rom to flexion, extension, lateral rotation. Negative spurlings.  
Shoulder: Mild periscapular tenderness, crepitus with active abduction. ROM 180 degrees of abduction, forward flexion. 5/5 strength with empty can testing, internal external rotation, negative obriens, Hawkins, neers testing. Myofascial soreness on posterior medial boarder of the scapula. Negative scapular liftoff with scapular stress, pain with scapular compression and active abduction.

**DIFFERENTIAL DIAGNOSIS:**

- Subscapular Bursitis
- Cervical Paraspinal Muscle Strain
- Cervical Radiculopathy
- Glenohumeral Joint Arthritis
- Labral Tear
- Neoplasm
- Multidirectional Instability
- Parascapular Strain
- RTC Tendonitis

**TESTS AND RESULTS:**

Musculoskeletal Ultrasound left periscapular region showing no subscapular bursal fluid collection. MRI: medial border of right upper scapula, within intermuscular planes between trapezius, erector spinae, serratus anterior muscles there is a 2.9 x 1.3 x 1.1 cm mass. Lobulated cluster of grapes morphology with interspersed fast and central low T2 signal dots. No surrounding soft tissue edema. 3cm soft tissue mass consistent with a vascular lesion such as soft tissue hemangioma.

**FINAL WORKING DIAGNOSIS:**

3cm soft tissue hemangioma

**TREATMENT AND OUTCOMES**

Consult Vascular Surgery  
Continue activities as tolerated

802 May 31 3:55 PM - 4:15 PM

**A Shot at Expanding Shoulder Pain Differential Diagnosis**

Mark McEleney, Andrew Peterson. *University of Iowa, Iowa City, IA.*

(No relationships reported)

**History**

14 yo male swimmer who was seen on 2/24/16, for evaluation of left upper extremity numbness and weakness of 2 month duration. Symptoms had begun the day after receiving his second of three injections for HPV vaccination series in his left shoulder on December 29, 2015. The patient woke up the following day with tightness in his left shoulder. Intense, sharp pain and weakness of his arm developed inhibiting participate in swim practice the following evening.

The patient had previously been seen by his pediatrician as well as an orthopedist, neurologist, and physical therapist. Parsonage-Turner syndrome was diagnosed clinically. The patient received a six-day course of oral methylprednisolone and underwent physical therapy for shoulder strengthening and range of motion. There was improvement of pain though weakness with shoulder flexion and abduction, decreased tactile sensation over the shoulder, and paresthesias of the fingertips had persisted.

**Exam**

Decreased tactile sensation over the dorsal hands and fingers. Passive ROM full, active ROM was limited to 90 of forward flexion and abduction. Scapular winging with flexion and abduction. 5/5 strength with resisted internal and external rotation. 4+/5 strength with empty can and Speed's test. Lift off test was positive.

**Differential Diagnosis**

cervical disk herniation, cervical neural foraminal stenosis, mass lesion compressing the brachial plexus, calcific tendonitis, acute subacromial bursitis, adhesive capsulitis, thoracic outlet syndrome

**Tests/Results**

NCS/EMG of the left upper extremity (2/24/16)  
-mild median neuropathy at the left wrist  
Left shoulder MRI without contrast (5/31/16)  
-normal

**Final Working Diagnosis**

Parsonage-Turner syndrome

**Treatments and Outcomes**

Two rounds of IVIG (135 g) separated by 24 hours were given on 3/7/16 - 3/8/16. Shoulder strength improved significantly and pain resolved completely within one week of treatment. There was slightly diminished muscle bulk of the supraspinatus, deltoid, bicep, tricep, and latissimus dorsi as well as scapular winging with wall push-up and scapular dyskinesia at follow-up exam (3/28/16). Mild (4+/5) weakness with shoulder shrug/protraction/retraction, resisted internal rotation, and supraspinatus testing persisted to visit on 5/31/16.

803 May 31 4:15 PM - 4:35 PM

**Shoulder "Droop" In Multi-sport Athlete**

Amy Rabatin<sup>1</sup>, Daniel Lueders<sup>2</sup>, Cara Prideaux<sup>1</sup>. <sup>1</sup>Mayo Clinic, Rochester, MN. <sup>2</sup>University of Michigan, Ann Arbor, MI.

(Sponsor: Karen Newcomer, FACSM)

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(No relationships reported)

**HISTORY:** A 16 year old, right handed, multi-sport male athlete presented with right shoulder region asymmetry noted 3 months prior by teammates and athletic trainer. Scapular dyskinesia noted one month prior. No associated pain, paresthesias, sensation changes, or frank weakness. Active range of motion was impaired with overhead activities, but did not adversely affect sports performance. No history of shoulder, arm or neck trauma or injury. Past medical history unremarkable with no recent viral illnesses.

**PHYSICAL EXAM:** Peripheral pulses intact, normal capillary refill. Gross asymmetry and atrophy in right trapezius and latissimus dorsi muscle bulk with prominence of right scapula inferior angle. Right acromion 2-3 cm inferior to left. Normal activation of serratus and stabilization of scapula with wall push with no frank scapular winging.

Right scapula dyskinesia with slowed elevation and rotation with shoulder abduction and forward flexion. Ten degrees of right glenohumeral internal rotation deficit. 2/5 right shoulder elevation and external rotation strength, otherwise normal. Reflexes and sensation normal. No tenderness to palpation. No pain with Neer's, Hawkins, Scarf, O'Brien's and dynamic labral shear testing. No shoulder apprehension.

**DIFFERENTIAL DIAGNOSIS:**

1. Brachial plexopathy
2. Focal myopathy or myositis
3. Neuromuscular disease
4. Mononeuritis

**TEST AND RESULTS:**

Shoulder radiograph:

- Normal

MRI chest:

- Diminutive right trapezius relative to left. Mild increased T2 signal in right trapezius with subtle post contrast enhancement. No abnormality noted in latissimus dorsi.

EMG:

- Electrophysiologic evidence of focal myopathy involving right trapezius, latissimus dorsi and sternocleidomastoid.

Laboratory:

- CK, CRP, and ESR normal

- Connective tissue disease testing negative

- Fascioscapulohumeral Dystrophy testing negative

**FINAL/WORKING DIAGNOSIS:**

Focal myopathy involving right trapezius and latissimus dorsi, possible FSHD variant

**TREATMENT AND OUTCOMES:**

1. Physical therapy - scapular stabilization and strengthening of compensatory musculature.
2. Overhead sport evaluation. Neuro-reeducation focused on form and positioning during exercise performance.
3. Educated in safety with weightlifting activities.
4. Participated in football camp and fall football.

804 May 31 4:35 PM - 4:55 PM

**Soccer Player with Neck Pain and Upper Extremity Parasthesias**

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<sup>2</sup>University of Pittsburgh Medical Center, Pittsburgh, PA.

(Sponsor: Dr. Bradley C. Nindl PhD, FACSM)

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(No relationships reported)

**HISTORY:** An 18 year old right hand dominant female Division 1 soccer goalie with no medical history presented in February to clinic with neck pain and right upper extremity parasthesias radiating to her wrist. Initial symptoms began in October after diving for a ball when an opponent fell on to her right shoulder, neck, and head. She was diagnosed with a concussion and was held out of competition for 3 weeks during which she reports resolution of her symptoms. Her symptoms gradually returned and then remained present during activity only after she was cleared to return to play from her concussion.

**PHYSICAL EXAMINATION:** Full cervical and upper extremity range of motion. No tenderness or swelling in the cervical spine or upper extremities. Upper extremity strength was 5/5, reflexes were 2+/4, and sensation was intact to light touch and pinprick. Speed's, Yergason's, Empty Can, Hawkin's, O'Brien's, Spurling's, cervical facet provocation, Neer's, and Tinel's at the medial elbow were negative. Adson's, Wright's Hyperabduction, Allen's, and Costoclavicular maneuvers reproduced her symptoms.

**DIFFERENTIAL DIAGNOSIS:**

Brachial Plexopathy

Cervical Radiculopathy

Cervical Discogenic Pain Syndrome

Cervical Fracture

Clavicle Fracture

Mononeuropathy

Shoulder Impingement Syndrome

Spondylolisthesis

Thoracic Outlet Syndrome

Tumor

**TEST AND RESULTS:** Cervical X-ray (November 2)-No abnormalities

MRI cervical spine without contrast (November 13)-Punctate focus of increased susceptibility in the cervical cord at C1-C2. Recommend MRI with contrast to exclude hemorrhage or vascular malformation

MRI cervical spine with contrast (November 19)-Previously questioned susceptibility at C1-C2 is not seen and most likely represents artifact

EMG/NCS (February 13)-Normal study without evidence of radiculopathy, brachial plexopathy, or mononeuropathy

Right upper extremity ultrasound (February 18)-Vascular compression with reproduction of symptoms in provocative positioning

**FINAL WORKING DIAGNOSIS:** Vascular Thoracic Outlet Syndrome

**TREATMENT AND OUTCOMES:** Through a comprehensive rehabilitation program and adjustment in her throwing mechanics she was able to prevent provocation of symptoms without hindering her performance and ultimately was able to continue her college soccer career without symptoms or limitations

805 May 31 4:55 PM - 5:15 PM

**Do Not Get Stung By What Is Not A Stinger In Boys Lacrosse Player**

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(No relationships reported)

14 year old male is at the sports medicine outpatient clinic with his mother. She mentions that her son gets "stingers" all the time. The stingers are felt to be appreciated in the bilateral upper arms. The duration is for many months (greater than 6.) Time makes them better and they are worse with motion around the neck or playing lacrosse.

**PHYSICAL EXAMINATION:** VITAL SIGNS: Pulse is 72 and regular, respirations 18 and regular, blood pressure 122/78. GENERAL: WNWD 14yom in no acute distress. EXTREMITIES: No peripheral edema or varicosities. NEURO: Inspection: no atrophy or bruising Palpation: no tenderness to palpation to the spinous process of the neck DTRs: Negative for Hyperreflexs bilaterally. Cervical range of motion: 1. Right side bending: Within normal limits, painful. 2. Left side bending: Within normal limits. 3. Forward flexion: 45 degrees with pain at the end of range. 4. Extension: Within normal limits. Special Test: + Spurlings:shows Positive with pain down the bilateral arms and occasional tingling and numbness. MSK: Palpation of the upper neck and shoulders is non tender ROM: full range of motion of arms is noted Gait: normal with normal station

**Images:** MRI C Spine: Cranioclavial angle of 139.  
**DIFFERENTIAL DX:** 1. HERNIATED DISK 2. SPINAL STENOSIS 3. OCCULT FRACTURE OF THE C SPINE 4. TUMOR OF THE SPINAL CORD 5. ABSCESS OF THE SPINAL CANAL 6. PSYCHOGENIC ETIOLOGY 7. VASCULAR ANOMALY/ THORACIC OUTLET 8. REDUCED CLIVAL ANGLE

**FINAL DIAGNOSIS** ABNORMAL CRANIOCLIVAL ANGLE  
Cranioclival angle is the angle at the base of the skull that forms when a line is drawn at the posterior of the axis and the dorsum of the skull base. Normal angles range from 150 to 180 degrees. If the measurement is 150 degrees or less, there may be the concern for ventral spinal cord compression.

**Disposition:** Patient was referred to Orthopedic spine clinic. Consult performed there determined that there was no evidence of any symptoms at rest or baseline. There was no evidence of cord compression or injury on images. Only recommendations were to avoid contact sports and to follow up if any further symptoms presented. After discussion of the risks (of invasive surgery) and the benefits patient and his parents decided not to pursue further work up and to stop all contact sports including lacrosse.

**B-59 Basic Science World Congress/Poster - Cognition, Intelligence, and Learning**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM

Room: Hall F

822 Board #1 May 31 2:00 PM - 3:30 PM

**The Acute Effects Of A Physically Active Games Lesson On Cognition In Primary School Children**

Andy J. Daly-Smith<sup>1</sup>, Margaret A. Defeyter<sup>2</sup>, Jim McKenna<sup>1</sup>, Pamela L. Graham<sup>2</sup>, Melissa A. Fothergill<sup>2</sup>, Scott Lloyd<sup>3</sup>. <sup>1</sup>Leeds Beckett University, Leeds, United Kingdom. <sup>2</sup>Northumbria University, Newcastle, United Kingdom. <sup>3</sup>Redcar & Cleveland Borough Council, Redcar, United Kingdom.

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(No relationships reported)

Evidence regarding the impact of acute physically active bouts on cognition in schools is conflicting. Treatment fidelity of PA bouts is often unconfirmed, while many studies focus on few cognitive outcomes. **PURPOSE:** To investigate effects of a physically active games lesson (PAGL) on cognition in primary school children. **METHODS:**

Six schools (N=123, F=73; 9.9±0.3yrs) were ranked and paired by socio-economic status, with one per pair randomly allocated, by coin toss, to a ~40 min PAGL (n=62) or sedentary class lesson (n=61). One week post-familiarisation, immediately before and 10-mins after each lesson, pupils completed a computerised cognitive battery (COMPASS): simple, easy and hard reaction time (correct response reaction time, RT), Stroop (RT and % correct answers, %C), Digit Vigilance (RT & %C), Tower of London (ToL; thinking time TT, RT & %C), immediate word recall (%C), delayed

word (RT & %C) and picture recall (RT & %C). MVPA was measured in 15-second epochs using accelerometers and Evenson cutpoints. A threshold for the PAGL analysis was  $\geq 12$ mins MVPA. Two-way ANOVA with repeated measures assessed changes in cognitive outcomes. **RESULTS:** Average MVPA was 12.19 $\pm$ 2.55mins (range 7.00-17.50mins). Only 36 participants (58%) met the MVPA threshold. Negative effects of time were observed for: simple RT ( $p=0.024$ ); hard RT (RT,  $p<0.001$ ; %C,  $p=0.002$ ); Stroop congruent (%C,  $p=0.006$ ); Digit-vigilance (RT,  $p=0.003$ ); immediate word recall (%C,  $p<0.001$ ); delayed word recall (%C,  $p<0.001$ ) and delayed picture recall (%C,  $p<0.001$ ). Positive effects of time were observed for ToL RT ( $p<0.001$ ). Significant interaction effects favoured the PAGL for ToL thinking RT ( $p=0.048$ , Partial eta squared = 0.041). **CONCLUSIONS:** We addressed a range of weaknesses affecting previous studies of the acute effects of PA. Low MVPA excluded many pupils from analysis. MVPA during PAGLs may be insufficiently intense or prolonged to influence these cognitive processes. ToL performance may be improved by MVPA total or the cognitive demands of PAGL lessons.

823 Board #2 May 31 2:00 PM - 3:30 PM  
**The Impact of Daily Physical Education on Perceptual Speed and PACER Laps Over Time**

Haley K. Holan, Julian A. Reed, Abigail C. Short. *Furman University, Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)  
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 (No relationships reported)

Developmental research has demonstrated that Perceptual Speed is related to higher cognitive abilities and linked to increases in fitness and physical activity participation. Epidemiological research has also shown that there is an inverse relationship between cardiorespiratory fitness and all-cause mortality. **PURPOSE:** The purpose of the study was to examine the impact of 45 minutes of daily physical education on Perceptual Speed and on fitness performance among youth attending Legacy Charter School. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education and Perceptual Speed among youth in grades 2<sup>nd</sup>-5<sup>th</sup> attending Legacy Charter, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2016 - pre-test assessment in September 2014) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school who provided physical education once per week was identified and utilized as a comparison. **RESULTS:** Legacy Charter School students observed significant gain increases on: 2 of 4 ( $p<0.05$ ) Perceptual Speed sections, including the Total section, compared to 0 of 4 for the control ( $p<0.05$ ). When stratified by gender, Legacy Charter females observed significant gain score increases on 3 of 4 sections. In particular, significant increases were observed in the Total section (Gain Score=14.14;  $F=8.17$ ;  $df=1,162$ ;  $p=0.005$ ) over time. On the PACER fitness test, Legacy Charter School students observed significant gain score increases (Gain Score=9.75;  $F=64.07$ ;  $df=1$ ;  $p=0.000$ ) over time. Legacy Charter School males and females also demonstrated significant increases in gain scores on the PACER test (Males: Gain Score=11.59;  $F=40.58$ ;  $df=1,170$ ;  $p=0.000$ ) (Females: Gain Score=8.06;  $F=27.26$ ;  $df=1,166$ ;  $p=0.000$ ). **CONCLUSION:** 45 minutes of daily physical education led to increases in Perceptual Speed and fitness performance among Legacy Charter male and female elementary school students over time from 2014 to 2016. Funded by Campbell Young Leaders.

824 Board #3 May 31 2:00 PM - 3:30 PM  
**Links Between Daily Physical Education, Fluid Intelligence, and Fitness Levels of Underserved Middle School Youth**

Abigail C. Short, Julian A. Reed, Haley K. Holan. *Furman University, Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)  
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 (No relationships reported)

The investigation of the impacts of regular physical activity on cognition and general intelligence is under studied, however findings from a report from the Institute of Medicine (IOM) suggest positive associations between participation in regular physical activity and youth brain health. Unfortunately, only 8% of American public middle schools provide daily physical education according to the CDC School Health Policies and Program Study. **PURPOSE:** Examine the impact of 45 minutes of daily physical education on fluid intelligence and fitness levels among underserved middle school youth attending Legacy Charter School. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on fluid intelligence and the fitness performance among middle school youth attending Legacy Charter, a Title I school in the southeastern US. Gain scores (post-test assessment in May 2016 - pre-test assessment in September 2015) were calculated, stratified by ethnicity and gender, and analyzed

for significance. The interaction between school and time was estimated for each outcome. Each analysis was adjusted by age to control for baseline differences by school. A control school that did not provide daily physical education was utilized as a comparison. **RESULTS:** Legacy Charter School underserved females improved in fluid intelligence total score (Gain Score=2.16;  $F=5.88$ ;  $df=1$ ;  $p=.016$ ), aerobic capacity (Gain Score=0.59;  $F=7.796$ ;  $df=1$ ;  $p=.006$ ), number of push-ups performed (Gain Score=2.58  $F=25.065$ ;  $df=1$ ;  $p=.000$ ), and number of curl ups performed (Gain Score= 5.64;  $F=37.592$ ;  $df=1$ ;  $p=0.000$ ) compared to controls. Legacy Charter School underserved males improved in aerobic capacity (Gain Score=1.94;  $F=4.316$ ;  $df=1$ ;  $p=.039$ ), number of push-ups performed (Gain Score=2.60;  $F=35.542$ ;  $df=1$ ;  $p=.000$ ), and number of curl-ups performed (Gain Score=11.27;  $F=42.904$ ;  $df=1$ ;  $p=.000$ ) compared to controls. **CONCLUSION:** These findings suggest that daily physical education can influence the cognitive and fitness performance of underserved middle school youth. Funded by Campbell Young Leaders.

825 Board #4 May 31 2:00 PM - 3:30 PM  
**Dose Response Effect Of Physical Activity And Behavioral Regulation Measures On The Science Achievement Of At-risk Middle School Girls**

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 (No relationships reported)

**PURPOSE:** After school programs have played a key role in engaging youth in the learning process by providing opportunities to explore interests, increase health and wellness, set goals, solve problems, and connect with adult role models. The purpose of this study is to measure the effects of an after school program with a fitness and informal health and nutrition science curriculum on cognitive processes and science achievement in previously sedentary middle school girls. **METHODS:** A between subjects study was designed with  $n=29$  female adolescents (mean age = 12.03 + .73) engaged in supervised triathlon training, health and nutrition science education in a 20 week intervention. A second group of  $n=30$  randomly selected females (mean age = 12.93 + .91) served as the comparison group. To assess changes in science achievement, data were collected pre- and post- intervention. Hierarchical regression analyses examined the linear association of physical activity, aerobic fitness level, cognition and science content knowledge controlling for relevant covariates. **RESULTS:** Science achievement by treatment group was significantly predicted by fitness level  $F(5,53) = 6.27, p < .001$ ; physical activity  $F(5,53) = 6.98, p < .001$ ; aspects of cognition including behavioral regulation  $F(5,50) = 5.88, p < .001$ ; and processing speed  $F(5,53) = 6.27, p < .001$ . **CONCLUSIONS:** The intervention with informal nutritional science learning and a controlled aerobic fitness component suggested improved cognition and science achievement in previously sedentary middle school girls.

826 Board #5 May 31 2:00 PM - 3:30 PM  
**The Effect of Different Exercise Modalities on Cognition Among Adolescent Populations**

Akash R. Patel, Kenneth D. Hartline, Alexandria Riopelle, Nell B. Pawlenko, Tracy L. Zaslow, Anita Herrera-Hamilton. *Children's Hospital Los Angeles, Los Angeles, CA.*  
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 (No relationships reported)

**PURPOSE:** A growing body of literature documents the beneficial effects of aerobic exercise on cognition. One of the most interesting findings dictates that aerobic exercise preferentially benefits executive function, a term for complex cognitive processes including attention, working memory, mental flexibility, reasoning, planning, and inhibition. The purpose of this study was to measure the effect of acute intervals of two different exercise modalities (soccer and running) on cognition and executive function among adolescents between the ages of 11-14 years. **METHODS:** Ninety-eight middle-school students (50 males, 48 females, mean age = 13.09 years) volunteered to participate in this prospective study. Baseline neurocognitive and background data was collected at an initial study point. Two-weeks after the initial study point, subjects were matched by age, math class, and grade. Participants were randomized into one of three study groups involving soccer, running, or no aerobic activity for 30 minutes. Directly after the 30-minute exercise period, all participants were re-administered the neurocognitive battery. **RESULTS:** Subjects in the soccer group had significantly higher average score differences from baseline ( $M = +0.588, SD = 0.556, p = .01$ ) on a neuropsychological measure of executive functioning, specifically planning and organization (Rey-Osterrieth Complex Figure) compared to subjects who did not participate in aerobic activity ( $M = -1.770, SD = 0.573$ ). There was no significant difference found for this measure between subjects who participated in 30 minutes of running and those who did not engage in aerobic activity. No significant differences found between groups on measures of creativity and divergent thinking, processing speed, perceived stress, self-efficacy, or inhibitory control and cognitive flexibility. **CONCLUSIONS:** The modality of physical activity may

influence subsequent cognitive performance. Specifically, physical activity involving strategy and planning may prime maturing adolescent brains toward enhanced organization. The duration of these cognitive effects are unknown; further investigation is needed.

827 Board #6 May 31 2:00 PM - 3:30 PM  
**Low Academically-achieved Students Did Not Get Worse Score from Being Physically-active**

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 (No relationships reported)

It is not surprised that parents and educators struggled for time resources allocated to low academically-achieved students. Cutting physical activity (PA) time is one of the common practices as PA has been generally thought to produce negative impact on academic performance. Such belief has not yet been verified. **PURPOSE:** To examine the associations between mathematics performance and level of PA engagement in Chinese adolescents.

**METHODS:** A total of 882 grade 9<sup>th</sup> Chinese students were randomly recruited in Hong Kong that covered all 18 districts and three school bandings (high, middle, and low). Participants' mathematics performance was assessed at the beginning (T0) and the end (T1) of an academic year using validated and uniformed test papers. Their PA level was measured using self-reported questionnaire (PAQ-A). At both T0 and T1 time points, participants were classified as physically-active, moderate-active, and inactive according to the composite ratings in PAQ-A. They were further categorized into Go-Active, Go-Inactive, and Unchanged-PA groups based on the changes in their PA status throughout the academic year. Longitudinal changes in mathematics scores over the year were compared among the groups using two-way repeated measures ANCOVA, adjusted for family income and revision time.

**RESULTS:** Significant Time (T0 - T1) x PA-group interaction effect on mathematics ( $F=5.22, p=0.02$ ) was observed. Significant improvement was found in Go-Active participants. When same analysis was split by school-banding, no adverse effect was shown in low-banding students ( $F=2.35, p=0.14$ ) but a significantly positive change in high- and middle-banding students. Shift of PA status from T0 to T1 was a significant predictor of mathematics score change ( $p=0.02$ ). **CONCLUSIONS:** Higher school-banding students gained better mathematics scores from being more active. More importantly, a reduction in PA time among low-achieved adolescents seemed unrelated to academic performance. This study demonstrates that students' academic achievement (i.e. mathematics scores) may not be boosted considerably from cutting their PA time. However, such finding has yet to be examined in other learning areas such as languages and science subjects.

828 Board #7 May 31 2:00 PM - 3:30 PM  
**Combined Associations Between Sitting Time And Physical Activity With Cognition And Academic Achievement In Young-adults**

Mireia Felez-Nobrega<sup>1</sup>, Charles H. Hillman<sup>2</sup>, Eva Cirera-Viñolas<sup>1</sup>, Anna Puig-Ribera<sup>1</sup>. <sup>1</sup>*University of Vic- Central University of Catalonia, Vic, Spain.* <sup>2</sup>*Northeastern University, Boston, MA.*  
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 (No relationships reported)

Working memory capacity (WMC) is a core cognitive process that involves holding and manipulating information to meet task goals. WMC, in conjunction with other cognitive processes, is essential for improving vocational performance, academic achievement and for developing skills to achieve life goals. While evidence indicates the positive influence of structured aerobic exercise on WMC, few studies have examined how sitting time (ST) -alone or in combination with habitual physical activity (PA)- influences WMC. **PURPOSE:** To examine combined associations between self-reported context-specific ST and PA with WMC and academic achievement in a sample of Spanish adults. **METHOD:** Undergraduates (n=371; 21 years  $\pm$  3 yrs, 44% female) from University of Vic-Central University of Catalonia completed a 68-item survey that assessed socio-demographic variables (e.g., age, gender, academic year), min/week of light, moderate and vigorous PA (International Physical Activity Questionnaire), min/day of domain-specific ST (Last 7 days sedentary behavior questionnaire), academic performance (grade point average) and perceived stress (Perceived Stress Scale). WMC was assessed through a multiple complex span task that included: Operation Span, Symmetry Span and Rotation Span. These tasks interleave a processing task with a short list of to-be-remembered items. General linear models - adjusted by PA, ST, gender and stress- assessed combined associations between ST and PA with WMC and academic achievement. **RESULTS:** Performing at least 3 hrs/week of moderate-intensity PA was related to increases in WMC ( $p<0.001$ ). However, PA intensity was not associated with academic performance.  $>3$ hrs seated on a weekend day while performing non-screen leisure activities (e.g., listening to music) was related to reduced WMC after adjusting for

PA intensity ( $p=0.012$ ). Similarly,  $>3$ hrs/weekday spent seated in these sedentary activities and in leisure-forms of screen time were inversely associated with academic performance regardless of PA time and intensity ( $p=0.033$ ;  $p=0.048$ ). **CONCLUSION:** Moderate PA may benefit working memory; however, specific domains of leisure-time sedentary behavior may have an unfavorable influence on working memory and academic performance regardless of time spent in PA.

829 Board #8 May 31 2:00 PM - 3:30 PM  
**Effect of Physical Activity on Cognitive Control in College-Aged Students**

DAVID PHILLIPS<sup>1</sup>, BRADLEY GREGORY<sup>1</sup>, JEFFERY L. HART<sup>1</sup>, QUINN DILWORTH<sup>1</sup>, PATRICK ARVILLE<sup>1</sup>, RYAN D. BURNS<sup>2</sup>. <sup>1</sup>*SOUTHERN UTAH UNIVERSITY, CEDAR CITY, UT.* <sup>2</sup>*UNIVERSITY OF UTAH, SALT LAKE CITY, UT.*  
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**PURPOSE:** To determine the effect of Physical Activity (PA) on three differing types of cognitive processes, within an under-researched segment of the population. **METHODS:** 45 College-Aged Students were recruited from a University in the Southwestern United States. These participants completed three computer-driven tests from a battery of measurements that assess various components of cognitive control (CC)- One Card Learning Test (Attention) Two Back Card Test (Working Memory) Revised Groton Learning Maze Test (Inhibition/ Executive Function). Testing took place after a bout of Sedentary Activity, and two weeks later, after a bout of individualized PA (based on VO<sub>2</sub> max). **RESULTS:** Due to the high intellect/ high fit nature of the participants there was no statistical significance with the One Card learning or Two Card Back Tests (i.e. many reached the test 'ceiling' on the initial attempt). After controlling for sex, age, GPA, BMI and aerobic capacity, there was significant differences between sedentary and PA conditions in both moves (mean difference = 0.136,  $p < 0.001$ , Cohen's  $d = 0.85$ ) and duration (mean difference = 22179,  $p < 0.001$ , Cohen's  $d = 0.74$ ) within the Revised Groton Maze Learning Test. The differences between conditions represented a medium-to-large effect. There were no moderating influences on the condition differences.

**CONCLUSIONS:** This study adds to the existent literature that suggests PA may facilitate increases in CC, dependent on the nature of the cognitive task.

830 Board #9 May 31 2:00 PM - 3:30 PM  
**Correlation Of BDNF And Irisin With Aerobic Fitness And Cognition In Graduate Students**

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**PURPOSE:** A positive relationship between exercise and cognition has been observed in the developing brains of school children and the degenerating brains of elderly adults. However, this relationship remains relatively unstudied in the fully functioning brains of young adults. Brain-derived Neurotrophic Factor (BDNF) is known to promote neurogenesis and long-term potentiation within the hippocampus and is believed to mediate the effect of exercise on brain structure and function. A recently discovered myokine, irisin, may upregulate expression of hippocampal BDNF in response to exercise. This study explored the impact of fitness on cognition in graduate students and considered BDNF and irisin as potential mediators of the relationship.

**METHODS:** Forty-four apparently healthy graduate student participants (19 women) completed a comprehensive online cognitive assessment (Lumosity™) and an incremental maximal treadmill exercise test immediately followed by blood collection. Aerobic fitness was measured in terms of maximum oxygen uptake (VO<sub>2</sub>max) during the exercise test and expressed relative to body mass (mL/kg/min) for data analysis. Plasma concentrations of BDNF and irisin were determined by enzyme-linked immunosorbent assay (ELISA).

**RESULTS:** Participants were 26.0 (23.0-28.3) years old, with 19.4 (12.1-24.7) % body fat and a VO<sub>2</sub>max of 44.8 (38.3-53.5) mL/kg/min; median (IQR). The median score on the cognitive assessment was 63.5 (55.8-74.0) %. The median plasma BDNF concentration was 1.00 (0.28-2.09) ng/mL and irisin was 19.79 (16.98-24.65) ng/mL. Significant correlations between aerobic fitness and performance on the cognitive assessment were not found. An inverse relationship was observed between aerobic fitness and BDNF ( $\rho=-0.32, P=0.03$ ), as well as irisin ( $\rho=-0.27, P=0.11$ ). Irisin was moderately and positively correlated with cognitive assessment score ( $\rho=0.33, P=0.03$ ).

**CONCLUSIONS:** Irisin may be a valuable peripherally detectable marker of cognitive ability. An inverse relationship between fitness and irisin is inconsistent with the original understanding of irisin's role. The lack of correlation between aerobic fitness and cognitive performance may suggest the presence of a cognitive ceiling, above which the benefits of exercise on cognition significantly taper off.

831 Board #10 May 31 2:00 PM - 3:30 PM  
**The Effects of Exercise Intensity on Cognition In Adults Age 18-45**  
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**Purpose:** Growing evidence suggests that moderate intensity continuous training (MICE) appears to improve cognition function. Physical activity to improve cognitive function is thus strongly recommended, however evidence regarding the training intensity is still lacking. The purpose of this randomized study was therefore to assess the effects of a high intensity interval training (HIIT) compared to MICE, representing the same total training load, for improving cognitive functions in healthy adults. **Methods:** Twenty-five participants exercised three times a week for 6 weeks after randomization to the HIIT or MICE training group. Target intensity was 60 % of maximal aerobic power (MAP) in the MICE group and 100% MAP in the HIIT group. A maximal graded test, a cognitive battery of paper tasks and a computerized Stroop task, were performed before and after the six weeks training program. **Results:** After training, MAP increased significantly in both the HIIT and MICE groups (9% and 15 %,  $p < 0.01$ ). The cognitive results from this study showed that after 6 weeks of training HIIT was mainly associated to a greater improvement of overall reaction time in the executive components of the computerized Stroop task ( $980.43 \pm 128.97$  ms vs  $890.89 \pm 109.45$  ms,  $p < 0.01$ ). Participants in the HIIT training also improved their test time in the executive component of the Trail test after 6 weeks of training ( $42.35 \pm 14.85$  s vs  $30.35 \pm 4.13$  s,  $p < 0.01$ ). **Conclusion:** Exercise intensity was clearly an important factor for improving executive functions in young adults. These findings may have important implications in designing effective training programs to help improve cognition in different populations.

832 Board #11 May 31 2:00 PM - 3:30 PM  
**Time-Dependent Effects of Acute Cycling Exercise On Long-Term Emotional Memory and Salivary Alpha-Amylase**  
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Psychological research has strongly documented the memory-enhancing effects of emotional arousal. Current opinion implicates the central release of stress hormones, specifically norepinephrine, as the neurobiological basis for this enhancement. Experimental induction of arousal has been shown to enhance long-term memory in a time-dependent manner. While extensive research has provided evidence for the memory benefits of exercise training, the effects of an acute bout of exercise on long-term memory are not as well understood. Furthermore, acute exercise of a sufficient intensity and duration stimulates norepinephrine release. This presents an opportunity to investigate the role of acute exercise-induced arousal in the modulation of long-term memory. **PURPOSE:** The purpose of this study was to determine the time-dependent relationship between acute exercise-induced arousal and long-term emotional memory. **METHODS:** Forty healthy young adults (22±4 yrs) were randomly assigned to an exercise-before, exercise-after, or rest group. Participants in the exercise groups completed a high-intensity session of cycling exercise before or after viewing pleasant, neutral, and unpleasant images. Exercise intensity was prescribed using Borg's Ratings of Perceived Exertion (RPE) scale, and participants were instructed to exercise at an intensity of 15 ('Hard'). Salivary  $\alpha$ -amylase (sAA), a noninvasive biomarker of noradrenergic activation, was measured as an indicator of arousal. A recognition memory test was administered after a 48-hour delay. Memory data were submitted to a 3×3×2 (Group × Valence × List) mixed ANOVA. The sAA data ( $n = 33$ ) were submitted to a 3×4 (Group × Time) mixed ANOVA. **RESULTS:** No effect of Group or Valence on recognition memory was revealed, however; high-intensity cycling (159±18 bpm) increased sAA in both exercise groups, indicated by a significant Group × Time interaction,  $F(6,90) = 6.995$ ,  $p = .001$ ,  $\eta^2 = 0.318$ , and confirmed with paired  $t$ -tests ( $p < .05$ ). **CONCLUSION:** We demonstrated that an RPE-prescribed 'hard' bout of cycling exercise resulted in increased sAA. Further investigation is needed to draw conclusions about the memory-enhancing potential of acute aerobic exercise. Supported by the University of Maryland Kinesiology Graduate Research Initiative Fund.

833 Board #12 May 31 2:00 PM - 3:30 PM  
**Changes In Cortical Neural Arousal As A Result Of Increasing Exercise Intensity**  
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 (No relationships reported)

Exercise has been shown to affect central nervous system arousal, which in turn may impact cognitive performance during certain tasks. What is not known is if there is an intensity threshold for these effects to occur. **PURPOSE:** To investigate changes in cortical neural arousal as a result of increasing exercise intensity. **METHODS:** This study included 22 recreational runners (12 women, 10 men) with a mean (SD) age of 25.1 (6.2) years. Subjects were asked to complete three 30 minute runs on a motorized treadmill at prescribed rating of perceived exertion (RPE) levels of 13, 15 and 17. These correspond to the verbal descriptors of "somewhat hard," "hard," and "very hard," respectively. Individuals were blind to the treadmill control panel but allowed to adjust their speed throughout the trials in order to maintain the prescribed RPE. Prior to and immediately after each exercise session, subjects were asked to complete a critical flicker fusion threshold test (CFFT). This test is designed to assess cortical neural arousal via visual stimuli and requires individuals to determine the precise moment in which a low frequency flashing light fuses into a solid light (ascending) and vice versa (descending). Subjects identified the change by pressing a handheld button on a wired remote. The final value was an average of three ascending and descending values. **RESULTS:** No changes occurred from pre ( $37.5 \pm 3.8$  Hz) to post ( $37.4 \pm 4.2$  Hz) exercise at RPE13 ( $p = 0.729$ ). Similarly, pre ( $37.1 \pm 4.2$  Hz) and post ( $37.7 \pm 4.4$  Hz) values did not differ at RPE15 ( $p = 0.082$ ). However, there was a significant increase from pre ( $36.7 \pm 3.6$  Hz) to post ( $37.8 \pm 4.8$  Hz) values after exercise at RPE17 ( $p = 0.019$ ). **CONCLUSIONS:** These results confirm that a specific threshold exists where cortical sensitivity is determined by the intensity level of exercise. These findings may be useful when considering ways in which to enhance cognitive performance during certain tasks that require substantial focus and attention. Increases in cortical arousal as the result of exercise could positively affect cognitive functioning, and could be advantageous for athletic, professional, and military populations.

834 Board #13 May 31 2:00 PM - 3:30 PM  
**Habitual Physical Activity Moderates the Negative Influence of Adiposity on Cognitive Control**  
 Nicholas W. Baumgartner, Anne M. Walk, Caitlyn G. Edwards, Alicia R. Covello, Morgan R. Curran, Ginger E. Reeser, Andrew M. Taylor, Hannah D. Holscher, Naiman A. Khan. University of Illinois, Champaign, IL.  
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**PURPOSE:** To assess the moderating influence of time spent engaging in moderate to vigorous physical activity (MVPA) on the known inverse relationship between adiposity and cognitive control. **METHODS:** Bivariate correlations and hierarchical linear regression analyses were conducted among a sample of adults between 25-45 years ( $N = 65$ , 39 females). Subjects completed a modified version of the Eriksen Flanker task to assess cognitive control, specifically attentional inhibition. Whole body adiposity (%Fat) was assessed using Dual Energy X-ray Absorptiometry (DXA). Daily percent time spent engaging in MVPA ( $> 1951$  counts per minute) was monitored using an accelerometer (Actigraph GT3X+) worn for at least 4 days (minimum 8 hours/day). **RESULTS:** After adjusting for significant demographic variables (age and IQ), %Fat was a negative predictor of attentional inhibition ( $\beta = -0.32$ ,  $P = 0.02$ ) such that those with higher %Fat exhibited lower inhibitory control, as measured by incongruent Flanker task accuracy. Interestingly, the negative effect of %Fat ( $\beta = -0.21$ ,  $P = 0.13$ ) was mediated after controlling for the influence of %MVPA. Furthermore, hierarchical linear regression analyses revealed an added positive effect of %MVPA on incongruent Flanker task accuracy ( $\beta = 0.30$ ,  $P = 0.03$ ), with those spending a higher percentage of time engaged in MVPA demonstrating higher attentional inhibition. **CONCLUSIONS:** Although previous research has examined the relationship between excess fat mass and cognitive function, the influence of habitual physical activity in moderating this relationship has received comparatively less attention. These results replicate previous work linking excess fat mass to lower cognitive control while extending the body of literature by demonstrating that habitual moderate to vigorous activity mediates this influence while independently and positively predicting cognitive control. These findings have implications for public health policy advocating for greater daily MVPA for cognitive health among adult populations. Funded by the Department of Kinesiology and Community Health at the University of Illinois and the Hass Avocado Board.

835 Board #14 May 31 2:00 PM - 3:30 PM  
**Training-Induced Modulation of Cerebral Blood Flow and Cognition**

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Exercise may be a means to ameliorate the progression of cognitive decline in older adults, although the mechanisms underlying exercise-induced neuroprotection are not well understood.

**Purpose:** (i) To assess cerebral hemodynamics under exercise-induced stress on cognitive function; (ii) To determine the cerebral changes occurring during cognitive tasks; We hypothesized that these effects will be different with training.

**Methods:** Right-handed college-aged adults (28 sedentary and 24 athletic) performed 10 minutes of light and moderate (20% and 65% max power) constant-load cycling. Right middle cerebral artery (rMCA) blood flow velocity (CBFv) was continuously monitored during exercise and cognitive test using Transcranial Doppler ultrasonography (TCD). Cognition was assessed using the Cogstate brief battery test: Detection (psychomotor function/ processing speed), Identification task (visual attention), One-card learning (Visual learning & memory), One-back task (working memory) and Groton maze (for visuospatial memory) before and immediately after exercise.

**Results:** Exercise increased CBF during 20% but this was not significant for either group. Exercise at 65% decreased CBF with a significant decrease of -9.6% ( $p < .05$ ) for athletes. It also decreased for sedentary individuals but it was not significant. Cognitive performance improved significantly during the ONB with a significant increase in reaction time (RT). At 20 and 65% for sedentary and only at 65% for athletes. Speed on the Groton Maze test increased following exercise at 65% however this increase was associated with a significant increase in number of errors in the sedentary participants. Athletes demonstrated increased Groton maze speed however no significant change in errors (1.3%). Athletes also demonstrated an increase in RT for the ONB only following exercise at 65%.

**Conclusion:** Training status may demonstrate adaptations to cerebral blood flow and cognition.

836 Board #15 May 31 2:00 PM - 3:30 PM  
**Differences In Brain Structure And Function Among Yoga Experts And Controls**

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Yoga is a mind body based physical activity that has demonstrated a variety of physiological and psychosocial benefits. Recent studies have also examined the benefits of this practice on behavioral measures of cognitive function. **PURPOSE:** To determine the effect of yoga practice on brain function and structure by examining: i) differences in brain activation, and ii) differences in grey matter volume of subcortical structures among yoga-experts and controls. **METHODS:** Participants included 13 yoga experts, defined as having more than 3 years of regular yoga practice, and age-sex-matched controls. All participants completed a 6-minute walk test to assess fitness, psychosocial and demographic questionnaires. They were scheduled to complete a 3T MRI scan lasting one hour, during which the Sternberg working memory task was administered. **RESULTS:** The mean age of the participants was 35.8 and 35.7 respectively and the experts on average had 9.3 years of yoga experience. There were no groups differences on demographic measures of income, education, personality, and on estimated VO<sub>2</sub>max (6-minute walk) or physical activity assessed using the Godin leisure time exercise questionnaire. Experts showed less activation in the frontal pole area of the prefrontal cortex compared to controls during the encoding phase of the Sternberg task. Reaction time and accuracy on the task did not differ between the two groups. We investigated grey matter volume differences in the hippocampus, thalamus, and caudate nucleus and the left hippocampal volume was found to be greater in yoga experts compared to controls. **CONCLUSION:** Our preliminary results suggest that regular long-term yoga practice affects selective structures and neural networks in the brain. The literature on behavioral studies of yoga appears to corroborate these findings as the frontal pole and hippocampal areas have been implicated in performance on executive function measures. Future studies need to examine intervention effects of yoga and explore the potential of this practice to maintain and improve cognitive health across the lifespan.

837 Board #16 May 31 2:00 PM - 3:30 PM  
**Effects of a Combined Aerobic and Cognitive Training Intervention on Cognitive Function in Cancer Survivors**

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**INTRODUCTION:** Cancer-related cognitive impairment (CRCI) has been reported to negatively affect upwards of 75% of cancer patients undergoing treatment. Treatment and management of CRCI has proven to be a difficult task due to the fact that it has yet to be fully characterized. Some studies have shown that cognitive training or aerobic exercise may mitigate aspects of CRCI. Yet, it is unclear whether simultaneously combining these two interventions could provide additive or synergistic benefits on cognitive function in cancer survivors. **PURPOSE:** To determine the effects of a quasi-randomized, controlled aerobic and cognitive training intervention on cognitive function in cancer survivors ( $N = 28$ ). **METHODS:** Pre and post physical and cognitive assessments were administered. A 36-session computer-based cognitive, aerobic, and flexibility training intervention was completed. Participants were assigned to one of the following groups: aerobic exercise only (AER), cognitive training only (COG), simultaneous aerobic exercise plus cognitive training (AER+COG), or a control flexibility only group (CON). **RESULTS:** No significant ( $p > 0.05$ ) main effects between groups and variables were observed. Within groups measures revealed that the AER logical memory scaled scores (+33%), delayed recall scaled scores (+27%), block design scaled scores (+19%), and letter-number sequencing scaled scores (+12%) significantly increased ( $p < 0.05$ , respectively) pre-to-post. The CON group significantly ( $p < 0.05$ ) increased from pre-to-post in controlled oral word association gender, age, and education verbal fluidity subtests (Z-scores). All cognitive scores (AER+COG and COG groups) failed to significantly ( $p > 0.05$ ) increase pre-to-post. **CONCLUSIONS:** Aerobic training alone had the greatest impact on cognitive function. Individually, these methods may be appropriate for addressing CRCI in this population, but combined training of this nature may be too demanding for cancer survivors suffering from CRCI.

838 Board #17 May 31 2:00 PM - 3:30 PM  
**Golf Intervention For Veterans Exercise: Can Golf Influence Gait Speed And Cognition In Older Veterans?**

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(No relationships reported)

Gait speed is an important predictor of successful aging. For example, slow gait speeds are associated with poor health outcomes and decreased dual-task (DT) walking performance is associated with increased fall risk. We hypothesize that golf may improve gait speed, DT gait speed, and cognitive function in older military veterans. **PURPOSE:** The objective of the present study was to examine the influence of a 12-week golf intervention on walking performance and cognitive function in older military veterans. **METHODS:** Gait speed and cognition were measured before and after a 12-week golf intervention (2 x weekly; 90 min per session). Two male participants (74 and 67 years old) completed 5 gait trials walking as fast as possible, 5 dual-task gait trials walking as fast as possible while performing a backwards counting task, and the Dimensional Change Card Sort Test, Flanker Inhibitory Control and Attention Test, List Sorting Working Memory Test, Picture Sequence Memory Test, and Pattern Comparison Processing Speed Test, which make up the Fluid Cognition composite score of the NIH Cognition Toolbox. **RESULTS:** Participants improved gait speed by 5.3% and 15.8% and fast DT gait speed by 29.2% and 26.1%. Fluid Cognition composite scores improved by 11% and 1% and the percent change in DT accuracy were -2.9% and 0%. **CONCLUSION:** Following the 12-week golf intervention, both participants improved their fast gait speed, fast DT gait speed, and fluid cognition function. There was little to no decrease in counting accuracy during the fast DT gait speed. These results demonstrate that the participant's improved gait speeds were not at the expense of maintaining cognitive performance. These preliminary findings suggest that the physical and cognitive demands of golf (navigating the course, walking hilly terrain, bending over, swinging, shifting the center-of-pressure, planning and strategizing) may improve physical and cognitive function in older military veterans. Future expansion of this study will inform the development of golf programs to improve everyday function and quality of life in older adults.

839 Board #18 May 31 2:00 PM - 3:30 PM

**Changes in Cognition and Power Output in Adults Following High-Velocity Circuit Resistance and Treadmill Training**

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Previous studies report that increases in aerobic capacity produce improvements in cognition. However, the effects of power training on cognitive domains are not well understood. **PURPOSE:** To compare the effects of high-velocity circuit resistance (CRT), treadmill (TM) training and no exercise (CONT) on cognitive domains and power output in older adults. **METHODS:** Fifteen subjects (2M, 13F; 71.3 ± 2.5 yr) participated in 12-wks of CRT, TM or CONT. Executive function (EF)/attention, EF, episodic memory, working memory, processing speed and overall cognition were measured by the flanker (FL), dimensional card sort (DCS), picture sequence (PS), list sorting (LS), pattern comparison (PC), and composite score (CS), respectively, using the NIH Cognition Battery. The walking response and inhibition test (WRIT) also assessed EF. A global score (GS) was determined by the WRIT. Aerobic power (AP) was determined from a peak oxygen consumption test, and lower body power (MP) by a chair stand. **RESULTS:** A between-groups analysis revealed significant decreases in MP (MD= -269.3, SE= 91.6, p=.04) for TM compared to CONT and a decrease approaching significance compared to CRT (MD= -213.7, SE= 81.9, p=.07). There was a significant main effect for AP (p=.05, n<sub>2</sub>p=.448) with a trend towards an increase for TM compared to CONT (MD=2.4, SE=1.0, p=.09) and CRT compared to CONT (MD=2.5, SE=1.0, p=.07). No significant interactions were present for cognitive measures. Within-group analyses revealed a significant increase in PC (MD=12.6, SE=4.9, p=.04), a decrease in MP (MD=-205.3, SE=56.9, p=.01), and a trend towards an increase in LS (MD=9.8, SE=4.7, p=.08) and GS (MD=33.1, SE=16.2, p=.07) for TM. For CONT, there was a significant decrease in PC (MD=-12.8, SE=4.9, p=.04) and AP (MD=-2.4, SE=.8, p=.02). Correlation analyses revealed a strong positive association between AP and FL (r=.99, p=.008), MP and GS (r=.97, p=.03), and an inverse correlation between MP and AP (r=-.97, p=.03) and MP and FL (r=-.93, p=.02) for CRT. A strong positive correlation was observed for AP and FL (r=.96, p=.03) for TM, and an inverse correlation between MP and FL (r=-.99, p=.04) for CONT. **CONCLUSION:** TM and CRT resulted in an increase in AP compared to CONT that corresponded to improvements in EF and WRIT performance, however, only TM exhibited significant decreases in MP.

840 Board #19 May 31 2:00 PM - 3:30 PM

**Differences Between Functional Fitness and Cognitive Impairment in Independent Older Adults in the Community**

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**PURPOSE:** The purpose of this study is to examine the performance of functional fitness in a community-dwelling elderly population with different levels of cognitive impairment. **METHODS:** 316 community-dwelling older adults aged 60 to 91 years were divided into normal cognitive group (NOR, N=84, 68.5±0.76 yrs), mild cognitive impairment group (MCI, N=124, 71.8±0.62 yrs) and serious cognitive impairment (SCI, N=108, 75.8±0.67 yrs) group using the Saint Louis University Mental Status (SLUMS) examination. The Senior Functional Fitness Test (SFFT) was used to measure upper muscle strength (30-second arm curl), lower muscle strength (30-second chair-to-stand), aerobic endurance (two-minute step), upper (back scratch) and lower flexibility (chair sit-and-reach), agility and dynamic balance (eight-foot up-and-go). **RESULTS:** There was a significant relationship between the SLUMS score and SFFT (p<.05). The NOR subjects scored significantly higher than the SCI subjects in BMI(5%), lower- and upper-body strength (33.1%; 17.4%), max strength (22.5%), upper- and lower-body flexibility (102.1%; 83.1%), cardiovascular endurance (16.2%) and dynamic balance (29.5%) (p<.05). The MCI subjects also had better performance than the SCI group with regard to lower- and upper-body strength (23.9%; 13.7%), cardiovascular endurance (13.8%), upper- and lower-body flexibility (71.3%;34.0%), and dynamic balance (20.5%) (p<.05). Furthermore, there were no significant differences between MCI and NOR group in cardiovascular endurance and muscle strength. **CONCLUSIONS:** The level of cognitive impairment was correlated to the degree of body composition and functional fitness in the group of community-dwelling elderly adults examined in this work, influencing muscle strength, flexibility, cardiovascular endurance and dynamic balance. The MCI period is perhaps the key phase during

which it is still possible for most elderly people to return the normal condition of functional fitness in cardiovascular endurance and muscle strength. Therefore, the any director or interventions aimed at achieving this should be properly developed modified to reflect the elderly subject adult's level of cognitive abilities.

841 Board #20 May 31 2:00 PM - 3:30 PM

**Peak Heart Rate during the 6-Minute Walk Test Predicts Cognitive Performance of Healthy Older Adults**

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**Purpose:** Cardiorespiratory fitness positively correlates with cognitive function in healthy older adults (Barnes et al., 2003) and quality of life depends on maintaining cognitive and physical health (Ortman et al., 2014). The submaximal 6-minute walk test (6MWT) is a commonly used clinical assessment of cardiorespiratory fitness in older adults, but the relationship between 6MWT and cognitive performance remains undefined. Here, we tested the relationship between 6MWT and cognitive performance in healthy, ethnically diverse older adults. **Methods:** In this cross-sectional study, 90 participants (69 female, 21 male), ages 60-95 years (75 + 9.5 yrs.; mean + SD), were recruited from the local area. Cognitive performance was measured in the Modified Mini-Mental State Test (3MS), Trailmaking tests A and B, and Animal Naming test. Physical measures included 6MWT active and recovery heart rates, distance walked, anthropometric data, peak hand-grip strength, and surveys including Physical Activity Scale for Elderly (PASE) and Perceived Stress Scale (PSS). Stepwise multiple regression analyses were used to evaluate the contributions of 6MWT performance and physical measures to cognitive performance. **Results:** Mean 3MS scores (92.5 + 7.7) revealed that our population was cognitively healthy. Controlling for demographic covariates, peak heart rate recorded during the 6MWT (6MWT HR<sub>PEAK</sub>) significantly predicted performance on 3MS (R<sup>2</sup>=0.462, p<0.001), and Trailmaking A (R<sup>2</sup>=0.328, p<0.001) and B tests (R<sup>2</sup>=0.379, p<0.001). Controlling for age and education level, PASE was found to significantly predict Animal Naming test performance (R<sup>2</sup>=0.309, p<0.001). **Conclusion:** Results suggest that peak exercise intensity, as determined by 6MWT HR<sub>PEAK</sub>, significantly contributes to executive function and self-reported physical activity levels with verbal fluency.

842 Board #21 May 31 2:00 PM - 3:30 PM

**Physical Activity, Fitness And Cognitive Function Among Community-dwelling Elderly -baseline Data Of Fujisawa Plusten Project.**

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**PURPOSE:** Physical activity (PA) are important for maintenance and improvement of cognitive health as well as prevention of non-communicable diseases. We are conducting a 2-year (2015-2017) community-wide campaign to promote PA in Fujisawa city, Kanagawa, Japan. The campaign contains multilevel interventions. As a part of these interventions, community-dwelling elderly groups who commit doing exercise together at least once a week were registered. We analyzed the baseline data and examined the relationship between PA, fitness levels and cognitive function. **METHODS:** Participants were 157 elderly group. Physical activity levels were assessed using a triaxial accelerometer for 1 week. We used steps and duration of moderate-to-vigorous PA as indicators of PA level. In terms of fitness level, one foot standing, grip power, chair stand test and sit & reach test were examined. Cognitive function were assessed by Cognitive Assessment for Dementia iPad version 2 (CADi2) which consists of 10 simple questions and is self-administered. We dichotomized CADi2 score as less than 9 (low) and 9 or 10 (high) and compared physical activity level, physical fitness level between the two groups using unpaired t-test. **RESULTS:** The sample consisted of 104 women (age: 76.0±6.9 yrs, mean±SD) and 53 men (74.4±5.1 yrs). CADi2 score (median (25-75%tile)) was 9 (8-10) in women and 9 (9-10) in men, respectively. Other results were shown in the table.**CONCLUSION:** Fitness level of low-score elderly of cognitive function is tend to lower compared to high-score elderly. Longitudinal observation with intervention is necessary to know further relationships. Supported by Comprehensive Research on Aging and Health Science Research Grants for Dementia R&D from the Japan Agency for Medical Research and Development (AMED).

	Women			Men		
	CADIZ Score		p-value	CADIZ Score		p-value
	high	low		high	low	
Steps (/day)	5264±2506	4206±2548	0.057	6225±2936	4632±3282	0.12
MVPA (min/day)	73.9±34.8	60.8±38.2	0.098	69.1±29.4	58.2±35.8	0.29
One foot standing (seconds)	33.6±23.2	16.3±17.9	<0.001	28.2±24.0	25.0±23.9	0.7
Grip power (kg)	21.0±4.7	17.4±5.1	<0.001	33.7±5.6	28.4±4.3	0.005
Chair-stand test (/30 seconds)	22.5±7.7	20.3±5.8	0.18	24.7±6.2	19.9±5.2	0.029
Sit & reach test (cm)	38.4±9.0	33.0±8.7	0.005	29.5±11.7	32.3±5.4	0.45

843 Board #22 May 31 2:00 PM - 3:30 PM  
**Exercise And Cognition Among Individuals At Risk For Or Diagnosed With Alzheimer'S Disease: A Meta-analysis**

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Exercise training is gaining attention regarding its role in the prevention and treatment of Alzheimer's disease (AD). **PURPOSE:** The purpose of our meta-analysis was to evaluate: the effect of exercise on cognitive function in individuals at risk for or diagnosed with AD; potential moderators of the cognitive effects of exercise; and whether the cognitive effects of exercise are dependent upon *Frequency, Intensity, Time, and Type (FITT)* of the exercise. **METHODS:** Databases were searched for trials that measured pre- and post-exercise cognitive function in adults at risk for or diagnosed with AD. Analyses followed random-effects assumptions. **RESULTS:** 19 studies with 23 interventions qualified with 1,256 subjects (71.1% women; 28.3% men) that were 77.0±7.5yr and who completed 9.2±4.3yr of school. A majority of the sample was at risk for AD due to mild cognitive impairment (64%), another 1% was at risk due to a parent diagnosed with AD, and 35% had AD. Exercise interventions were performed at vigorous intensity for older adults (3.7±0.6 metabolic equivalents) for 3.4±1.4 d·wk<sup>-1</sup>, 45.2±17.0 min-session for 18.6±10.0 wk. A majority were aerobic exercise training (AET) interventions (65%) and 35% other types (i.e., concurrent [31%] or resistance exercise training [4%]). Only questionnaires were used to assess cognitive function with the Mini-Mental State Examination most commonly used (61%). Overall, there was a positive, moderate effect of exercise on cognitive function versus control (standardized mean difference [SMD]=0.47, 95% confidence interval [CI]=0.26, 0.72; P=59.6%). The within group analysis revealed exercise improved cognitive function (SMD=0.20, 95% CI=0.11, 0.28; P=0%), whereas cognitive function declined in the control group (SMD=0.18, 95% CI=0.36, 0.00; P=65.1%). Furthermore, AET had a strong, positive effect on cognitive function (SMD=0.66, 95% CI=0.30, 1.02), whereas the other exercise types did not (SMD=0.19, 95% CI=-0.12, 0.49). **CONCLUSIONS:** Our findings suggest that exercise may reverse the decline in cognitive function that occurs among older adults who are at risk for or have AD, with favorable exercise effects that are largely mediated by AET. Future randomized clinical trials that include objective measurements of cognitive function are needed to confirm our novel findings.

844 Board #23 May 31 2:00 PM - 3:30 PM  
**Feasibility Of Square-stepping Exercise To Improve Mobility And Cognition In Long-term Care And Retirement Living.**

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Square-stepping exercise (SSE) is a visuospatial working memory task with a cued stepping response; it has demonstrated mobility and cognitive benefits in older adults. **PURPOSE:** To explore whether a SSE program is feasible in long-term care (LTC) and retirement living (RL) facilities in populations with diverse mobility and cognitive abilities. **METHODS:** A cluster-randomized trial was conducted; 4 sites (2 LTC and 2 RL) were randomized to SSE [2x/wk for 12-wks by trained kinesiologists (kings)] or control (CON). Recruitment, attendance, program fidelity, and feedback were monitored throughout the program. **RESULTS:** All residents were invited to participate; in the intervention sites, there were 192 and 144 beds for the LTC and

RL, respectively. Recruitment was via information sessions. Intervention participants (n=30) were 80.5 ± 13.2 yrs old, 77% female, and had 12.2 ± 3.2 years of education. In LTC (n=15) there was an average of 5.5 residents in attendance at each session ranging from 3-9 over 19 sessions. LTC residents attended an average of 45.6% sessions (range: 10.5-79.0%); 6 attended >50% of sessions. In RL (n=15) there was an average of 7.8 residents in attendance at each session ranging from 3-12 over 24 sessions. RL residents attended an average of 21% of sessions (range: 8.3-75%); 8 attended >50% of sessions. To maintain a pragmatic approach, SSE was modified following feedback: sessions were reduced from 60 to 45 min; residents who used gait aids were assisted by kins; and in LTC program, progression was limited. Residents in RL became peer-coaches to assist kins and act as moderators. Anecdotal feedback from kins and residents was positive, with comments about SSE being fun but also a 'good' challenge; both sites have continued the program. **CONCLUSIONS:** Recruitment for this study was considered a success from the perspective of the LTC and RL facilities. Attendance was variable; it is understandable with a variety of mobility and cognitive abilities that achieving perfect attendance is unlikely. It is reasonable, with program modifications and flexibility in program progression, for this to be a feasible program for adults living in LTC and RL facilities to engage physically, cognitively and socially. **FUNDING:** Western Centre for Studies in Family Medicine, Schlegel Villages and Ontario Graduate Scholarship.

B-60 Basic Science World Congress/Poster -  
**Sports, Performance, and Injury**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
 Room: Hall F

845 Board #24 May 31 2:00 PM - 3:30 PM  
**Factors Influencing Visual Cognitive Performance Training**

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It is recognized that visual cognitive abilities is an important characteristic of athletic performance, however, testing, training and determination of factors that influence this ability has been elusive. **PURPOSE:** The purpose of the Nutrition, Vision and Cognition in Sport Study (IONsport) is to determine the factors that explain the large difference in visual cognitive performance and training responses between elite and non-elite athletes. **METHODS:** College age men and women performed 15 visual cognitive training sessions in 10 visits to the laboratory (all 10 visits within 15 days). On the days of training, all food intake was documented along with measures of body composition, sleep patterns, fluid intake and recent exercise. Longer term assessments of these and other factors were measured prior to initiating training. Mean nutritional intakes were calculated for the 10 days of food records. **RESULTS:** Excluding results from the initial training session in which variability was high, participants increased visual cognitive performance by 27.5% (P<0.001) which was not significantly different (P>0.05) between men (32.1%) and women (24.1%). Linear regression was performed using select nutritional candidates (based on literature evidence and using mean 10 day intake) and non-nutritional factors to predict trained visual cognitive performance. Nutritional copper (r<sup>2</sup>=0.237, p=0.01) and percent body fat (r<sup>2</sup>=0.11, P=0.027) entered the significant model (P=0.001). Mean visual cognitive performance improvement for copper intakes that were 16-47%, 50-109% and 132-346% of the Dietary Reference Intake (Recommended Dietary Allowances, RDA) were 10.1%, 22.6% and 43.1%, respectively. **CONCLUSION:** These results suggest that dietary copper intake at or below the RDA may impair visual cognitive training performance and more broadly suggest that visual cognitive performance is more than an innate ability.

846 Board #25 May 31 2:00 PM - 3:30 PM  
**Different Influences Of Aerobic Exercise Types On Cognitive Control Of Athletes**

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Acute exercise has been shown to improve executive function, and in particular performance on tasks that measure inhibitory control. However, few studies have compared laboratory-based exercise sessions to more complex modes of exercise, such

as soccer, that involve attention to multiple aspects of the environment and for which performance success depends on the active engagement of executive control processes. **PURPOSE:** To compare the effects of acute treadmill exercise versus futsal (indoor soccer) on performance and electroencephalographic event-related potentials measured during an inhibitory control task. **METHODS:** Twelve experienced soccer players (24.8±2 years) completed three counterbalanced 20-minute sessions of: 1) seated rest; 2) moderate intensity treadmill exercise; and 3) a game of futsal. Once heart rate (HR) returned to within 10% of pre-activity levels, participants completed the Stroop Color Word Conflict Task while reaction time (RT) and P300 event-related potentials were measured. **RESULTS:** HR did not significantly differ during treadmill exercise (122.4±5.4 bpm) compared to futsal (126.7±6.7 bpm). Reaction time during Stroop performance was significantly faster following the futsal game (765±29 ms) compared to seated rest (835±28 ms), but was not significantly different than treadmill exercise (784±22 ms). However, the P300 amplitude at three midline recording sites was significantly greater following futsal ( $F_z=5.77±2.87$ ;  $C_z=4.84±1.66$ ;  $P_z=4.25±1.43$   $\mu\text{V}$ ) compared to both the treadmill exercise ( $F_z=4.96±2.66$ ;  $C_z=4.02±2.58$ ;  $P_z=3.7±1.02$   $\mu\text{V}$ ) and seated-rest conditions ( $F_z=4.19±1.58$ ;  $C_z=3.12±1.69$ ;  $P_z=3.09±1.42$   $\mu\text{V}$ ). **CONCLUSIONS:** These findings suggest that single bouts of indoor soccer among college-aged soccer players, compared to treadmill and seated-rest conditions, may engender the greatest effect on brain networks controlling attention allocation and classification speed during the performance of an inhibitory control task. Future research is needed to determine if cognitively engaging forms of sport-related aerobic exercise may differentially impact executive control processes in less experienced and older adult participants.

847 Board #26 May 31 2:00 PM - 3:30 PM  
**The Effects of Repeated, Consecutive High-Intensity Exercise on Cognitive Performance in Well-Trained Team Sports Players**

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Improvements in cognitive performance and mood are generally accepted following moderate intensity exercise; however, the impact of high-intensity exercise is less clear. Given that professional team sports are performed at high or maximal intensity, which can be further compounded during periods of intensified periods of competition, investigations into the effect of such exercise on cognition are needed. **PURPOSE:** To determine the effect of repeated high-intensity exercise on cognitive function, mood and perceptions of both physical and mental energy, and fatigue. **METHODS:** In a counterbalanced crossover design, twenty-four well-trained, sub-elite rugby players (mean ± SD age, height, mass were 20.7 ± 1.9 yrs, 181.7 ± 5.5 cm, 88.2 ± 9.0 kg, respectively) completed a series of repeated sprints (20 x 20 m, three times per day for two consecutive days) or a seated control. Prior to and following each set of sprints or equivalent control duration, a selection of cognitive tests including simple reaction time, four-choice reaction time (FCRT), Corsi blocks and Stroop task (ST) were completed in addition to visual analogue scales assessing mood, energy and fatigue. Repeated-measures ANOVAs were conducted with pairwise comparisons where necessary ( $\alpha = 0.05$ ). **RESULTS:** No changes were observed in any cognitive, mood, energy or fatigue measures after one single high-intensity session. However, compared to the control, ST accuracy was lower in the exercise condition (-0.6%,  $P < 0.05$ ) which was largely due to a sharp decline at bout 3 on day 1 that continued throughout day 2. Additionally, FCRT was slower on day 2 (+2.2%) whilst feelings of alertness (-12%), contentedness (-5%), and physical (-22%) and mental (-24%) energy were reduced and ratings of physical (+22%) and mental (+40%) fatigue increased (all day 2 vs. day 1,  $P < 0.05$ ). No changes were observed in the control condition. **CONCLUSION:** Intensified periods of exercise have detrimental effects on cognitive performance, mood and perceptions of physical and mental energy, and fatigue. The deleterious effects on these parameters could be contributing to increased injury rates during fixture congestion alongside decrements in performance. Player rotation may help alleviate these effects whilst also prompting further research into cognitive recovery strategies.

848 Board #27 May 31 2:00 PM - 3:30 PM

**Injury-Related Reductions in Skilled Visuomotor Learning Revealed by Single Trial Analysis and Response Time Variability**

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 (No relationships reported)

Classical psychometric tests emphasize measures of central tendency as it relates to response times, contact times, and errors. More sophisticated techniques, however, may complement neurophysiological measures of neuroplasticity in response to behavioral interventions or changes in intrinsic state. **PURPOSE:** To determine whether learning on a skilled lower extremity visuomotor task was affected by prior ACL injury.

**METHODS:** Eighteen healthy women between 18 and 32 yr participated. Nine women served as controls; nine others had unilateral ACL reconstruction between 6 months and 5 years from the start of the investigation. All participants completed 120 trials of a choice reaction test with a Stroop-like effect and randomly-ordered stimulus presentation order (3 sets of 40 repetitions with 30 sec rest between sets and 1 sec intertrial interval) (The Quick Board, LLC Memphis TN). Response time, contact time, and error count was recorded for each leg during each trial.

**RESULTS:** In total, controls performed 525 trials with the dominant leg and 555 trials with the non-dominant leg. ACLs performed 550 trials with the injured leg and 530 trials with the uninjured leg. Average time to set completion, response time, contact time, and error count did not differ by group or leg or measurement (mean or median). ACLs displayed better initial response times but failed to improve to the same extent as controls (6.1% improvement,  $y = -1.51x + 1110.2$ ,  $R^2=0.74$  for non-injured; 2.7% improvement,  $y=-0.97x + 1004.8$ ,  $R^2=0.62$  for ACL). Greater improvements in response time were generally observed in the (initially worse performing) non-dominant leg. In the less frequently injured (3/9) dominant leg, virtually no improvement (1.4%) in response time was observed in ACLs overall, resulting in a 341.5% relative improvement in controls. The variability of single trial response time increased from the dominant to the non-dominant leg and from the healthy to injured leg.

**CONCLUSIONS:** Single trial analysis revealed injury-related deficits in skilled visuomotor learning years after ACL rupture and rehabilitation despite the apparent recovery of the musculoskeletal system. This suggests a central neurological association with musculoskeletal injury that may affect neuroplasticity in the affected and unaffected extremity.

849 Board #28 May 31 2:00 PM - 3:30 PM

**Unique Leg-specific Executive And Motor BOLD Activity With Visually-guided Imagery Following ACL Injury**

Shawn D. Flanagan, 15203<sup>1</sup>, Courtenay Dunn-Lewis<sup>1</sup>, James A. Onate<sup>2</sup>, Jeff S. Volek<sup>2</sup>, Carl M. Maresh, FACSM<sup>2</sup>, William J. Kraemer, FACSM<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>Ohio State University, Columbus, OH. (Sponsor: William J. Kraemer, Ph.D., FACSM)  
 (No relationships reported)

Given the change in sensorimotor system activation during limited movements of the injured leg after unilateral ACL rehabilitation, we asked whether the frontostriatal network might be involved during visually-guided action-imagery. **PURPOSE:** To determine whether injured individuals displayed different activity during a proprietary cognitive motor-oriented imagery test. **METHODS:** Healthy women (18-32 yr, n=19) provided written informed consent. Ten served as controls; nine others experienced unilateral ACL rupture, repair, and rehabilitation between 6 months and 5 years from the start of the study. All participants completed a proprietary attention-switching task for 4 trials of 10 repetitions. The test required subjects to react to congruent and incongruent signals prompting them to jump and land with the right or left leg. Subjects wore a camera to record first person perspectives of test performance. Brain images were acquired with a three tesla Siemens Trio MRI with TIM system. Subjects watched the cues and their first person performance while imagining themselves physically reacting/jumping in response to the cues. A three-dimensional magnetization-prepared rapid gradient-echo (MP-RAGE) sequence acquired whole-brain structure. Voxel size was set at 1.0mm<sup>3</sup> for structural scans and 3.0mm<sup>3</sup> for functional scans. Significant clusters were included if meeting a six-voxel cluster threshold. A false discovery rate (FDR) threshold was set at  $q=0.05$ . Map clusters were then converted to voxels of interest, and small cluster suppression highlighted the most affected brain regions. **RESULTS:** Occipital activity increased in response to visual cues. BOLD signal increased in the prefrontal cortex, primary somatosensory cortex, and the primary, pre, and supplementary motor areas ( $p<0.01$ ). Activity was lower in ACLs than controls, particularly when using the injured leg. However,

activity was increased in the right dorsolateral prefrontal cortex in both groups, with more pronounced increases in the injured group; the highest dIPFC activity was observed when participants imagined jumping and landing with their injured leg. **CONCLUSIONS:** Prefrontal regions of the brain display heightened activity after ACL individuals, whereas motor regions tend to display decreased activity compared to controls.

850 Board #29 May 31 2:00 PM - 3:30 PM  
**Cardiovascular Dynamics During The Cold Pressor Test In Recently Concussed College Athletes**

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Concussion patients who are experiencing symptoms appear to have impaired cardiovascular responses during sympathoexcitatory tests such as handgrip exercise and head-up tilting. However, it is not known if impaired cardiovascular responses are present during a cold pressor test (CPT).

**PURPOSE:** We tested the hypothesis that recently concussed college athletes would have a blunted cardiovascular response during a CPT.

**METHODS:** Four college athletes (age:  $19 \pm 1$  years, 2 women) who were within 7 days of concussion diagnosis and still reporting symptoms and four healthy controls (age:  $27 \pm 4$  years, all men) underwent a CPT. During the CPT, the participant's right hand was submerged in an ice slurry mixture for 120 seconds. Heart rate (ECG) and blood pressure (photoplethysmography) were continuously measured and averaged at baseline and every 30 seconds during the CPT.

**RESULTS:** Heart rate was increased at 30 seconds ( $20 \pm 5$  bpm,  $P = 0.001$ ) and 60 seconds ( $26 \pm 13$  bpm,  $P < 0.001$ ) in the healthy controls but remained unchanged throughout the CPT in the concussed athletes (peak increase at 120 seconds:  $10 \pm 5$  bpm,  $P = 0.257$ ). Mean arterial pressure was elevated throughout the CPT in the healthy controls with a peak increase of  $27 \pm 6$  mmHg at 120 seconds ( $P < 0.001$ ). The peak increase in mean arterial pressure of  $9 \pm 6$  mmHg in the concussed athletes was observed at 120 seconds, but did not reach statistical significance ( $P = 0.079$ ). Systolic blood pressure was elevated at 60 seconds and throughout the remainder of the CPT in healthy controls reaching a peak increase of  $28 \pm 6$  mmHg at 120 seconds ( $P < 0.001$ ). Systolic blood pressure in concussed athletes did not increase at any point of the CPT ( $P > 0.196$  for all time points). Diastolic blood pressure in healthy controls was elevated throughout the CPT and reached a peak increase at 120 seconds ( $21 \pm 4$  mmHg,  $P < 0.001$ ). In concussed athletes, diastolic blood pressure was elevated only at 120 seconds ( $7 \pm 5$  mmHg,  $P = 0.014$ ) of the CPT.

**CONCLUSIONS:** These preliminary data show that recently concussed athletes have a blunted cardiovascular response to the CPT. These data support evidence indicating that concussed patients who are experiencing symptoms have impaired cardiovascular responses to sympathoexcitatory stimuli.

851 Board #30 May 31 2:00 PM - 3:30 PM  
**Effects of Multiple Sports Related Concussions On Neurocognition and Cerebral Vascular Function**

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**PURPOSE:** To determine the differences in neurocognition (NC) and cerebral vascular reactivity (CVR) between athletes with multiple sports related concussions (mTBI) and matched controls (C).

**METHODS:** Twelve athletes ( $22 \pm 0.5$  y SEM) who reported multiple sports related concussions ( $\geq 3$ ) and 12 matched [age, sex, body mass index (BMI), and athletic status] healthy concussion free controls ( $23 \pm 0.5$  y) were recruited. **Neurocognitive methods** Each participant completed neurocognitive testing (NC) including WASI II, HVLIT R, Grooved Pegboard, DKEFS, Connors' CPT test II, WAIS-IV subsets, and BRIEF. **CVR methods** Participants were fitted with a custom breathing circuit attached to a computer-controlled gas-blending device to evaluate baseline end-tidal carbon dioxide ( $P_{aCO_2}$ ). To alter brain blood flow a  $P_{aCO_2}$  gas challenge, which consisted of two square wave increases of 10 mmHg above baseline  $P_{aCO_2}$  and a ramp protocol that decreased  $P_{aCO_2}$  to 32 mmHg and then increased linearly to 50 mmHg over a 7 min. period was utilized while  $P_{aO_2}$  was maintained at 100 mmHg. Each participant underwent brain imaging using a 3T MRI for concurrent structural and functional (BOLD) imaging. CVR (% BOLD signal change/mmHg  $CO_2$ ) was computed by using a robust linear least squares fit to the correlation between the two time courses.

**RESULTS:** As expected mTBI and C were similar in age ( $22 \pm 1$  vs.  $23 \pm 1$  y,  $P = 0.07$ ), height ( $173 \pm 3$  vs.  $174 \pm 3$  cm,  $P = 0.76$ ), weight ( $76 \pm 6$  vs.  $80 \pm 6$  kg,  $P = 0.37$ ) and BMI ( $24 \pm 1$  vs.  $26 \pm 1$  kg/m<sup>2</sup>,  $P = 0.18$ ). Baseline  $P_{aCO_2}$  ( $38 \pm 1$  vs.  $36 \pm 1$  mmHg,  $P = 0.44$ ) was

not significantly different. Whole brain gray matter CVR was also not significantly different in mTBI vs. C groups for the full sequence ( $0.380 \pm 0.014$  vs.  $0.379 \pm 0.014$  %BOLD/mmHg,  $P = 0.94$ ), squares waves only ( $0.380 \pm 0.017$  vs.  $0.390 \pm 0.017$ ,  $P = 0.68$ ) and ramp only ( $0.377 \pm 0.013$  vs.  $0.375 \pm 0.013$ ,  $P = 0.92$ ). Differences in NC testing (mTBI vs. C) were DKEFS Trail Making-motor speed ( $11.4 \pm 0.3$  vs.  $12.5 \pm 0.3$ ,  $P = 0.02$ ); DKEFS Color Word Inference inhibition ( $13.0 \pm 0.4$  vs.  $11.8 \pm 0.4$ ,  $P = 0.05$ ); and Connors' CPT Test II Commission (%) ( $58.2 \pm 2.8$  vs.  $51.4 \pm 2.8$ ,  $P = 0.04$ ).

**CONCLUSIONS:** The data from this study suggest that multiple sports related concussions do not have long-term effects on CVR, however NC data showed reduced reaction time and attention.

Supported by National Football League Charities

852 Board #31 May 31 2:00 PM - 3:30 PM  
**The Effect of Industrial Hyperthermia on Firefighters' Cognitive Function in Warm Humid Environment**

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Firefighting is a physically and mentally strenuous job requiring rapid, appropriate decision making in extremely hot environmental conditions. Intact cognitive function is imperative to firefighters' effectiveness and safety. **PURPOSE:** To investigate the effect of industrial hyperthermia [rectal temperature ( $T_{re}$ )  $\geq 38^\circ\text{C}$ ] on cognitive performance while wearing a firefighters' encapsulating protective ensemble after exercise in a warm, humid environment. **METHODS:** Eight healthy male subjects ( $VO_{2max}$ :  $52.83 \pm 5.60$  mL.kg<sup>-1</sup>.min<sup>-1</sup>; Age:  $26 \pm 4$  yrs) performed computer-based cognitive tests (Go/No-Go) before and after exercise under hyperthermic conditions ( $30^\circ\text{C}$  / 70% relative humidity). Exercise included 40-min treadmill walking at 40 %  $VO_{2max}$  or until  $T_{re} \geq 39^\circ\text{C}$  while wearing a firefighters' protective ensemble. For the Go/No-Go tests, participants were required to button-press to a target stimulus, and withhold button-presses to a non-target. The test appears as a  $2 \times 2$  grid with one star in each square. A letter is presented in one square for duration of 500 milliseconds (ms), followed by an inter-stimulus interval of 1500ms. The first test (P-Go) required participants to respond to the target letter P and withhold response to the non-target letter R. The second test (P-No-Go) was a reversal, with R as the target and P as the non-target. Both tests had 160 trials (320 total), and constant ratio of targets to non-targets (80:20). Comparisons were drawn using paired-samples t-test with statistical significance shown at  $p < 0.05$ . **RESULTS:** Following hyperthermia, participants' reaction time (RT) was reduced in both tests (Go/No-Go) and exhibited a non-significant increase in percentage performance error (PE) compared to normothermic condition. The mean differences found between hyperthermic and normothermic conditions are:  $T_{re}$ :  $1.46 \pm 0.44^\circ\text{C}$ ,  $p = 0.0001$ ; P-Go RT:  $-17.22 \pm 18.89$ ms,  $p = 0.0365$ ; P-No-Go RT:  $-36.31 \pm 28.11$ ms,  $p = 0.0081$ ; and PE:  $1.02 \pm 2.20\%$ ,  $p = 0.2333$ . **CONCLUSION:** Cognitive function was not altered negatively by hyperthermia. However, the hyperthermia condition resulted in accelerated reaction time which may have been influenced by change in human mood following mentally stressful hyperthermic conditions. Accelerated reaction time may cause a non-significant change in firefighters' performance.

853 Board #32 May 31 2:00 PM - 3:30 PM  
**Annual Baseline Drift in Professional Rugby League Players**

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**Purpose:** Annual baseline testing within professional Rugby League has been mandatory since 2004. The question: "Do annual baselines drift over time or as a result of a concussion in rugby league players?" is unanswered. If they do drift, what is the magnitude and in what tasks and is this correlated with associated concussions. This study evaluated if baselines drift over time and if so is this related to concussive injury or accumulating injury.

**Design:** Retrospective study

**Method:** Participant players were those who held a professional contract between the 2006-2012 season. It is mandatory to provide an annual baseline test using CogSport and following any diagnosed concussion, with full symptom resolution, a valid return to play test. Concussion test data was provided by CogState Australia from tests performed over 7 seasons.

**Results:** Over the 7-year period 4762 players suffered 470 concussions (2.65/1000 hours, 95% Confidence Interval 2.4 to 2.9). Reaction time on a choice reaction time task (Identification) slowed with previous concussions (0.017, .001 to .029,  $P=0.05$ ) but not seasons. Accuracy on a working memory task (One Back) decreased with concussion (-0.05 to -0.05,  $P=0.001$ ) and on an episodic memory task (One Card Learning) decreased with previous concussion (-0.041, -0.049 to -0.34,  $P=0.001$ ) and season (-0.006, -0.007 to -0.005,  $P=0.001$ ).

**Conclusions:** Over seven seasons, item scores within the CogSport test varied as a function of previous concussion and time suggestive of a subtle deterioration in cognitive performance with prior concussions. Individual items within the CogSport test were influenced by differing factors and more detailed examination of the scores and co-factors is warranted.

854 Board #33 May 31 2:00 PM - 3:30 PM  
**Change in Serum Protein S100B Following a Collegiate American Football Game**

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(No relationships reported)

Protein S-100 Beta (S100B) is a calcium handling protein found in astrocytes. Following traumatic injury to the brain, S100B can be measured in blood serum as an indicator of brain damage severity. **PURPOSE:** To determine if S100B is increased in the serum of football players following a game in which traumatic head injury was not reported yet subconcussive hits were experienced by the players. **METHODS:** S100B was measured in the serum of 15 football players before and after two collegiate varsity football games. Of the 15 players, seven received a large amount of playing time, and eight received no playing time and served as the control group. In addition, the change in serum level of S100B was correlated to the number of total hits (described as impact to the head or body) each player sustained to determine if S100B serum levels rose in correlation with the number of hits each player experienced. **RESULTS:** No concussions or significant head injuries were reported by any of the players or certified athletic training staff, yet S100B (Pre-game 1:  $0.051 \mu\text{g}\cdot\text{L}^{-1} \pm 0.056$  vs. Post-game 1:  $0.084 \mu\text{g}\cdot\text{L}^{-1} \pm 0.055$ ,  $p=0.019$ ) (Pre-game 2:  $0.088 \mu\text{g}\cdot\text{L}^{-1} \pm 0.071$  vs. Post-game 2:  $0.170 \mu\text{g}\cdot\text{L}^{-1} \pm 0.151$ ,  $p=0.028$ ) increased significantly in those who played. S100B (Pre-game 1:  $0.031 \mu\text{g}\cdot\text{L}^{-1} \pm 0.008$  vs. Post-game 1:  $0.022 \mu\text{g}\cdot\text{L}^{-1} \pm 0.009$ ,  $p=0.069$ ) (Pre-game 2:  $0.052 \mu\text{g}\cdot\text{L}^{-1} \pm 0.009$  vs. Post-game 2:  $0.041 \mu\text{g}\cdot\text{L}^{-1} \pm 0.017$ ,  $p=0.161$ ) did not increase significantly in those who did not play. Pearson Correlation showed there was a moderate correlation between the change in S100B and the number of hits each player experienced ( $R^2=0.419$ ;  $p=0.009$ ). **CONCLUSION:** Serum S100B concentration does increase in response to subconcussive injury in a manner dependent on the number of hits the athlete withstands. Despite the increase in S100B levels caused by a football game, the increase in S100B was found to be similar to that found in runners, soccer players, or basketball players but greater than that found in swimmers and cyclists. This indicates sustaining subconcussive hits from playing football may cause damage to the brain but be no more damaging than playing other sports resulting in external forces being applied to the brain.

855 Board #34 May 31 2:00 PM - 3:30 PM  
**Affective Responses During High-intensity Exercise Detect Changes In  $W'$**

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The feeling scale (FS) provides a valid measure of positive or negative feelings (i.e., affect) during dynamic exercise; however, research on constant work rate (CWR) exercise has been confined to lower intensities. Exercise >critical power (CP) is characterized by a time-dependent utilization of the finite work capacity >CP ( $W'$ ), resulting in predictable time limits to exhaustion ( $t_{LIM}$ ). Glycogen depletion (GD) evokes declines in  $W'$ , independent of changes in CP, resulting in earlier  $t_{LIM}$ . **PURPOSE:** To determine if GD evokes a more rapid time-dependent change in affect correlating to physiological responses during exhaustive CWR exercise. **METHODS:** In counterbalanced-order, 15 participants completed CWR exercise at 10% >CP in glycogen loaded (GL) and GD conditions. The FS, pulmonary gas exchange, capillary lactate, and electromyography (EMG) of the vastus lateralis were evaluated. **RESULTS:** A  $62.3 \pm 22.5$  s reduction in  $t_{LIM}$  ( $p < 0.05$ ) and a  $3.2 \pm 1.2$  mmol·L<sup>-1</sup> reduction of end-exercise blood lactate concentration ( $p < 0.01$ ) was evoked by GD. A greater decline in slope relative to time for the FS was observed for GD (-1.87 ± 1.12) vs. GL (-1.24 ± 0.91) ( $p < 0.01$ ), correlating with earlier  $t_{LIM}$  in both the GL ( $r = 0.78$ )

and GD ( $r = 0.76$ ) conditions. A 13.4% increase in iEMG occurred in the GD trial ( $p < 0.05$ ). Oxygen uptake ( $VO_{2max}$ ) kinetics for ~½ of the sample exhibited a continuous primary phase until exhaustion (i.e., extreme domain) whereas a O<sub>2</sub> slow component was observed with the remaining participants (i.e., severe domain). Exercise in the extreme domain evoked 43% greater decline in affective responses ( $p < 0.01$ ) and a  $274.6 \pm 78.1$  s reduction in  $t_{LIM}$  ( $p < 0.01$ ) and the gain in  $V_E/VCO_2$  relative to  $t_{LIM}$  was 6.9% greater for those exercising in the extreme domain ( $p < 0.001$ ). **CONCLUSION:** Affective responses during severe and extreme exercise is sensitive to changes in metabolic responses occurring with a compromised  $W'$ .

856 Board #35 May 31 2:00 PM - 3:30 PM  
**Vitamin D and Neuropsychological Skills of Cross Country Skiers at 64° North**

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Vitamin D insufficiency and deficiency are well-documented in populations living north or south of approximately 35° N or S latitude, respectively; these are even more pronounced during winter months. Athletes have been shown to be more susceptible to insufficiency and deficiency than non-athletes. Vitamin D has been linked to mental cognition. Winter-sports athletes residing in the circumpolar north may experience sub-optimal vitamin D levels and depressed cognitive abilities during the competitive season.

**PURPOSE:** To determine if significant differences of vitamin D concentrations and manual dexterity exist in winter athletes mid- and post-season in the circumpolar North. **METHODS:** Fifteen competitive cross country skiers residing at 64° N were recruited for this study. Blood samples were taken in early February ("mid-season") and in late April ("post-season"). Subjects completed the Purdue Pegboard Test (PPT), an assessment of mental cognition and manual dexterity, at the time of the blood draws. Plasma vitamin D concentration was measured as 25-hydroxyvitamin D [25(OH)D] using an ELISA. Significance was determined by permutation test with 95% confidence interval. **RESULTS:** Subjects exhibited significantly lower mean concentration of plasma 25(OH)D in post-season ( $\mu=3.39$  ng/mL,  $SD=4.53$ ) as compared to mid-season ( $\mu=5.94$ ,  $SD=3.37$ ). PPT revealed significantly higher scores in three of four tests in post-season ( $\mu=18.00$ ,  $SD=1.31$ ;  $\mu=16.89$ ,  $SD=1.12$ ;  $\mu=46.64$ ,  $SD=3.40$ ) versus mid-season ( $\mu=17.04$ ,  $SD=1.82$ ;  $\mu=15.98$ ,  $SD=1.62$ ;  $\mu=41.69$ ,  $SD=4.37$ ) with no significant differences in the remaining test. **CONCLUSION:** Post-season mean plasma 25(OH)D concentration was significantly lower than mid-season. This could be explained by significantly reduced intake of vitamin D supplements post-season. PPT scores improved significantly in two of four tests in the post-season suggesting that 25(OH)D may not necessarily be linked to cognitive function measured with PPT. However, mean 25(OH)D concentrations from both mid- and post-season fell below the Institute of Medicine's definition of "deficient" suggesting that subjects' improvement on PPT may have been attributable to another factor or factors such as reduced stress levels.

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857 Board #36 May 31 2:00 PM - 3:30 PM  
**The Effects of Self-selected Music as a Diverting Activity Between Two Bouts of Fatiguing Isokinetic Leg Extensions**

Vanessa M. Rojo, Gloria H. Moon, Jared W. Coburn, FACSM, Lee E. Brown, FACSM, Pablo B. Costa. *Cal State Fullerton, Fullerton, CA.* (Sponsor: Jared W. Coburn, FACSM)  
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Previous studies have shown music's ability to act as an ergogenic aid. However, there is limited research investigating the effects of music as a diverting activity in fatiguing exercise protocols. **PURPOSE:** To investigate the effects of listening to music as a diverting recovery intervention on peak torque and percent torque decline.

**METHODS:** Thirty-nine recreationally trained men ( $n = 18$ ;  $22.3 \pm 2.7$  y;  $177.6 \pm 8.8$  cm;  $80.7 \pm 10.0$  kg) and women ( $n = 21$ ;  $22.2 \pm 1.7$  y;  $162.2 \pm 5.2$  cm;  $62.6 \pm 9.9$  kg) performed 4 experimental visits consisting of 2 bouts of 50 maximal isokinetic leg extensions at  $180^\circ\cdot\text{s}^{-1}$ . Between each bout of maximal exercise, 2 minutes of recovery involving one of the 4 interventions (no music, white noise, self-selected slow tempo music, and self-selected fast tempo music) was completed. Torque values were collected during the pre-intervention and post-intervention maximal isokinetic strength tests. Percent torque decline was calculated for both the first and second set of 50 repetitions.

**RESULTS:** There were no significant ( $p > 0.05$ ) 3-way interactions for peak torque or percent torque decline. There was a significant 2-way (time × sex) interaction ( $p < 0.05$ ) for peak torque. The decrease in peak torque from the pre-intervention test to

the post-intervention test was significantly greater for men (pre = 138.1 ± 3.68 Nm; post = 127.4 ± 3.2 Nm) than for women (pre = 84.7 ± 3.4 Nm; post = 80.4 ± 2.9 Nm), regardless of intervention. There was a significant main effect ( $p < 0.05$ ) for percent torque decline, where the torque decline was greater for the post-intervention test (45.8 ± 1.2%) than the pre-intervention test (43.2 ± 1.3%). There were no significant interactions or main effects involving diverting conditions ( $p > 0.05$ ).

**CONCLUSIONS:** These findings indicate that listening to self-selected music, slow or fast tempo, was not an effective diverting activity.

## B-61 Free Communication/Poster - Activity Interventions and Programming in Adults II

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

### 858 Board #37 May 31 3:30 PM - 5:00 PM How Sociodemographic Characteristics Of Activity Monitor Users Relate To Device Use And Perceived Physical Activity.

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Wearable activity monitors (AM) have been well accepted in some randomized controlled trials and have contributed to an increase in levels of physical activity (PA) in some, but not all participants. The sociodemographic profiles of users may be associated with the length of time (number of months) they wear the device, and how they perceive it impacts their PA behavior.

**PURPOSE:** To assess whether sociodemographic characteristics of AM users are related to 1) duration of device use, and 2) perceived changes in PA behavior.  
**METHODS:** Current (n=1355) and former (n=590) AM users from across the United States were recruited online and completed a web-based survey. Sociodemographics, health information, and AM use were queried. Moderate to vigorous PA (MVPA) score was calculated using the Godin Leisure Time PA Questionnaire. Respondents also reported how AM use influenced their PA. Descriptive statistics are reported as medians, means ± standard deviations, and frequencies. AM users were categorized based on the median use time: AM use for > 6 months or ≤ 6 months. Age, income and MPVA score were categorized by quartiles. Chi-squared analyses were used to compare groups for all categorical variables.

**RESULTS:** Respondents were 18-81 years old (33.0 ± 12.2) with 73.1% women. A majority were current AM users (69.7%) and BMI was 26.7 ± 6.6. The number of months of AM use among current users was 10.1 ± 11.6, and 6.8 ± 6.4 among former users. Age ( $\chi^2(3)=38.8$ ), income ( $\chi^2(3)=22.0$ ), MVPA ( $\chi^2(3)=22.4$ ) and relationship status (partnered vs single;  $\chi^2(1)=14.7$ ) were all significantly different across the device-use categories ( $p < 0.001$ ). A majority of current (76%) and former (53.2%) users perceived that the AM contributed to increased PA. Across all respondents, purchasing an AM themselves, as opposed to receiving it as a gift, was associated with a perceived increase in PA after device use ( $p < 0.05$ ).

**CONCLUSION:** Duration of activity monitor use was associated with the sociodemographic characteristics of users, with a majority perceiving an increase in their physical activity as a result of use. This supports the need for further research to explore how sociodemographic data can be used to tailor interventions to specific populations using technology-based objective monitoring.

### 859 Board #38 May 31 3:30 PM - 5:00 PM Predictive Indicators of Early Fitness Club Membership Termination in Japan: A Cohort Study

Nobumasa Kikuga<sup>1</sup>, Susumu S. Sawada, FACSM<sup>2</sup>, Munehiro Matsushita<sup>3</sup>, Yuko Gando<sup>2</sup>, Natsumi Watanabe<sup>4</sup>, Yuko Hashimoto<sup>4</sup>, Yoshio Nakata<sup>5</sup>, Robert A. Sloan<sup>6</sup>, Steven N. Blair, FACSM<sup>7</sup>, Noritoshi Fukushima<sup>1</sup>, Shigeru Inoue<sup>1</sup>. <sup>1</sup>Tokyo Medical University, Tokyo, Japan. <sup>2</sup>National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. <sup>3</sup>Waseda University, Saitama, Japan. <sup>4</sup>Juntendo University, Tokyo, Japan. <sup>5</sup>University of Tsukuba, Ibaraki, Japan. <sup>6</sup>Kagoshima University, Kagoshima, Japan. <sup>7</sup>University of South Carolina, Columbia, SC.  
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Approximately 40% of fitness club members in Japan have been reported to opt for early termination (within one year) of their membership. Identifying common

indicators among members who choose early termination may allow for the development of prevention strategies. **PURPOSE:** Identifying the characteristics of those who opt for early termination via a cohort study. **METHODS:** Across 17 fitness clubs, members completed a self-report questionnaire at baseline and follow-up.

The survey included the following indicators 1) baseline characteristics; 2) purpose of membership; 3) health status; and 4) psychological factors (perceived benefit of exercise, perceived barriers to exercise, and exercise self-efficacy). Participants were followed to determine whether they terminated their memberships. Odds ratios (OR) and 95% confidence interval (95%CI) for the incidence of early termination adjusted for age and gender were obtained using a logistic regression model. **RESULTS:** There were 1,839 participants (average age 37.9 years, 520 males and 1319 females) were involved in this observational study. During the follow-up period (six months on average), 428 participants early terminated. For every five-year increase in age, the gender-adjusted OR (95% CI) was 0.91 (0.87-0.94) for early termination. Members that joined an fitness club to relieve stress had an adjusted OR of 1.33 (1.06-1.68) for early termination. Additionally, the participants who joined an fitness club to improve their health had an adjusted OR of 0.81 (0.65-1.01) for early termination. The participants who agreed with the statement "recognition of one's ability to others," had a higher adjusted OR for early termination 1.46 (1.11-1.91). Similarly, the participants who agreed with the statement "improve appearance" had a higher adjusted OR for early termination 1.33 (1.03-1.72).

**CONCLUSIONS:** The predictive indicators for early fitness club termination included young age, perceived exercise benefit for stress reduction, "recognition of one's ability by others" and "improve appearance". Lastly, perceived benefit of health improvement may prevent early termination.

### 860 Board #39 May 31 3:30 PM - 5:00 PM Presence of Master Plans Supportive of Active Living in U.S. Municipalities

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**PURPOSE:** Community planning documents can play an important role in promoting the design and maintenance of communities to support active living. This study estimates the prevalence (overall and by municipality characteristics) of (1) community wide planning documents and (2) inclusion of objectives within plans supportive of active living.

**METHODS:** Data from the 2014 National Survey of Community-Based Policy and Environmental Supports for Healthy Eating and Active Living (CBS HEAL) were analyzed. CBS HEAL collects data through a survey of local officials for a nationally representative sample of US municipalities with a population of at least 1000 people (n=2005 representing a 45% response rate). Prevalence of a comprehensive or general Plan, 3 specific plan types (land use, transportation, and bicycle or pedestrian (stand-alone or part of a general Plan)), and 3 objectives (implementing Complete Streets policies, promoting street connectivity, or encouraging mixed-use development) were analyzed using survey weights to create national estimates.

**RESULTS:** Overall, 64% of US municipalities in our sample had a comprehensive or general plan. Plan is types ranged from 76% for a land use plan to 48% for a bicycle/pedestrian plan and 46% for a transportation plan. 67% of municipalities with plans had an objective for encouraging mixed-use development, 54% for the promotion of street connectivity, and 37% for the implementation of a Complete Streets policy. Across all plan types, municipalities with a larger population, that were urban, located in the West, with a median college graduate education level and a lower poverty prevalence had a higher prevalence of plans than their counterparts. Among municipalities with a plan, similar patterns by municipality characteristics were observed for the presence of objectives with one exception, presence of objectives by poverty level did not differ significantly.

**CONCLUSIONS:** Helping communities, especially smaller or rural municipalities and those with lower median education levels, address issues related to the adoption and creation of planning documents supportive of active living can be an important step toward creating more walkable communities.

### 861 Board #40 May 31 3:30 PM - 5:00 PM Exercise Trials In Co-morbid Adults: A Missed Opportunity For Behavior Change?

Ashley B. Sanders, Adam R. Konopka, Jaime L. Laurin, Benjamin F. Miller, Karyn L. Hamilton, FACSM, Heather J. Leach. Colorado State University, Fort Collins, CO. (Sponsor: Karyn Hamilton, FACSM)  
(No relationships reported)

**PURPOSE:** Exercise (EX) trials in adults with co-morbid conditions such as type 2 diabetes offer an opportunity to address behavior changes needed to increase physical activity (PA) and improve long-term health. The aim of this study was to determine whether it was feasible to include a low-dose PA behavior change intervention in

an EX trial. **METHODS:** For the original EX trial, participants were randomized to one of four groups, to test the interactive effects of metformin and post-exercise ingestion of protein versus carbohydrate on mitochondrial protein synthesis, and the blunting effect of metformin on EX response. Participants were  $\geq 55$  years of age, had fasting glucose values  $\geq 100$  mg/dl, hemoglobin A1c 5.7-6.4%, two hour postprandial glucose 140-200 mg/dl, or a family history of type 2 diabetes. All participants received supervised EX sessions, three times per week for 12 weeks. For the behavior change intervention, participants were randomized to receive a one-hour PA counselling session, or not, held after completion of the 12 week EX intervention. The session was based on social-cognitive theory, and the primary goal was to increase post-intervention PA maintenance through discussion of PA benefits, PA goal setting, and identifying and overcoming PA barriers. Self-reported PA was measured using the International PA Questionnaire (IPAQ), pre, post and three-months after the EX intervention. **RESULTS:** There was no additional time burden for participants or the principal investigators of the original EX trial. Baseline, post-intervention PA questionnaires, and the counselling session were done while participants were in the laboratory doing their oral glucose tolerance test, and the follow-up PA questionnaire was completed by mail or online. PA questionnaire completion rates were high; 30/31 (96.7%) completed baseline, 100% (N=17) completed post-intervention PA questionnaire and counselling session (if randomized to receive it), and 7/8 (87.5%) have completed the three-month follow up PA questionnaire. **CONCLUSIONS:** Based on the high completion rates and no added time commitment, including behavior change strategies as part of an exercise trial is feasible. This trial is ongoing, and upon completion, effectiveness of the counselling session for increasing PA at three-month follow-up will be examined.

862 Board #41 May 31 3:30 PM - 5:00 PM  
**Effects Of Removing Electronic Devices From An Athletes' Sleeping Environment On Sleep And Anxiety**  
 Maddison J. Jones<sup>1</sup>, Brian Dawson<sup>1</sup>, Peter R. Eastwood<sup>1</sup>, Shona Halson<sup>2</sup>, Joanna Miller<sup>2</sup>, Ian C. Dunican<sup>1</sup>, Peter Peeling<sup>1</sup>. <sup>1</sup>The University of Western Australia, Crawley, Australia. <sup>2</sup>Australian Institute of Sport, Bruce, Australia.  
 (No relationships reported)

Studies have suggested that the light emitted from electronic devices can impair sleep. However, it is unclear whether removing electronic devices from the sleeping environment in the evening and overnight provides an extended sleep opportunity. **Purpose** To investigate the effects of removing electronic devices in the evening and overnight on measures of sleep and anxiety during a seven-night training camp. **Methods** Twenty-six water-polo athletes (12 males, 14 females, aged 17±1 y) attending a training camp were allocated to either a no-device group (no electronic devices could be used after dinner or overnight; ND) or a control group (unrestricted electronic device use; CON). Athletes in the ND group also completed a modified version of the Nomophobia Questionnaire (Yildirim, 2015), which measured anxiety related to being unable to use electronic devices. Sleep was monitored with wrist actigraphy in both groups. One-way ANOVA calculated between-group differences and repeated measures ANOVA calculated within-group differences across each night. Cohen's *d* effect sizes were calculated for anxiety scores. **Results** Athletes in the ND group went to bed earlier than those in the CON group on the first night of camp (21:40±0:48 h vs. 22:20±0:48 h;  $p=0.049$ ). Athletes in the ND group also spent longer in bed (520±41 min vs. 478±41 min;  $p=0.015$ ) and slept for longer (474±55 min vs. 433±41 min;  $p=0.044$ ) than the CON group on the first night. However, there were no differences between groups for any other nights. Electronic device-related anxiety in the ND group did not significantly change from the first (61±27) to the last night of the camp (49±18), although a moderate effect size for the change in scores over time ( $d=0.50$ ) suggested a trend towards decreased anxiety over time. **Conclusion** Removing electronic devices from athletes overnight resulted in sleep extension on the first night of the training camp. It is possible that the lack of differences between the two groups for the remaining six nights was due to athletes in the ND group seeking other means of delaying bedtime (e.g. by engaging in other activities). Future research is needed to better understand the effects of electronic device use in young adults and athletes, particularly in relation to evening electronic device use habits.

863 Board #42 May 31 3:30 PM - 5:00 PM  
**Effects of Sitting and Three Treadmill Desk Speeds on Cognitive Function, Typing Speed and Accuracy**  
 Rebecca R. Rogers, Alec Hulmes, Kinsey Sessions, Yifan Shen, Conner Siekmann, John K. Petrella, FACSM, Mallory R. Marshall. *Samford University, Birmingham, AL.*  
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 (No relationships reported)

Active workstations have become a common method of combating the prolonged sedentary setting of the workplace and potentially decrease the risk of chronic diseases and health conditions due to inactivity. However, there is no evidence to indicate an optimal treadmill speed to increase physical activity without compromising employee

productivity. **PURPOSE:** The purpose of this study was to determine whether four workstations including sitting, walking on a treadmill at 1.0 mph, 1.3 mph and 1.7 mph affect typing speed, typing accuracy, and cognitive function in college students. Additionally, this study aimed to determine optimal speed for treadmill desk users. **METHODS:** Forty college-age students (n=20 males, n=20 females) were recruited into the study. Participants completed a health history and informed consent. The university Institutional Review Board approved the study. Participants completed one counterbalanced trial with one cognitive test and one typing test at each of the four workstations with a two-minute break between each test and workstation. Each participant sat, walked at 1.0 mph, 1.3 mph and 1.7 mph while performing the Stroop test for cognitive function and a typing test to assess speed and accuracy. The order of the four workstations and order of the tests were randomized. **RESULTS:** No significant differences were found in the Stroop test for the percent correct for normal ( $p=0.277$ ) or interference responses ( $p=0.940$ ) or the average response time for normal ( $p=0.909$ ) or interference response time ( $p=0.808$ ) responses between the workstations. No significant differences in average type speed in words per minute ( $p=0.673$ ), the average error count ( $p=0.764$ ) or the average adjusted speed in words per minute ( $p=0.836$ ) for the typing tests at each workstation. **CONCLUSION:** Cognitive performance, typing speed and accuracy are not affected by sitting or walking on a treadmill desk. Data suggests cognition and typing productivity are not compromised by using a treadmill desk. Results indicate active workstation users are able to choose various walking speeds (1.0 mph, 1.3 mph and 1.7 mph) to minimize the sedentary nature of an occupational setting without concern of impaired workplace performance.

864 Board #43 May 31 3:30 PM - 5:00 PM  
**Immersive Cycling Environment Yields High Intensity Heart Rate Without High Perceived Effort In Novice Exercisers**  
 Jinger S. Gottschall<sup>1</sup>, Bryce Hastings<sup>2</sup>. <sup>1</sup>The Pennsylvania State University, University Park, PA. <sup>2</sup>University of Auckland, Auckland, New Zealand. (Sponsor: Larry Kenney, FACSM)  
**Reported Relationships:** J.S. Gottschall: Ownership Interest (Stocks, Bonds); FITOLOGY, LLC.

Exercise prescription is a multifaceted topic with the singular goal of defining a protocol that maximizes health and adherence. The ACSM guidelines reference previous results that there is an intensity threshold to continually improve fitness and reduce disease risk. The threshold for well-trained individuals is 95-100% max heart rate (HR) whereas the threshold for less-trained individuals is only 70-80% max to achieve the same benefits. Exercising at these intensities can be uncomfortable and unpleasant leading to low compliance. However, past research has demonstrated that engaging distractions such as an instructor, music, or digital images can enhance enjoyment while diminishing rate of perceived exertion (RPE). It is therefore possible that an instructor-guided workout with digital images synchronized to music could be the ideal combination to reach higher intensities with a lower perception of effort. **PURPOSE:** Our aim was to compare an audio (AUD; music only) environment with an immersive (IMM; music + digital images) environment during group fitness cycling classes in both well-trained and less-trained individuals. **METHODS:** To date, 6 elite participants (more than 10 hours PA/wk) and 6 novice (less than 2 hours PA/wk) completed 8 AUD and 8 IMM classes in 8 wks. Both class formats were approximately 40 minutes in duration with parallel strength and speed intervals led by an instructor. We collected HR (% time in 80-100% max zone) during each class and survey data (RPE, satisfaction, enjoyment) immediately after each class. **RESULTS:** For the elite participants, % time in the max zone and RPE were significantly greater during AUD (54 + 8%; 18 + 1) compared to IMM (46 + 9%; 15 + 2;  $p < 0.05$ ). In contrast, for the novice participants, RPE was significantly less during IMM (16 + 2) compared to AUD (18 + 1;  $p < 0.05$ ) while the % time in the max HR zone did not differ between the two conditions (AUD = 62 + 11%; IMM = 64 + 12%; all values mean + sd). Satisfaction ratings were high for both groups and both conditions, but the novice participants rated IMM as more enjoyable than AUD. **CONCLUSION:** Both AUD and IMM group fitness cycling formats are an ideal way to meet the exercise guidelines with high satisfaction. IMM may promote adherence in novice participants compared to AUD as HR intensity did not differ, RPE was less and enjoyment was greater.

865 Board #44 May 31 3:30 PM - 5:00 PM  
**Use Of Sit-To-Stand Workstations: Impact On Physical Activity**  
 Shiann Wickham, Catherine Patrick, Larissa Boyd, Melissa Powers. *University of Central Oklahoma, Edmond, OK.*  
 (No relationships reported)

**USE OF SIT-TO-STAND WORKSTATIONS: IMPACT ON PHYSICAL ACTIVITY**  
 Shiann Wickham, Catherine Patrick, Larissa Boyd, Melissa Powers University of Central Oklahoma, Edmond, Oklahoma  
 Prolonged sitting affects daily total physical activity. Standing in order to break long periods of sitting may be beneficial to an individual's health. **PURPOSE:** The purpose

of this pilot study was to determine whether physical activity would change when using a sit-to-stand workstation in a workplace environment. **METHOD:** Volunteers from the faculty of the University of Central Oklahoma included apparently healthy male and female adults ( $N = 11$ ,  $M = 39.09 \pm 10.445$  years). Participants were asked to use sit-to-stand workstations for a minimum of three hours per workday. The International Physical Activity Questionnaire (IPAQ) was used to measure self-reported daily physical activity. **RESULTS:** Dependent  $t$ -tests were used to analyze changes in self-reported physical activity over 5 months. Non-significant ( $p > .05$ ), meaningful improvements were seen in METmin/wk for walking ( $d = .19$ ), total physical activity ( $d = .14$ ), moderate activity ( $d = .01$ ), and vigorous activity ( $d = .02$ ). Total minutes of sit time per week ( $d = .25$ ) and average daily minutes sitting ( $d = .25$ ) decreased ( $p > .05$ ). **CONCLUSION:** Sit-to-stand workstations do provide an increase in daily physical activity levels. Although the results were non-significant, they do indicate a small decrease in time spent sitting along with small improvements in walking and total physical activity. Decreasing employee sitting time can increase the amount of physical activity achieved throughout the day. Future research should evaluate the use of sit-to-stand workstations in a larger, more diverse group of employees.

Table 1  
Paired  $t$ -test Comparisons of Subjectively Measured Physical Activity Before and After 5 Months of Sit-to-Stand Workstation Use

	Pre		Post		$t$	$p$
	M (SD)	95% CI	M (SD)	95% CI		
Walking (met·min·wk)	699.00 (537.72)	[337.75, 1060.25] [1309.37, 5356.99] [453.54, 2681.01] [347.88, 2335.76] [1348.25, 2889.94] [192.61, 412.85]	802.78 (626.05)	[382.19, 1223.36]	.50	.63
Total PA (met·min·wk)	3333.18 (908.30)		3764.32 (3491.25)	[1418.87, 6109.77]	-.63	.55
MPA (met·min·wk)	1567.27 (1657.81)		1590.91 (1303.82)	[714.99, 2466.83]	-.05	.96
VPA (met·min·wk)	1341.82 (1479.50)		1370.91 (2379.25)	[227.50, 2969.32]	-.07	.95
Weekly ST (min·wk)	2119.10 (1147.42)		1838.18 (618.48)	[1422.68, 2253.68]	.72	.49
Daily ST (min·d)	302.73 (163.92)		262.60 (88.36)	[203.34, 321.95]	.72	.49

Note. MET = metabolic equivalent; min. = minutes; wk. = week; d = day; PA = physical activity; MPA = moderate physical activity; VPA = vigorous physical activity; ST = sit time; SD = standard deviation; CI = confidence interval.

866 Board #45 May 31 3:30 PM - 5:00 PM

### Bicycling for Exercise Helps Maintain a Youthful Metabolic Cost of Walking in Older Adults

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(No relationships reported)

Impaired walking performance is a key determinant of morbidity among older adults. A distinctive characteristic of impaired walking performance among older adults is a greater metabolic cost compared to young adults. Specifically, healthy older adults have been shown to have a 15-20% greater metabolic cost of walking compared to young adults. However, a recent study suggests that older adults who routinely run for exercise have a lower metabolic cost of walking compared to older adults who walk for exercise. Yet, it remains unclear if other aerobic exercises such as bicycling elicits similar improvements on walking metabolic cost among older adults. **PURPOSE:** To determine if regular bicycling exercise affects metabolic cost of walking in older adults. To our knowledge, there has been no research looking at metabolic cost of walking in older adults who bicycle for exercise. **METHODS:** 13 young adults ( $23 \pm 2$  years), 16 "older walkers" ( $71 \pm 5$  years) who walk  $\geq 30$  min, 3x/week, and 17 "older bicyclists" ( $68 \pm 3$  years) who bicycle  $\geq 30$  min, 3x/week, walked on a level treadmill at four speeds (0.75, 1.25, 1.60, and 1.75 m/s). Using an open circuit expired gas analysis, we measured  $\dot{V}O_2$  and  $\dot{V}CO_2$  in the last 2 minutes of each 6 minute trial to determine metabolic cost (J/kg/s). We compared metabolic cost in the three groups. **RESULTS:** Across the range of walking speeds, older bicyclists had a 9-17% lower

metabolic cost of walking compared to older walkers ( $3.24 \pm 0.14$  vs.  $3.80 \pm 0.16$  J/kg/s, respectively;  $p = .006$ ) and similar metabolic cost of walking compared to young adults ( $p = .973$ ).

**CONCLUSIONS:** Bicycling exercise mitigates the age-related deterioration of walking metabolic cost, whereas walking for exercise appears to have a minimal effect on improving metabolic cost of walking in older adults. We suspect the greater aerobic intensity of bicycling exercise may maintain muscle mitochondrial efficiency in aging and thus helps explain the lower metabolic cost of walking in older bicyclists versus older walkers.

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867 Board #46 May 31 3:30 PM - 5:00 PM

### Exergaming Intervention in Sedentary Middle-Aged Adults Improves Lower Extremity Functional Fitness and Exercise Self-Efficacy

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Interactive video game technology has been extensively utilized in rehabilitative settings. However, few studies have explored the potential benefits of interactive video games as a within-the-home exercise instrument for middle-aged adults who do not have a gym membership or who otherwise cannot regularly make it to their local fitness center. Features of interactive "exergaming" (modeling proper exercise biomechanics, increasing self-monitoring of behavior, encouraging participants to set health-related goals, and rewarding regular use) may help increase self-efficacy (SE), which in turn could promote physical activity and functional fitness (FF).

**PURPOSE:** To compare FF and SE in relation to exercise tests and self-reported questionnaires in sedentary men and women before and after regularly participating in interactive video game play ( $n = 12$ ,  $56 \pm 4$  yrs,  $162.1 \pm 10.9$  cm,  $79.2 \pm 19.1$  kg,  $39.6 \pm 7.7\%$  fat mass).

**METHODS:** All subjects were initially screened and underwent a battery of FF tests and SE questionnaires. Subsequent observations took place in a monitored laboratory setting where subjects engaged in self-selected, low- to moderate-intensity exergaming involving aerobic, resistance, flexibility, or neuromotor training for 20 min/3d/wk between August 2015 and June 2016. After 8 weeks, FF and SE were retested.

**RESULTS:** Exercise using interactive video game technology significantly increased 30-second Sit-To-Stand repetitions ( $14.2 - 16.8$ ,  $p < 0.05$ ). Additionally, all participants reported with 100% confidence they would continue to exercise for at least 20 min/3d/wk for up to 8wks post-study if they owned an interactive video game system within their home.

**CONCLUSIONS:** Exergaming improved lower extremity functional strength and endurance as well as participants' confidence in their ability to continue exercising beyond this study in previously sedentary middle-aged adults. Interactive video game systems should be considered a viable option for convenient, enjoyable, within-the-home exercise programs to assist individuals in meeting ACSM physical activity guidelines.

868 Board #47 May 31 3:30 PM - 5:00 PM

### Association between Increased Activity and Wellbeing under Weight Stable Conditions

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(No relationships reported)

The increasing prevalence of physically inactive adults within the United States continues to be a health burden, as inactivity is linked to several non-communicable diseases. Even modest increases in activity can improve health benefits, even without weight loss. However, little is known about the psychosocial outcomes of exercise in weight stable conditions.

**PURPOSE:** The purpose of this research is to evaluate the effects of time spent in aerobic activity on self-reported psychosocial outcomes in previously sedentary young adults when weight is maintained.

**METHODS:** 65 previously sedentary overweight/obese adults ( $54\%$  male,  $31.3 \pm 7.3$  years), were randomized into a high flux (35 kcal/kg/week) or low flux (17.5 kcal/kg/week) exercise group for a 6-month aerobic intervention. All sessions were on site and consisted of 3-5 sessions per week for approximately 1 hour (dependent on body weight). Additionally, weight maintenance ( $\pm 3\%$ ) was required for the entire 6 months. Exercise trainers monitored heart rate (HR) every 5 minutes to ensure intensity

between 70-75% of maximal HR and all sessions were timed and recorded. To evaluate wellbeing, participants completed assessments relating to mood (POMS) and health status (SF-36) at baseline and at intervention completion.

**RESULTS:** The average exercise time in the high (n=32) and low (n=33) flux group was 220.0 ± 54.6 minutes and 155.9 ± 28.6 minutes per week, respectively. Quintiles were created based off average time per week of aerobic exercise (±SD) (mean values for least time to most time: 137.3 ± 19.2, 175.6 ± 8.8, 249.4 ± 39.4 minutes). There was a linear trend (p for trend < .05) across quintiles for SF-36 (Role Emotional) subscale for time spent in routine activities due to emotional wellbeing, after adjusting for age and sex. No other significance was seen across the 6-month psychosocial wellbeing assessments.

**CONCLUSION:** These results indicate that an increase in time spent exercising will allow for less time spent in routine tasks due to emotional wellbeing. No other significance was found within the POMS or SF-36 evaluations. While these results are consistent with previous findings, more research is necessary to determine if exercise duration contributes to spending less time on daily activities in weight stable adults.

869 Board #48 May 31 3:30 PM - 5:00 PM  
**Physical Activity of Parents and Children Playing Together and the Effects of Varying Structured Activity**

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(No relationships reported)

Parents are key for promoting physical activity (PA) in children. Family Gym provides a free, 90 minute weekly opportunity for families with young children (ages 3-8) to be active together. Family Gym is located in a community center in a Boston, MA low-income, minority neighborhood.

**PURPOSE:** To examine the PA levels of parents and children during Family Gym sessions and to determine the effect of varying lengths of structured activity sessions for parents and children.

**METHODS:** Twelve children (4.8 ± 1.9 yrs) and their parents (27.2 ± 9.4 yrs) participated in group sessions which included free play followed by staff structured activities that were either short (S) (n = 8, averaging 4.4 ± 1.4 minutes per session) or extended (E) (n = 9, averaging 18.9 ± 3.5 minutes per session) in duration. PA levels of each participant were measured using an Actigraph GT9X accelerometer worn at the waist. Percent of time spent in sedentary behaviors (%sed), and in light (%LPA), and in moderate-to-vigorous (%MVPA) PA were estimated using the Troiano cut points for parents, using Pate cut points for children 3 to 5 yrs, and Puyau cut points for children 6 to 8 yrs. Paired t-tests were used to test for differences in PA levels in S versus E sessions. Independent t-tests were used to compare PA between parents and children.

**RESULTS:** Parents and children did not differ in %sed (p>.05). Compared to children, parents had significantly more %LPA during the S and E sessions (parents, 69.0 ± 10.5 and 63.3 ± 15.5 vs. children, 33.4 ± 23.1 and 30.1 ± 19.5, respectively; p<.05) and less %MVPA (parents, 16.3 ± 6.8 and 10.8 ± 4.9 vs. children, 56.0 ± 24.2 and 57.6 ± 25.7, respectively; p<.05). Parents had less %MVPA in E versus S sessions (10.8 ± 4.9 vs 16.3 ± 6.8, respectively; p = 0.036) while there was no difference between the E and S sessions for %sed (E, 24.1 ± 14.5 vs. S, 14.2 ± 10.4; p = 0.215) or %LPA (E, 63.3 ± 15.5 vs. S, 69.0 ± 10.5; p = 0.421). There were no differences between E and S sessions for children's %sed, %LPA, and %MVPA.

**CONCLUSIONS:** Parents are not as active as their children in an open play environment. However, open play appears to be as effective as structured activity for increasing %MVPA in children. Organized but unstructured programming is needed to increase PA in parents in group play settings with their children.

Funded by the Creative Economy Initiatives Fund, UMass

870 Board #49 May 31 3:30 PM - 5:00 PM  
**Exergaming Intervention in Sedentary Individuals Improves Attitudes Towards Exercise and General Health**

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(No relationships reported)

Interactive video game technology has been utilized in rehabilitative settings. However, research is limited in its possible role as a within-the-home exercise instrument for those who do not have a gym membership, or who otherwise cannot regularly make it to their local fitness center. **PURPOSE:** To compare quality of life and emotional well being before and after eight weeks of exercise using interactive

video game technology in sedentary community members. **METHODS:** 12 Sedentary, middle-aged men and women (56±4 years, 162.0±10.9 cm, 79.2±19.1 kg, % fat mass 39.6±7.7%) exercised under monitored conditions using interactive video game technology at a low to moderate intensity level for 20 minutes a day, three days a week for eight weeks. Participants were allowed to choose which activities they participated in each visit. The SF-36 questionnaire for assessing general health was administered before and after the intervention. Participants took a Subjective Exercise Experience Survey (SEES) with a scale ranging from 1 (not at all), 4 (moderately) to 7 (very much so) after the completion of the study. **RESULTS:** Self-reported SF-36 physical functioning scores approached significance (84.6 before to 90.4 after, p < 0.08) after eight weeks of exercise. Review of the SEES taken after an exergaming session at the end of the study showed that after exergaming subjects felt slightly tired, but not at all drained. They also reported feeling positive and not at all discouraged post exercise. **CONCLUSION:** Virtual gaming platforms may be utilized by sedentary community members in place of regular physical activity. Eight weeks of exergaming might improve physical functioning and have a positive effect on sedentary individuals attitudes toward exercise and general health. Supported by Departmental Funds.

871 Board #50 May 31 3:30 PM - 5:00 PM  
**Comparing The Effects Of Intrinsic And Extrinsic Motivational Support On Physical Activity Level During Exercise**

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Exercise plays an important role in health maintenance; however, it is unclear what the best motivation is for maintaining a long-term exercise plan. **PURPOSE:** To examine the effects of intrinsic and extrinsic motivational support programs on physical activity levels in older Japanese subjects.

**METHODS:** Forty-one older subjects (age, 73.2 ± 7.3 years; body mass index, 26.9 ± 3.2; male, n = 17; female, n = 24) were randomly assigned to an intrinsic motivational support (IMS) or an extrinsic motivational support (EMS) group. Both groups participated in a 12-week exercise program that met once a week. Each 60-min exercise session included warm-up period, dual-task "square-step", and cool-down period. Subjects in the EMS group were given a monetary reward (JPY500=US\$5) every week if they achieved each target values of average daily step counts during 7 days between sessions. Subjects in the IMS group received a program that was designed using a self-determination theory to enhance competence, self-determination, and relatedness. The motivations to exercise were assessed by a questionnaire (BREQ-2) and the amount of physical activity was measured by a three-axis accelerometer before and after the program. BREQ-2 evaluates five types of motivations to exercise (i.e., amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation).

**RESULTS:** Moderate-to-vigorous physical activity (MVPA) was defined as 77.0 ± 28.4 min at baseline and 86.4 ± 37.0 min at post in the IMS group and 72.4 ± 33.3 min at baseline and 96.7 ± 39.0 min at post in the EMS group. No significant time x group interaction was found in the MVPA values. In the IMS group, there was a significant trend (P = 0.08) in the score for intrinsic regulation to exercise (15.0 ± 2.7 points at baseline, 16.0 ± 2.0 points at post). In total subjects, the amount of physical activity was not significantly correlated with any of the five types of intrinsic motivations for exercise.

**CONCLUSIONS:** These results suggest that the exercise program with intrinsic motivational support and extrinsic motivational support both enhanced physical activity level in study participants and that effectiveness did not differ between the two programs. This research was designed to examine 1-year follow-up test for these legacy effects.

872 Board #51 May 31 3:30 PM - 5:00 PM  
**Association between Physical Activity and Weight Loss: Mediation Effects of Dietary Restraint and Disinhibition**

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The complex relationship between eating behaviors and physical activity, and their effects on weight loss, is not well understood.

**PURPOSE:** To examine the indirect effects of moderate-to-vigorous physical activity (MVPA) on weight loss through changes in eating behaviors (dietary restraint and disinhibition) in response to a behavioral weight loss intervention (BWL).

**METHODS:** Subjects (n=221; 42.8±9.2 years; BMI=32.7kg/m<sup>2</sup>±3.6) with complete data were included in this secondary mediation analysis. The 18-month BWL included prescribed energy intake of 1200-1500kcal/d and MVPA to 300min/wk. Weight, Restraint (flexible (FR), rigid (RR)), Disinhibition (internal (ID), external (ED)) and MVPA were assessed at 0, 6, and 18 months. Restraint and Disinhibition were measured by questionnaire. Objective MVPA was defined as bouts >10 min in duration and >3.0 METs.

**RESULTS:** Weight decreased [6mo:-9.07±6.26kg; 18mo:-8.1±8.5 kg] and MVPA increased [6mo: 673.9±1199.1 MET-min/wk; 18mo: 428.6±101.4 MET-min/wk](p<0.001). RR [6mo:2.85±1.89; 18mo:2.50±1.94] and FR [6mo:2.13±1.76; 18mo: 1.73±1.73] increased and ID [6mo:-2.41±3.11; 18mo:-1.74±3.25] and ED [6mo:-1.05±1.65; 18mo:-0.82±1.59] decreased over time. Change in FR and ID, but not RR or ED, partially mediated the effect of MVPA on weight loss at 6 months. At 18 months, change in FR, RR, and ID, but not ED, partially mediated the effect of MVPA on weight loss.

**CONCLUSIONS:** The influence of MVPA on weight loss may be partially explained by improvements in eating behaviors. Interventions designed to focus on changing these specific eating behaviors in combination with MVPA may improve weight loss in adults with obesity.

<i>Mediator Analyses: Effect of Eating Behavior Changes on the Association Between Change in PA and Weight Loss</i>		
<i>Mediators:</i>	<i>Baseline to 6 months Indirect Effect (95% CI)</i>	<i>Baseline to 18 Months Indirect Effect (95% CI)</i>
Δ Flexible Restraint	(-0.3857, -0.0338)*	(-0.7386, -0.0957)*
Δ Rigid Restraint	(-0.2110, 0.0457)	(-0.7464, -0.1408)*
Δ Internal Disinhibition	(-0.3856, -0.0442)*	(-1.1561, -0.2469)*
Δ External Disinhibition	(-0.1691, 0.0196)	(-0.2185, 0.2031)

\*indicates significance

Supported by NIH (HL008840)

873 Board #52 May 31 3:30 PM - 5:00 PM

### Using Focus Groups To Culturally Tailor A Diabetes Intervention In A Pacific Northwest Tribal Reservation

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**BACKGROUND:** Despite having many health programs available, native men on the Colville Indian Reservation do not regularly participate.

**PURPOSE:** This qualitative study was designed to gain an understanding of how to effectively recruit and retain American Indian men in a Diabetes Prevention Study.

**METHODS:** Before recruitment, IRB approval was received from Washington State University and the Colville Tribes. Forty participants (31 males, 9 females) volunteered for five focus groups held in Omak, Nespelem, Keller and Inchelium. Verbal permission was given by participants for audio taping the discussion. Each participant completed a survey prior to the focus group to gather additional data related to diet and exercise. No identifying information was collected on the survey or in the focus groups. Questions elicited opinions about nutrition, physical activity (PA) and culture related to participation in a healthy lifestyle program, including perceived obstacles to participation. Participants were also asked whether their emotional state, including stress, trauma, historical trauma and depression may influence their decisions to participate in the program and in making personal health decisions. Dinner was served at each focus group and all received two \$25.00 Walmart gift cards.

**RESULTS:** Participants identified a lack of quality produce at local grocery stores as a primary reason for poor eating habits. The men reported that they did not like to shop or cook, but thought recipes and video demonstrations would be helpful. Everyone thought inter-community competition would be motivation to increase PA and decrease weight. They recommended using native cultural activities in the program i.e., traditional dancing, hunting, fishing and gathering roots and berries to increase relevance. Obstacles identified included their emotional state, weather and seasons, as well as a lack of facilities and time.

**CONCLUSIONS:** Changing our intervention based on these suggestions is the next step. A secondary benefit mentioned in the focus groups is using cultural activities to encourage men, which will also keep those activities alive for the youth in the tribe. Colville tribal men do have an interest in their health and would like to participate in our program if we make it culturally-based and at a time that is convenient.

874 Board #53 May 31 3:30 PM - 5:00 PM

### Factors that Associate With Better Exercise Compliance in Mobile App Based Program: The Virtual Trainer Project

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Exercise-related mobile apps and wearable movement detection devices have become popular tools for active lifestyle promotion. Behavioral modification theories such as goal setting, stimulus control, incentive scheme, and self-determination theory could be easily integrated into mobile apps program design so as to make these exercise motivational strategies more interesting and appealing. Limited studies have evaluated these strategies for promoting better exercise compliance. **PURPOSE** To evaluate factors that contribute to a better exercise compliance in a mobile-app based exercise promotion program called the Virtual Trainer (VT) project. **METHODS** A VT mobile app that integrated various lifestyle modification theories, such as goal setting (exercise prescription module), know-how (educational materials dissemination), stimulus control (constant exercise reminding messages and health tips), incentive (exercise credit-points accumulated for prize redemption), feedback system (online health & fitness assessment), and self-determination theories (personalized exercise training scheduling), was designed and prescribed to 126 Chinese adults (age=20.98 +/- 5.35 yrs.) for a 8-12 weeks exercise intervention program. Exercise compliance was computed from ratio of completed exercise session that recorded from the VT system against planned exercise session at the beginning. At end of intervention a questionnaire was completed by participants to report ratings that they perceived as useful for encouraging exercise participation. Responses were compared between the high compliance group (100% compliance) and low compliance group (<70% compliance). **RESULTS** High compliance group accounted for 67% of total whereas low compliance group 15%. Mean compliance rate for low compliance group was 44.9%. Regarding VT built-in psychological factors the high compliance group reported significantly higher rating in educational contents (p<.01), feedback system (p<.05), stimulus control (p<.05), whereas other factors were not different between groups. **CONCLUSION** Among various behavioral modification theories the stimulus control, know-how, and feedback system are more effective strategies in promoting exercise compliance when integrated with mobile technology.

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### Exergaming by Sedentary Middle-Aged Adults Did Not Alter Self-Reported Dietary Intake and Physical Activity

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Self-regulation and self-control is a critical consideration to ensure the cogency of the final result in long-term, exercise-related studies since they act as confounding variables that can impact the outcome. Although researchers inform subjects to maintain unwavering lifestyle habits during an experiment, sedentary older people who barely focused on healthy dietary intake and exercise tend to alter their eating and exercise habits due to health awareness evoked by the research experiment.

**PURPOSE:** To investigate the change in dietary nutrients and physical activity after sedentary middle-aged adults have participated in regular, consistent exergaming.

**METHODS:** 12 sedentary, middle-aged men and women (56±3.6 years, 162.0±10.9 cm, 79.2±19.1 kg, % fat mass 39.6±7.7 %) used interactive exercise exergaming under monitored conditions at a low to moderate intensity level with self-selected exercises for 20 minutes a day, 3 days a week for 8 weeks. A three-day diet record was used to assess dietary intake and the Yale Physical Activity Survey (YPAS) to estimate energy expenditure and to document the frequency and intensity of various activities before and after the study for each subject.

**RESULTS:** No significant differences were found between before and after the exercise intervention for total energy intake or any dietary nutrient. The only variable in the YPAS analysis to change was the standing score which significantly increased after exergaming (5.00-7.33, p<0.05). However, total energy expenditure per day (p=0.10) as well as the activity dimension index (p=0.12) did not change.

**CONCLUSION:** Dietary intake and overall physical activity did not change. This indicates a strong control for confounding variables, which can impact final results besides the exercise due to exergaming. The increase in standing score suggests that participation in exergaming can lead to more awareness for healthier lifestyle habits.

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**Myplate Enhances Physical Activity Along With Nutritional Knowledge In College Students: A Pilot Study**

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**Purpose:** The objective of this study was to investigate whether MyPlate, used as a nutritional assessment and an educational platform, can improve nutritional knowledge, eating attitudes and physical activity levels compared to food records. **Methods:** One hundred twenty university students (18-22 years old) with a normal Body Mass Index (BMI) were recruited and randomly yet equally assigned into one of three groups after signing an IRB approved informed. The groups were: MyPlate group (MG), food records group (FG), and control group (CG). All participants attended two nutritional seminars and completed a modified and validated general nutrition knowledge questionnaire (GNKQ), Eating attitude test (EAT-26) at the beginning and the end of the 4-week study period. A detailed exercise log was also obtained from each participant for the entire period of study. **Results:** Participants in the MG group showed a significant improvements in their nutritional knowledge ( $p < 0.05$ ), eating attitude ( $p < 0.05$ ) and physical activity ( $p < 0.05$ ) compared with other groups. Vegetable consumption elevated from start to finish in the MG ( $p < 0.05$ ) along with a trend towards elevated wholegrain consumption. Males tended to show a more positive eating behavior compared with females in all groups. No significant differences were observed in eating attitude, and physical activity in FG compared with CG. **Conclusion:** MyPlate appears to be an effective tool to improve physical activity, nutritional knowledge and promote positive eating behaviors and therefore wellness.

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**Comparison of Mindful and Slow Eating Strategies on Acute Energy Intake**Anna Peluso<sup>1</sup>, Kelliann K. Davis, FACSM<sup>2</sup>, Bethany Barone Gibbs<sup>2</sup>, Elizabeth M. Venditti<sup>2</sup>, John M. Jakicic, FACSM<sup>2</sup>. <sup>1</sup>Greensboro College, Greensboro, NC. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. (Sponsor: Kelliann K. Davis, FACSM)

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**Purpose:** Mindfulness and slow eating techniques are commonly recommended to aid in weight loss within behavioral weight management programs; yet, the role of these eating strategies on acute energy intake (EI) and satiety are not clear. The purpose of this study was to investigate the effects of mindful and slow eating strategies on acute EI and satiety.

**Methods:** 24 subjects (median BMI: 29.1 (24.3 – 36.7), median age: 24.0 (21.0 – 31.8)) were randomized to one of three eating conditions (EAT, SLOW, or MIND). For the EAT condition, subjects were instructed to eat as they normally would for both test meal sessions. For the SLOW condition, subjects were instructed to eat as they normally would for their first test meal session and to slow their eating for their second test meal session. For the MIND condition, subjects were instructed to eat as they normally would during their first test meal session and were given brief instructions on mindful eating for their second test meal session. For each condition, subjects were provided ad-libitum access to a test meal and EI was calculated based upon food consumed during this period. Subjects rated their level of satiety following each meal. **Results:** There were no significant differences in EI between eating strategy conditions (EAT: 848 (704-1071) kcals, MIND: 673 (485- 846) kcals, SLOW: 756 (611-1076) kcals) ( $p = 0.786$ ). There was a trend toward a decrease in energy intake in the MIND condition (mean change in energy intake:  $-64.4 \pm 178.4$  kcals) compared with the EAT (mean change in energy intake:  $98.3 \pm 169.6$  kcals) condition and a prevention of increased intake in the SLOW (mean change in energy intake:  $2.6 \pm 107.9$  kcals) condition ( $p = 0.133$ ). There were no significant differences in ratings of satiety between conditions.

**Conclusion:** Neither mindful nor slow eating strategies significantly decreased acute EI or satiety, although a decrease in EI achieved through a brief mindfulness practice and prevention of increased intake through slow eating may be clinically meaningful for weight management. Future studies should aim to investigate the potential benefits of slow eating and mindfulness for weight management.

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**Adherence-related Psycho-perceptual Responses To High-intensity Interval Training In Physically Inactive Middle-aged Adults**

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(No relationships reported)

High-intensity interval training (HIIT) has recently been advocated as a time efficient alternative to traditional continuous exercise for combating physical inactivity related morbidities. Previous studies have demonstrated the physiological health benefits of HIIT, but relatively little is known about the adherence related psycho-perceptual responses to this form of exercise in physically inactive individuals. **PURPOSE:** To compare the adherence-related psycho-perceptual responses after a single session of HIIT versus moderate-intensity continuous exercise (MICE) and vigorous-intensity continuous exercise (VICE) in physically inactive middle-aged adults. **METHODS:** Using a repeated measures randomized cross over design, twelve middle-aged apparently healthy physically inactive males (mean age:  $46.8 \pm 7.5$  years; BMI:  $23.4 \pm 2.1$  kg m<sup>-2</sup>;  $VO_{2max}$ :  $39.5 \pm 5.6$  mL kg<sup>-1</sup> min<sup>-1</sup>) undertook three main trials (7-days apart) consisting of: HIIT (10 x 1-min run at 100%  $VO_{2max}$  interspersed with 1-min active recovery at 50%  $VO_{2max}$ ), MICE (40-min run at 65%  $VO_{2max}$ ) and VICE (20-min run at 80%  $VO_{2max}$ ). Participants' adherence-related psycho-perceptual responses including: (i) Self-efficacy assessed via a 5-item task-specific questionnaire; (ii) Perceived enjoyment responses measured via the Physical Activity Enjoyment Scale (PACES) and (iii) exercise modality preference were assessed upon completion of the trials. [hg1] One-way repeated measures ANOVA was used to identify within-subject differences. Pairwise comparison was conducted with LSD corrections. **RESULTS:** There was a significant main effect between the trials. Participants displayed significantly lower exercise task self-efficacy scores towards HIIT ( $42.7 \pm 25.3$ ) and VICE ( $49.2 \pm 23.9$ ) than MICE ( $63.4 \pm 18.3$ , both  $P < 0.01$ ) based upon pairwise comparison. Additionally, only 17% of participants (2 out of 12) reported a preference to engage in HIIT as opposed to either MICE and VICE. No significant difference was found for perceived enjoyment responses between the trials. **CONCLUSION:** Our finding suggests that HIIT does not promote self-efficacy and may not be an adherable exercise strategy for health promotion in physically inactive middle-aged individuals. Future research examining the long-term adherence to HIIT in this population is warranted.

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**Social Impact Bonds - Applicability In Preventive Medicine**

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(No relationships reported)

Social impact bonds (SIBs) are a relatively new financial model which suggests the entry of private investors into the public sector, in fields which are under the responsibility of government establishments. The private investor goal is to initiate a social program agreed upon together with the government. The investor will receive payment only according to the program's success in achieving its objectives. The growing rate in obesity and related chronic diseases calls for new creative and innovative solutions. **PURPOSE:** To assess the applicability of SIB in preventive medicine and health promotion programs. **METHODS:** Reviewing of all the available academic and governmental publications on existing SIBs and analyzing the reasons for their success and failure. **RESULTS:** Sixty SIBs were launched between 2010-2016 in 15 countries mainly UK, USA, Australia, and Israel focusing on issues of: education, prisoners' rehabilitation, unemployment, health and family care. Out of 22 projects whose data has been delivered, 21 show a very positive outcome. The first SIB ever launched was to reduce recidivism. The project matured in 2016 was declared a success and returned in full the investors' capital. **CONCLUSIONS:** The SIB is a novel model that has the potential to make a dramatic change in the strategy of funding health promotion programs (e.g., obesity epidemic). The model is applicable in preventive medicine and health promotion programs given that a clear and fair contract is signed between the public authority and the private investor. To note, SIBs can be a primary catalyzer in health promotion programs, but cannot substitute government's responsibility for permanent solutions.

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**Health Promotion Intervention On Rural Roads In Sweden - A Case Study Of Cycling Safety**Ruggero L. Ceci<sup>1</sup>, Christopher J. Patten<sup>2</sup>. <sup>1</sup>Swedish Transport Administration, Stockholm, Sweden. <sup>2</sup>Swedish National Road and Transport Research Institute, Borlänge, Sweden. (Sponsor: Christopher Dunbar, FACSM)

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**PURPOSE:** In Sweden, as well as in many countries in Scandinavia and in northern Europe, there is a growing trend to allocate the daily exercise routines to cycling and walking in the form of work commuting. This has led to an increase of bikers with light race bikes and garment for race bike training along the roads and streets of major cities like Stockholm and Gothenburg and elsewhere. The health gained from this new trend is of course an important factor to consider and the Swedish authorities, cycling organizations and researchers are actively engaged in the development and evaluation of this health trend. One crucial factor in this development is the safety of the bikers on the public roads with mixed traffic. A cyclist is often overtaken by cars and other vehicles and does not have control over the distance between them and the other vehicles. However, if the cyclist had control over the distance between themselves and the motor vehicle/object, how much space would they give themselves? To investigate how road safety factors such as proximity to vehicles passing the bikers on a rural roads a study was conducted.

**METHODS:** The experiment was conducted in an indoor athletics arena at Lugnet stadium in Falun where 48 participants were assigned to one of three groups. Group one with a balanced order of the object-proximity variable ( $n = 24$ ); group two with the object-proximity variable ordered closest first and moving outward from the track ( $n = 12$ ); and group three with object-proximity variable ordered furthest away first and moving inward towards the track ( $n = 12$ ). The participants were donned with a bicycle helmet with a GoPro camera, a second camera was attached to the handlebars. Independent variables were object proximity to the bicycle lane (cm) measured from the center of the lane; dependent variables were lateral position in cm to moving objects, cycling speed and heart rate.

**RESULTS:** The preliminary results suggest that bicycle lane must be at least 140 cm broad to accommodate a 'comfortable' passing distance (for the cyclist). The equivalent passing speeds equates to a car speed of approximately 40 km/h. If the car speeds were higher, the bicycle lane will need to be broader.

**CONCLUSIONS:** This would suggest that the current minimum bicycle lane breadth (in Sweden) of 70 cm would appear to be woefully under-dimensioned.

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**Relationship Between Affective Responses And Adherence To High Intensity Interval Training In Obese African-American Women**Alvin L. Morton<sup>1</sup>, Kelley Strohacker<sup>1</sup>, Michael J. McKenzie, FACSM<sup>2</sup>, Melicia C. Whitt-Glover, FACSM<sup>3</sup>, David L. Mount<sup>4</sup>, Lyndsey M. Hornbuckle<sup>1</sup>. <sup>1</sup>University of Tennessee, Knoxville, TN. <sup>2</sup>Winston-Salem State University, Winston-Salem, NC. <sup>3</sup>Gramercy Research Group, Winston-Salem, NC. <sup>4</sup>Mind Body Institute Beyond, Winston-Salem, NC. (Sponsor: Melicia C. Whitt-Glover, FACSM)

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**Introduction:** A previous parent study showed significantly better adherence for high intensity interval training (HIIT; 31% dropout) compared to steady state (SS; 73% dropout) in a sample of inactive, obese African-American (AA) women ( $N=27$ ; age:  $30.5 \pm 6.8$  yrs;  $5274 \pm 1646$  steps/day; BMI:  $35.1 \pm 5.1$  kg/m<sup>2</sup>). However, the relationship between affective responses and adherence is unclear.

**Purpose:** To conduct exploratory and descriptive analyses of affective responses over time between SS vs. HIIT conditions, and between study completers vs. non-completers.

**Methods:** Subjects were randomized into a 16-week treadmill exercise intervention, consisting of 4 weeks of conditioning, then 12 weeks of SS or HIIT training. The intervention consisted of three, 32-min bouts/week. SS bouts consisted of continuous exercise at 60-70% of maximal heart rate ( $HR_{max}$ ). The time-matched HIIT bouts alternated 3-min lower-intensity intervals (60-70%  $HR_{max}$ ) with 1-min high-intensity intervals (80-90% of  $HR_{max}$ ). Core affect was assessed using the Feeling Scale (FS), pre- and post-exercise, as well as after the 8<sup>th</sup>, 20<sup>th</sup>, and 32<sup>nd</sup> minute of exercise. Possible FS scores range from -5 (very bad) to 5 (very good). Mean in-task FS scores are reported for the average of three sessions of week 5 and the last week of participation. Descriptive and frequency analyses are presented over the entire week.

**Results:** SS completers reported FS values of  $5.00 \pm 0.00$  both at week 5 and week 16. HIIT completers reported mean in-task FS values of  $2.88 \pm 1.19$  at week 5 and  $3.82 \pm 0.63$  at week 16. At week 5, SS and HIIT non-completers reported FS values of and  $4.08 \pm 0.86$  and  $2.91 \pm 1.77$ , respectively. During the final week of participation

( $8.7 \pm 3.3$  wks), SS and HIIT non-completers reported FS values of  $3.88 \pm 1.13$  and  $3.16 \pm 1.18$ , respectively. Of 221 SS and 586 HIIT bouts completed, 11 (5.0%) and 42 (7.2%) contained  $\geq$  one negative in-task FS score, respectively.

**Conclusion:** While HIIT subjects consistently reported lower FS values relative to SS subjects, mean values were positive and similar to those observed for SS exercise in prior studies. Further, despite lower FS values, HIIT subjects had less dropout. Thus, it seems that HIIT is feasible in this population. These pilot data suggest the need for further research on contributors to adherence to HIIT in low-active, obese AA women.

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**Effect Of Frequent Daily Walking Bouts On Sedentary Time And Self-perceived Fatigue In Free-living Adults**

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**PURPOSE:** Breaking up sedentary time with frequent short bouts of activity has been suggested as a novel strategy to reduce sedentary behaviors, but whether this strategy will be effective at reducing sedentary time in free-living conditions is unknown. In this pilot study, objective measures of physical activity and self-reported measures of fatigue and vigor were compared over 3-days among the following free-living conditions (1) microburst activity (MICRO: 5-min of brisk walking every hour for 9 hours), (2) one 45-min bout of brisk walking (ONE), and (3) a sedentary control condition (SED).

**METHODS:** Eighteen sedentary overweight adults (12F/6M, mean $\pm$ SD; age=32.2 $\pm$ 6.1 yo, BMI= 30.8 $\pm$ 2.5 kg/m<sup>2</sup>) completed each condition (MICRO, ONE, SED) in a randomized crossover study. The percentage of time spent in sedentary, light-intensity (LPA) and moderate-to-vigorous intensity physical activity (MVPA) were measured by accelerometry (ActiGraph GT3X+). At the end of each day, participants self-reported their level of fatigue and vigor using visual analog scales (VAS).

**RESULTS:** Both MICRO ( $7.5 \pm 3.3\%$ ,  $p=0.04$ ) and ONE ( $9.5 \pm 3.3\%$ ,  $p<0.0001$ ) increased the percentage of time spent in MVPA during waking hours compared to SED ( $5.2 \pm 2.4\%$ ). However, MVPA decreased between the first ( $10.1 \pm 2.5\%$ ) and the third day ( $8.2 \pm 2.5\%$ ,  $p=0.02$ ) of ONE, while no changes occurred in MICRO. ONE ( $79.3 \pm 5.9\%$ ,  $p<0.0001$ ), but not MICRO ( $83.1 \pm 5.4\%$ ) reduced the percentage of time spent sedentary during waking compared to SED ( $84.4 \pm 5.7\%$ ). The fact that LPA was lower with MICRO ( $10.6 \pm 4.1\%$ ) than with ONE ( $12.9 \pm 5.4\%$ ,  $p=0.03$ ) suggests a spontaneous displacement from LPA towards sedentary time. Participants reported feeling less "worn out" ( $34.3 \pm 25.9$  vs.  $42.8 \pm 26.1$ ,  $p=0.04$ ), "bushed" ( $33.8 \pm 25$  vs.  $41.6 \pm 24.1$ ,  $p=0.05$ ), and had a lower desire to close their eyes ( $37.3 \pm 27.5$  vs.  $44.1 \pm 26.6$ ,  $p=0.05$ ) and lie down ( $39.5 \pm 28.0$  vs.  $47.6 \pm 27.7$ ,  $p=0.055$ ) during MICRO compared to ONE conditions.

**CONCLUSIONS:** Performing a continuous bout of brisk walking per day seems to be more potent at increasing MVPA and reducing time spent sitting, however, the effects may not be long lasting. Small lifestyle changes such as those induced by microbursts of activity may be easier to implement in at-risk populations. Long term studies are needed to confirm this hypothesis.

883 Board #62 May 31 3:30 PM - 5:00 PM

**Effects Of Whole 30 Dietary Program On Body Composition And Crossfit Performance**Valden Luis Matos Capistrano Junior<sup>1</sup>, Renata Alves Caruauba<sup>2</sup>, Natália Marques<sup>2</sup>, Ana Beatriz Baptistella<sup>2</sup>, Renata Desiree Beserra de Sena<sup>1</sup>, Angela Siqueira Furtado Martin<sup>1</sup>, Adriana Pereira Sampaio<sup>1</sup>, Diego de Castro e Silva Lacerda<sup>1</sup>, Valéria Paschoal<sup>2</sup>, Andreia Naves<sup>2</sup>. <sup>1</sup>VC Nutrition Clinic research, Fortaleza, Brazil. <sup>2</sup>VP Research Institute, São Paulo, Brazil.

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**PURPOSE:** To evaluate the influence of Whole30 program on body composition and CrossFit performance in trained individuals.

**METHODS:** Sixty four subjects (age range: 21-54years) attended to nutrition education class to learn food items and recommended volumes comprising the Whole 30 program (allowed foods: meats, seafood/ fish, eggs, fruit, vegetables and mono and polyunsaturated fats; forbidden foods: sugar, sweeteners, alcohol, flour, oat, quinoa, corn, rice, starch, beans, soy, milk and dairy products) and underwent a 15-day training protocol (4 days/ week). On day 1 and day 15 of the training protocol, performance was measured as the minimum time taken to perform CrossFit workout. The body composition was evaluated by portable ultrasound during the days 1 and 30 of the dietetic program. The collected measures were chest (C), triceps (TR), subscapular (SB), medial axillary (MA), suprailiac (SI), abdomen (AB) and medial thigh (MT), and the fat percentage was automatically calculated by the Body View Software. Samples were tested for normal distribution and groups were compared by either Student's t-test or Wilcoxon Mann Whitney test. The type 1 error was set at  $p<0.05$ .

**RESULTS:** After 30 days of Whole 30 program, there was a significant reduction on the sum of 9 skinfolds (67.76±21.21 vs 53.89±16.32,  $p < 0.0001$ ), total fat (23.24±6.73 vs 19.66±6.37,  $p < 0.0001$ ) and trunk fat (47.07±16.14 vs 36.51±11.91,  $p < 0.0001$ ); and a significant gain of body fat-free mass (76.76±6.73 vs 80.34±6.37,  $p < 0.0001$ ). When subgroup analyses were performed by sex, it was found that the relative loss of body fat (sum of 9 skinfolds, total fat and trunk fat) were similar. Regarding performance, a time reduction to perform the Crossfit workout was observed (14'18" vs 12'33", pre and post dietetic intervention, respectively).

**CONCLUSIONS:** The Whole 30 dietary program promoted body fat reduction and fat-free mass gain in trained Crossfit individuals. Additionally, after 30 days of dietary program, there was observed improvement in performance by reducing the time taken to perform the CrossFit workout.

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**Variation In Daily Physical Activity During An Exercise Intervention Period In Older Adult Japanese**

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Previous studies have reported that healthy middle-aged adults spend less time on physical activity during the weekend than during the weekday. However, there are few reports about this topic that include older Japanese adults.

**PURPOSE:** To examine variation in the amount of daily physical activity during an exercise intervention for older Japanese adults. Variations between the sexes were also examined in this study.

**METHODS:** Forty-one healthy adults (female:  $n = 24$ ; male:  $n = 17$ ; age:  $73.2 \pm 7.3$  years) participated in an exercise intervention (UMIN000020678). The exercise program was conducted once a week for 3 months. Daily physical activity was measured using three-axis accelerometers (OMRON: HJA-750C). Physical activity data were categorized into two types: locomotive or household activity. For each day of the week, we compared locomotive and household activity between male and female participants using one-way ANOVA. Statistical significance was set at  $P < 0.05$ .

**RESULTS:** For all participants, physical activity amounts for each day of the week (Monday-Sunday) was  $21.7\text{-}23.0$  Mets-h/day. There were no significant ( $P < 0.05$ ) differences among the days of the week. The average total amount of daily physical activity through all 7 days of the week was higher for female subjects ( $24.2 \pm 4.5$  Mets-h/day) than for male participants ( $20.0 \pm 3.9$  Mets-h/day). The average amount of locomotive activity was higher for male participants ( $5.42 \pm 1.81$  Mets-h/day) than for female participants ( $4.8 \pm 2.0$  Mets-h/day). However, the average amount of household activity was higher for female participants ( $19.3 \pm 3.7$  Mets-h/day) than for male participants ( $14.6 \pm 3.5$  Mets-h/day).

**CONCLUSIONS:** The results suggest that there is no significant variation in daily physical activity amounts in older Japanese adults during our exercise intervention. Furthermore, female participants in this intervention had higher total amounts of daily physical activity because of higher household physical activity amounts, even though male participants had higher locomotor activity.

885 Board #64 May 31 3:30 PM - 5:00 PM  
**Effects Of Consecutive And Non-consecutive Days Of Resistance Training On Erythrocytes Responses**

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Exercise has been shown to alter blood parameters depending on the intensity, duration and type of activity. However, most of the documented changes stem from research using aerobic training with little exploration in resistance training (RT). **PURPOSE:** To determine the effects of 12 w of either 3 consecutive (C) or non-consecutive (NC) d/w of RT on erythrocyte responses. **METHODS:** Thirty healthy and recreationally active men [25 (SD 2) y] were randomly assigned to either C or NC for 12 w. Both groups performed 3 sets x 10 repetitions at pre-determined 10 repetition-maximum of leg press, latissimus pulldown, leg curl, shoulder press and leg extension for each RT session. Blood was sampled in untrained state pre (UT Pre), immediately post 3<sup>rd</sup> day of RT (UT 0 h), 24 h post 3<sup>rd</sup> day of RT (UT 24 h) in week 1, and also in trained state pre (T Pre), immediately post 3<sup>rd</sup> day of RT (T 0 h), 24 h post 3<sup>rd</sup> day of RT (T 24 h) in week 12. Whole blood was analyzed for red blood cell (RBC) counts, hemoglobin (Hb), hematocrit (Hct), mean cell volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), mean plasma

volume (MPV), and red cell distribution width (RDW). Analysis was conducted using Generalized Estimating Equations. **RESULTS:** Both groups were similar in age, weight [65 (10) kg], height [1.72 (.06) m], BMI [22.2 (2.7) kg/m<sup>2</sup>], systolic and diastolic blood pressures [114 (5)/69 (8) mm Hg], fasting glucose [4.5 (.3) mmol/L] and physical activity level [2144 (1428) MET-min/w] pre-RT. No interaction was found for all measures ( $p = .350\text{-}.944$ ). There were no group differences except for Hb, MCHC, and RDW ( $p = .001\text{-}.022$ ). Differences were due to the means (SE) of Hb [C: 15.150 (.194) > NC: 14.396 (.267) g/dL], MCHC [C: 35.071 (.217) > NC: 34.060 (.231) g/dL], and RDW [C: 12.553 (.163) < NC: 13.530 (.328) %] being lower in one group than the other at baseline. C and NC showed similar profile across respective time points. Hct, MCV and MCH increased at UT 0 h ( $p = <.001\text{-}.033$ ) but Hct lowered at UT 24 h ( $p = .006$ ) while MCH remained elevated at UT 24 h ( $p = .042$ ) compared to UT pre. RBC and Hb lowered at UT 24 h compared to UT Pre ( $p = .002\text{-}.029$ ). MCV and MPV increased ( $p < .001\text{-}.037$ ) while MCHC lowered ( $p = .022$ ) at T 0 h compared to T Pre. **CONCLUSION:** Both groups demonstrated similar post-RT responses in erythrocytes profile.

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886 Board #65 May 31 3:30 PM - 5:00 PM  
**No Difference in Body Composition and Strength between Consecutive and Non-consecutive Days of Resistance Training**

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**PURPOSES:** Health authorities worldwide recommends 2-3 d/w of resistance training (RT) for health, preferably spread 48-72 h apart. However, it is common among fitness buffs, top athletes and weekend warriors to RT on consecutive days. Yet, effects of recovery period in between RT sessions on many physiological variables are unclear. Therefore, the purpose of this study is to determine the effects of 12 w of either 3 consecutive (C) or non-consecutive (NC) d/w of RT on body composition and strength.

**METHODS:** Thirty young, healthy and recreationally active men [25 (SD 2) y] were randomly assigned to either C or NC for 12 w. Both groups performed 3 sets x 10 repetitions at 10 repetition-maximum (RM) of leg press (LP), latissimus pulldown (LAT), leg curl (LC), shoulder press (SP) and leg extension (LE) for each RT session. Body composition using dual-energy X-ray absorptiometry and 10RM for the RT were determined pre- and post-RT. Differences were analyzed using 2x2 mixed design repeated measures ANOVA (with aligned rank transformation for nonnormal data with or without equal variances). **RESULTS:** Both groups were similar in age, weight [65 (10) kg], height [1.72 (.06) m], BMI [22.2 (2.7) kg/m<sup>2</sup>], systolic and diastolic blood pressures [114 (5)/69 (8) mm Hg], fasting glucose [4.5 (.3) mmol/L] and physical activity level [2144 (1428) MET-min/w] pre-RT. No interaction was found for all measures of body composition and 10RM ( $p = .242\text{ to } .999$ ). There were no group differences ( $p = .143\text{ to } .948$ ) except bone mineral density (BMD), which was higher in C (11.81 kg/m<sup>2</sup>) than NC (11.08 kg/m<sup>2</sup>,  $p = .025$ ). However, C and NC improved their BMD similarly following RT [+0.19 kg/m<sup>2</sup>; 95% CI of gain (.11, .28),  $p = <.001$ ]. Both groups also gained weight ( $p < .001$ ; C: 65.7 to 67.0 kg; NC: 63.8 to 65.7 kg) due to lean body ( $p < .001$ ; C: 50.5 to 52.0 kg; NC: 48.6 to 50.6 kg) and bone mass gains ( $p = .003$ ; C: 2.50 to 2.53 kg; NC: 2.30 to 2.32 kg) with an insignificant fat loss ( $p = .438$ ). Body fat % reduced similarly for both groups ( $p = 0.029$ ; C: 18.7 to 18.0%; NC: 19.8 to 18.9%) with no change in fat distribution in the limbs and trunk ( $p = .172\text{ to } .898$ ). Both groups improved 10RM similarly for all exercises ( $p < .001$  for all; 55 kg for LP, 22 kg for LAT, 13 kg for LC, 6 kg for SP and 20 kg for LE). **CONCLUSIONS:** Both groups improved body composition and strength similarly post-RT.

Supported by NIE AcRF RI 5/14 YFF

887 Board #66 May 31 3:30 PM - 5:00 PM  
**A Mobile Application for Improving Gait Characteristics in Community-Dwelling Older Adults**

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**PURPOSE:** Evaluate the efficacy of a mobile health promotion application (app) to improve gait characteristics related to increased fall risk in older adults. **METHODS:** Community-dwelling older adults ( $N=38$ ; age  $72.42 \pm 12.58$ ) were recruited and randomly assigned to experimental ( $n=20$ ; app with exercise) or control ( $n=18$ ; app without exercise) condition. Pre/post gait analysis at self-selected (SS) and fast walking speeds was measured using the GAITRite® Electronic Walkway. Gait variables included ambulation time (AT), velocity, cadence, step length and width, base of support, cycle time, single and double support time. Statistical analysis included a

mixed-model ANOVA ( $p < .05$ ). RESULTS: No main effects were found. Significant improvements (group  $\times$  time) were observed for the experimental group at fast walking speed for AT ( $\lambda = .878$ ,  $F(1, 36) = 5.01$ ,  $p = .031$ ,  $ES = .122$ ); velocity ( $\lambda = .886$ ,  $F(1, 36) = 4.61$ ,  $p = .039$ ,  $ES = .114$ ); and step length ( $\lambda = .864$ ,  $F(1, 36) = 5.64$ ,  $p = .023$ ,  $ES = .136$ ). Significance at SS speed included AT ( $\lambda = .892$ ,  $F(1, 36) = 4.37$ ,  $p = .044$ ,  $ES = .108$ ) single support ( $\lambda = .887$ ,  $F(1, 36) = 4.59$ ,  $p = .039$ ,  $ES = .113$ ); and double support time ( $\lambda = .886$ ,  $F(1, 36) = 4.63$ ,  $p = .038$ ,  $ES = .114$ ). The remaining variables were non-significant. CONCLUSION: The mobile health promotion app can significantly improve AT, velocity, step length and body support time during the gait cycle at varying speeds to potentially reduce the risk of falls in older adults. Funded by The Retirement Research Foundation.

888 Board #67 May 31 3:30 PM - 5:00 PM  
**Nurses' Physical Activity Study: Caring For You So You Can Care For Others**

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Nurses face multiple negative stressors and report the greatest stress of all health care workers. The stress can have a negative effect on the health of nurses (e.g., obesity, fatigue, decrease in quality of life and satisfaction with life, and burnout). Stress is common among nurses with negative impacts on a nurse's health as well as the quality of care patients receive. It is important for nurses to implement self-care strategies techniques (e.g., physical activity) to lower feelings of stress.

**PURPOSE:** To examine the relationship between physical activity levels and measures of health among nurses in eastern NC.

**METHODS:** Nurses ( $n = 62$ , 94% females; 85% White; age =  $42.2 \pm 11.7$ ) were assessed for physical activity via the Fitbit Flex activity tracker over a 7 day period and the International Physical Activity Questionnaire. Nurses reported burnout, stress, and fatigue using self-reported questionnaires. Body mass index was measured by dividing weight (kg) by the participant's squared height (m).

**RESULTS:** BMI was significantly correlated with moderate-to-vigorous physical activity ( $r = -.28$ ), steps ( $r = -.029$ ), and vigorous intensity physical activity ( $r = -.32$ ). Fatigue was significantly correlated with moderate-to-vigorous physical activity ( $r = -.27$ ). Stress was significantly correlated with steps ( $r = -.27$ ), moderate intensity physical activity ( $r = -.25$ ), and light intensity physical activity ( $r = -.40$ ). Significant associations were also found between quality of life and light intensity physical activity ( $r = .40$ ), moderate intensity physical activity ( $r = .30$ ), and steps ( $r = .29$ ). A relationship was found between high intensity physical activity and burnout ( $r = .23$ ,  $p < .001$ ) and between steps and compassion fatigue ( $r = -.26$ ,  $p < .05$ ).

**CONCLUSIONS:** Findings demonstrated that stress, fatigue, and burnout were lowly correlated with physical activity among nurses. Thus, a physical activity intervention among nurses may be needed to fully see the effects of physical activity on nurses' health, and ultimately patient health and safety.

889 Board #68 May 31 3:30 PM - 5:00 PM  
**Evaluation of a Screening Device that Incorporates the ACSM'S Newly Revised Screening Guidelines**

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Major revisions in the ACSM's screening guidelines will be included in the 10<sup>th</sup> edition of the *ACSM's Guidelines for Exercise Testing and Prescription (GETP)*. The primary goal of the revised guidelines is to streamline the screening procedures published in the 9<sup>th</sup> ed. of the *GETP* by (a) eliminating the assessment of risk factors and stratification of individuals into low, moderate and high risk categories, and (b) possibly reducing the number of individuals needing to obtain medical clearance. A pre-activity screening questionnaire (PASQ) that incorporated the revised guidelines was administered to employees who participated in the 2016 University of South Florida FIT program.

**PURPOSE:** To evaluate the PASQ by obtaining feedback from FIT participants and the exercise professional who administered the PASQ. **METHODS:** After completing the PASQ, participants were sent an e-mail asking them to complete a survey to determine if the terms and questions in each of the following five sections of the PASQ were clear and understandable: (1) Instructions, (2) Current Physical Activity, (3) Medical Conditions, (4) Signs/Symptoms, and (5) Acknowledgement/Signature. **RESULTS:** Of the 20 participants, 15 (75%) completed the survey including 10 new and five returning FIT participants. All participants indicated "yes" when asked if the terms and questions were clear and understandable in all of the five sections except one participant. This individual indicated that the definitions of moderate and vigorous intensity (in Section 2) were not clear and understandable and commented that there

was not much variance in the activity levels. Regarding level of difficulty to complete the PASQ, 10 indicated "very easy" and five indicated "easy". The professional who administered/interpreted the PASQ indicated the process was easier and more time efficient than the PASQ used for the FIT program in previous years that incorporated the screening guidelines from the 9<sup>th</sup> ed. of the *GETP*. Three of the five returning FIT participants also indicated that the PASQ was easier and faster to complete than the previous PASQ. In addition, none of the FIT participants needed to obtain medical clearance compared to previous years in which 25-35% of the participants did. **CONCLUSION:** The PASQ was found to achieve the primary goal of the ACSM's revised guidelines.

890 Board #69 May 31 3:30 PM - 5:00 PM

**Perceived Enjoyment Responses to High-intensity Interval Exercise and Continuous Exercise in Physically Inactive Young Men**

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Exercise enjoyment is purported to predict future exercise engagement. While the physiological benefits associated with high intensity interval exercise (HIIE) have been well documented, limited information exists regarding individuals' enjoyment of this form of exercise in comparison to traditional continuous exercise modalities, particularly in physically inactive individuals. **PURPOSE:** To quantify rating of perceived enjoyment using the physical activity enjoyment scale (PACES) following HIIE, moderate-intensity continuous exercise, and vigorous-intensity continuous exercise in physically inactive young men. **METHODS:** Twelve physically inactive apparently healthy young men (mean age:  $24.33 \pm 1.72$  years; body mass index:  $23.49 \pm 4.64$  kg m<sup>-2</sup>;  $VO_{2max}$ :  $44.86 \pm 6.55$  mL kg<sup>-1</sup> min<sup>-1</sup>) participated in the study. Using a randomized cross over design, participants undertook three running trials consisting of HIIE (10 x 1 min at 100%  $VO_{2max}$  interspersed with 10 x 1 min active recovery at 50%  $VO_{2max}$ ), moderate-intensity continuous exercise (40 min at 65%  $VO_{2max}$ ) and vigorous intensity continuous exercise (20 min at 80%  $VO_{2max}$ ). After the completion of all trials, participants were asked to rate their perceived enjoyment using PACES. Statistical analysis was calculated using one-way ANOVA with repeated measures to examine within-subject effect. **RESULTS:** There was no significant difference in perceived enjoyment rating following HIIE ( $92.42 \pm 13.77$ ), moderate-intensity continuous exercise ( $87.67 \pm 15.38$ ), and vigorous intensity continuous exercise ( $90.58 \pm 16.38$ ) ( $p = 0.10$ ). **CONCLUSIONS:** Acute enjoyment responses to HIIE and continuous exercise were similar in physically inactive young adults. Future research is warranted to compare the chronic enjoyment responses to HIIT and continuous exercise in this population.

891 Board #70 May 31 3:30 PM - 5:00 PM

**Food Insecurity and Physical Activity Insecurity among Rural Oregon Families**

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Obesity rates are higher among rural compared to urban children in the U.S. for reasons that are incompletely understood. Emerging data suggest a relationship between food insecurity (FI) and physical activity (PA) insufficiency among children in the U.S., both factors that have been associated with obesity. Rates of child FI are known to be higher among rural compared to urban households, but research is mixed regarding rural/urban differences in PA. As such, exploring the relationships between FI, PA insufficiency, and obesity may help us better understand the rural/urban differences in child obesity rates.

**PURPOSE:** To examine the association between FI risk and family diet and PA behaviors associated with child obesity, among a sample of families residing in rural Oregon.

**METHODS:** Families ( $n = 144$ ) were recruited through six elementary schools (K-5/6) in low-income, rural, Oregon communities. Families completed surveys including a FI risk screener and the Family Stage of Change Survey (FSOC), a measure of readiness to change family-level diet ( $n = 6$  items), sleep ( $n = 1$  item) and PA ( $n = 5$  items) behaviors shown to predict child obesity. Logistic regression was applied to examine associations between FSOC scores and FI risk.

**RESULTS:** Among families at risk for FI (40.2%), a higher proportion were non-white (77.8% versus 22.2%;  $p = 0.036$ ) and had lower adult education levels (30.4% versus 11.8% with a high school degree or less;  $p = 0.015$ ) compared to families not at risk for FI. Of the 12 FSOC items, only one significant difference emerged between families at risk and not at risk for FI: families at risk for FI scored lower on an item reflecting their readiness to provide and support opportunities for structured PA ( $p < 0.001$ ).

Logistic regression analyses showed the odds for FI risk were 55% lower among families reporting higher readiness to provide and support structured PA opportunities ( $p=0.003$ ).

**CONCLUSIONS:** FI risk is associated with rural families' readiness to provide PA and support structured PA opportunities for their children. A better understanding of factors relating to readiness and ability to provide structured PA and its relationship to FI may inform future obesity prevention efforts for at-risk families.

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892 Board #71 May 31 3:30 PM - 5:00 PM  
**Impact of Visual Feedback on Exercise Intensity and Motivation**

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(No relationships reported)

**PURPOSE:** Determine if visual feedback motivates college-aged students to maintain a higher exercise intensity during an indoor cycling class and to ascertain the favored type of visual feedback.

**METHODS:** Thirty participants took part in a within-subject design experiment. Participants were assigned a heart rate monitor and identification number to record and monitor exercise intensity during each class session. Participants completed three cycling classes that were randomly assigned as a no visual feedback (NF), individual feedback (IF), or group feedback condition (GF). A Spielberger Trait Anxiety survey was completed before the first session and the Spielberger State Anxiety survey was completed before every cycling session. For each condition, participants stated if they enjoyed the heart rate feedback received and using the heart rate monitors. At the end of the study, participants specified the visual biofeedback condition they preferred.

**RESULTS:** The group feedback condition spent a higher percentage of time above 80% of their age-predicted heart rate maximum. Participants spent 17.5% of their time in the 80-90% heart rate zone and 2.8% in the 90-100% zone. No feedback and individual feedback groups spent 13.2% and 15.1% in the 80-90% heart rate zone and 0.9% and 2.7% in the 90-100% zone. A 1-way repeated measures ANOVA indicated a statistically significant difference between the time spent in the 60-70% heart rate zone between the three conditions. The group feedback condition had the highest average heart rate (138.1 bpm), maximal heart rate (174.4 bpm), and heart rate predicted caloric expenditure (293.5 kcal). A positive correlation was found between the group feedback RPE and enjoyment of group feedback ( $r=0.55$ ,  $p=0.01$ ). The RPE of individual feedback was positively correlated with working harder due to wearing a heart rate monitor ( $r=0.54$ ,  $p=0.01$ ) and receiving individual feedback ( $r=0.57$ ,  $p=0.01$ ). Twenty-one (70%) participants preferred group feedback, 4 participants (13.3%) favored the individual feedback, 1 participant (3.3%) chose no feedback, and 4 participants (13.3%) had no preference.

**CONCLUSIONS:** Participants favored group feedback over individual feedback and no feedback. Visual feedback was associated with higher exercise intensity and greater enjoyment of the exercise session.

893 Board #72 May 31 3:30 PM - 5:00 PM  
**Impact Of Sit-to-stand Workstation Use On Physical Fitness: A Pilot Study**

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(No relationships reported)

Recent studies indicate sedentary lifestyles have a negative impact on physical fitness. Modifying sedentary daily activities could maintain and improve optimal health. The introduction of sit-to-stand workstations within the workplace provides sedentary employees an opportunity to alternate between sitting and standing positions.

**PURPOSE:** The purpose of this pilot study was to determine if using a sit-to-stand workstation would improve physical fitness. **METHOD:** Eleven healthy male and female full-time faculty (age = 39.09±10.45 years) volunteered to use a sit-to-stand workstation for a minimum of three hours per workday for one year. Muscular fitness was assessed as hand-grip strength, partial curl-up test, and push-up test. Flexibility was measured using the sit-and-reach test, while estimated  $VO_{2max}$  was determined through the Queens College Step Test. Balance was evaluated by a timed one-leg stance with eyes closed. **RESULTS:** Six participants completed this one year pilot study. Three participants withdrew from the study due to inconvenience or difficulty using the workstation; one withdrew due to retirement. One additional participant was unable to complete post-testing. Independent samples *t*-tests indicate no difference at baseline in any physical fitness variable between those who completed the study and those who withdrew ( $p > .05$ ). Due to the sample size, no significant differences were observed in physical fitness over the one year period ( $p > .05$ ); however, potential meaningful changes were observed using Cohen's *d* calculations for effect size. Hand-grip strength increased by 3.17 kg ( $d = 0.11$ , +4.82%), while the number of curl-ups performed

increased by 3.5 ( $d = 0.17$ , +9.46%). Estimated  $VO_{2max}$  increased by 1.12 kg/ml/min<sup>1</sup> ( $d = 0.31$ , +2.57%) and one leg stance with eyes closed increased by 2.62 seconds ( $d = 0.15$ , +15.20%). **CONCLUSION:** Improvements in strength, balance, and  $VO_{2max}$  suggest sit-to-stand workstations may have a positive impact on employees' physical fitness. Participants who withdrew due to difficulty of use indicate a need for examining desk selection, instruction of use, and motivational techniques. Further investigation of a larger population should focus on potential physical fitness benefits and functionality for the user of sit-to-stand workstations.

894 Board #73 May 31 3:30 PM - 5:00 PM  
**Soccer Training Improves Metabolic and Cardiovascular Health in 50-70-yr olds with pre Type 2 Diabetes**

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(No relationships reported)

Type 2 Diabetes Mellitus is a pathological condition, which partly is provoked by an inactive lifestyle. **PURPOSE:** To examine effects of soccer training vs. dietary advice on glucose control, metabolic and cardiovascular health status in patients with pre-T2DM. **METHODS:** Fifty 50-70 yr-old untrained participants (26 women and 24 men; age: 61±1 yrs; height: 171±1 cm, weight: 85.7±2.3 kg;  $VO_{2max}$ : 22.1±0.8 ml·min<sup>-1</sup>·kg<sup>-1</sup>; mean arterial pressure (MAP): 103±2 mmHg) suffering from pre-T2DM were randomized into a soccer training (SOC; n=26) and control (CON; n=24) group. Both group received standardized dietary advice during a 16-wk intervention period. Additionally, SOC completed two sessions/wk of soccer training. Training consisted of small-sided games being increased progressively from 30 to 60 min per session during the 16-wk intervention period. Pre and post-intervention, the participants completed a maximal oxygen uptake ( $VO_{2max}$ ) bike test, an oral glucose tolerance test (OGTT), a DXA-scan, as well as assessments for blood lipid profile, blood pressure and resting heart rate. **RESULTS:** Post-intervention plasma glucose at rest and at 120 min in the OGTT were lowered ( $P<0.05$ ) in SOC and CON, with a greater effect ( $P<0.05$ ) in SOC compared to CON (-2.3±0.3 vs -1.2±0.4 mmol·L<sup>-1</sup>). After 16 wks  $VO_{2max}$  was improved ( $P<0.05$ ) by 4.3±0.5 ml·min<sup>-1</sup>·kg in SOC, which was more than in CON (-0.6±0.5 ml·min<sup>-1</sup>·kg). In SOC, body fat content and plasma triglycerides were lowered by -3.4±0.6 kg and -0.31±0.06 mmol·L, respectively, and with changes scores greater ( $P<0.05$ ) compared to CON. Moreover, SOC improved ( $P<0.05$ ) resting heart rate, lean body mass and waist circumference to a greater degree than CON. **CONCLUSIONS:** Soccer training in combination with dietary advice improves glucose control, as well as metabolic and cardiovascular health to a greater degree than dietary advice alone in 50-70 yr old patients with pre-T2DM.

Supported by a grant from the Faroese Research Council.

895 Board #74 May 31 3:30 PM - 5:00 PM  
**Do University Fitness Classes Meet Acsm'S Daily Activity Recommendations**

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(No relationships reported)

**Purpose:** The obesity crisis facing the American population is well documented. The American College of Sports Medicine (ACSM) recommends individuals exercise for 30 minutes five days a week at moderate intensity. College and University activity courses may be one avenue for obtaining such activity. **Methods:** To determine if college activity courses meet this requirement, physical activity was monitored in 78 students during their class activity period. The students were men and women between the ages of 18-35. Actigraph GTX9 accelerometers were used to estimate caloric expenditure as well as time spent in sedentary, light, and moderate intensity zones. **Results:** 3 out of the 8 fitness courses measured provided students with 30 minutes or more of physical activity, meeting ACSM recommendations. **Conclusion:** While college activity courses are a good supplement to an individual's physical activity regimen, many courses should not be considered sufficient to provide all of the daily exercise a student needs.

**B-62 Free Communication/Poster - Aging in Skeletal Muscle and Bone**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

896 Board #75 May 31 3:30 PM - 5:00 PM  
**Chronic Systemic Inflammation, Physical Activity and Skeletal Muscle in Elderly**

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(No relationships reported)

**PURPOSE:** It is hypothesized that chronic systemic inflammation is influenced by physical activity level and is involved in the age-related decline in muscle function. The impact of physical activity behaviours on the level of C-reactive protein (CRP) and tumour necrosis factor alpha (TNF- $\alpha$ ) in elderly women is investigated. The impact of chronic systemic inflammation on muscle mass and the cellular and molecular mechanisms behind the putative inflammation-mediated action on human muscle cells are explored.

**METHODS:** Total amount of sedentary time, 30-minute periods of sedentary time and breaks in sedentary behaviour and time spent in moderate-to-vigorous physical activity (MVPA) were assessed using accelerometry in a cohort of 89 elderly women. Serum HsCRP and TNF- $\alpha$  were measured. The proliferative and metabolic capacity of human muscle cells obtained from vastus lateralis and exposed to CRP are assessed. **RESULTS:** No variables of sedentary behaviour were significantly associated with the level of CRP or TNF- $\alpha$ . In contrast, time spent in MVPA was inversely associated with the level of CRP, independently of sedentary behaviour and waist circumference, but not TNF- $\alpha$ . Serum CRP levels were inversely associated to skeletal muscle mass. Elevated serum CRP levels were associated to reduced proliferative rate of human muscle cells and changes in the regulation of the size muscle cells.

**CONCLUSIONS:** Elevation in the inflammatory status in elderly is influenced by the amount of time spent in MVPA and exerts detrimental effects on skeletal muscle mass.

897 Board #76 May 31 3:30 PM - 5:00 PM  
**Biomarkers of Senescence in Aging Skeletal Muscle**

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(No relationships reported)

**PURPOSE:** Cells enter into a state of senescence in response to certain stressors, such as aging and age-related diseases. It is proposed that senescent cells drive pathogenesis (e.g., atherosclerosis). Hence, it is possible that senescent cells underlie sarcopenia. Biomarkers of senescence include p53, p21, p16, IL-6, and senescence associated beta-galactosidase (SA  $\beta$ -gal). These biomarkers have been extensively investigated using in vitro cell culture experimentation. The purpose of this study was to explore the role of senescence as a potential driver of age-associated sarcopenia. We hypothesized that biomarkers of senescence will be increased in aging skeletal muscle and it is highly associated with sarcopenia.

**METHODS:** To identify biomarkers of senescence in aging skeletal muscle, the extensor digitorum longus (EDL) and tibialis anterior (TA) muscles were excised from male C57BL/6 adult (<12 months, N=11) and elderly (>28 months, N=11) mice. The EDL was then used to assess ex vivo whole muscle physiology while the TA was used for histological and biochemistry analyses. Western blotting was performed to determine the expression of p53, p21 and p16, and an ELISA was performed to detect IL-6 content. Senescent cells were determined by SA  $\beta$ -gal staining. **RESULTS:** Muscle wet weight and absolute force production were significantly reduced in the elderly group. Aging resulted in a significant increase in p21 and IL-6, but did not alter p53 or p16 expression. Because the identification of senescent cells by SA  $\beta$ -gal staining was very low the statistical comparison between adult and elderly was not performed.

**CONCLUSIONS:** Taken together, selective biomarkers of senescence are present in muscles from elderly mice. Because p21 and IL-6 both increased in the elderly muscle, it is possible that these proteins play a role in the development of age-associated sarcopenia.

898 Board #77 May 31 3:30 PM - 5:00 PM

**The Effect of Weighted Vest Use During Caloric Restriction on Bone Health in Obese Older Adults**

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(No relationships reported)

**PURPOSE:** To explore the effects of weighted vest use during caloric restriction on bone density and turnover.

**METHODS:** 37 obese older adults underwent a 5.5 month dietary weight loss intervention (1000-1300kcal/d) with (D+V; n=20) or without (D; n=17) weighted vest use (10+ hrs/d). Bone mineral density (BMD) of the total hip, femoral neck and lumbar spine, and biomarkers of bone turnover (OC, BALP, PINP, CTX) were measured. General linear models, adjusted for baseline values of the outcome and gender, were used to examine intervention effects.

**RESULTS:** Mean age of participants was 70.1 $\pm$ 3 years, 78% were female, 78% were Caucasian, and baseline BMI was 35.3 $\pm$ 2.9 kg/m<sup>2</sup>. Average weight loss was 11.2 $\pm$ 4.3 kg and 11.0 $\pm$ 5.9 kg in the D+V and D groups ( $p=0.94$ ), and average weighted vest use was 6.7 $\pm$ 2.3 hrs/day. No significant changes in BMD or biomarkers were observed, although trends were noted for total hip BMD and BALP. Loss in total hip BMD was greater in the D group compared with D+V ( $\Delta$ : -18.7 [29.3, -8.1] mg/cm<sup>2</sup> versus -6.1 [-15.7, 3.5] mg/cm<sup>2</sup>;  $p=0.08$ ). BALP increased in the D+V group by 3.8% ( $\Delta$ : 0.59 [-0.33, 1.50] U/L) and decreased by -4.6% in the D group ( $\Delta$ : -0.70 [-1.70, 0.31] U/L,  $p=0.07$ ).

**CONCLUSIONS:** Weighted vest use during weight loss may attenuate loss of hip BMD and increase bone formation.

Funding for this study was provided by the Arthritis and Musculoskeletal Disease Research Center, and Center for Integrated Medicine at Wake Forest School of Medicine, and the Translational Science Center of Wake Forest University. An in-kind product donation was made by Jason Pharmaceuticals, Inc.

899 Board #78 May 31 3:30 PM - 5:00 PM

**Age-dependent Genomic Responsiveness Following Stretch-shortening Contraction Training In Rats**

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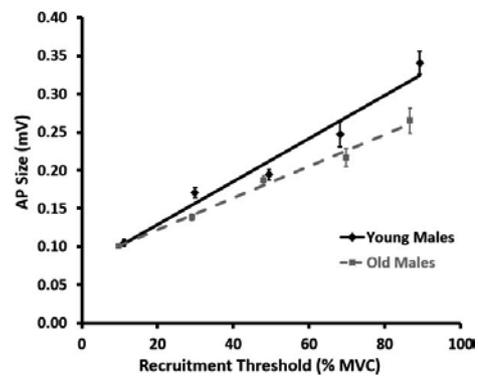
When administered repeatedly, "resistance-type" exercise training may result in adaptation; but, if not properly prescribed, may also result in maladaptation. Maladaptation is characterized by diminished muscle performance and/or muscle mass enhancement. Nevertheless, the genomic response owing to age-dependent adaptation or maladaptation has not been fully established. **PURPOSE:** Our aim was to characterize the genomic responses to adaptation or maladaptation following stretch-shortening contraction (SSC) training with aging. **METHODS:** Dorsiflexor muscles of F344xBN hybrid rats (N=8 per group) were exposed to 1 month of training using a custom-built dynamometer *in vivo*. Transcriptional microarray analysis was conducted in the tibialis anterior 24 hours following the final session. Genes fulfilling the criteria of fold change < -1.1 and > 1.1,  $p < 0.05$ , and False Discovery Rate  $p < 0.05$  were considered significant and analyzed by Ingenuity Pathway Analysis (IPA). **RESULTS:** Concomitant with age-dependent adaptive and maladaptive functional outcomes, transcriptional microarray analysis of muscles from young rats differentially expressed 475 genes following SSC training, while muscles of old rats differentially expressed 1095 genes. Bioinformatic analysis revealed that cellular function and maintenance was a major biological process and tissue development was a major physiological function overrepresented with genes altered by SSC training in young rats, while small molecule biochemistry was a major biological process and organismal development was a major physiological function overrepresented in old rats. Furthermore, in young rats, upstream regulator analysis predicted the activation of CREB1 (z-score 3.144) involved in transcriptional regulation and growth with a parallel inhibition of TSC2 (z-score -2.538) a negative regulator of cell size. In contrast, old rats displayed activation of MAP4K4 (z-score 4.526) involved in apoptotic signaling with concurrent inhibition of PPARC1A (z-score -4.347) that's involved in mitochondrial biogenesis and hypertrophy. **CONCLUSIONS:** The results highlight an altered age-dependent genomic pattern of responsiveness subsequent to SSC training, and emphasizes the molecular features which accompany these disparate outcomes.

900 Board #79 May 31 3:30 PM - 5:00 PM  
**Regression Equation To Predict Body Fat In Elderly Women Using Body Circumference Measures**  
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 (No relationships reported)

**Purpose:** The purpose of this study was to develop and validate an equation to estimate body composition in elderly women above 60 years of age using body circumference measures. **Methods:** The sample consisted of 60 women individuals with an average age of 68.23 ± 5.84 years, 63.97 ± 10.65 kg, 1.542 ± 0.52 m from the Vitória metropolitan area. The group was split into two subgroups: a regression group (n=50) used to develop the equations and a validation group (n=10) used for cross reference. A multiple linear regression was used to develop the equation. Both equations were compared using the Student's *t* test for paired samples. The reliability of the equations was analyzed by the *Blant and Altman* method. **Results:** The regression group had the following descriptive metrics: age 67.62 ± 5.87 years, body weight 64.27 ± 11.11 kg, height 1.53 ± 0.11 m, and percent body fat 41.73 ± 5.69%. The validation group had the following descriptive metrics: 71.3 ± 4.8 years, body weight 62.49 ± 8.34 kg, 1.55 ± 0.53 m, and percent body fat 41.75 ± 4.04%. Body circumference variables were used to develop equations to predict body fat. Using the stepwise selection criteria, the following equation was developed: % body fat = 0.343 (hip) + 0.289 (waist) - 0.0714 (handle)<sup>2</sup>. Several parameters validated the strength of the equation: R<sup>2</sup> = 0.997; EPE = 3.29; EPE ≤ 3.5%; and validation of the model based on the partial significance (F) of the subset of variables that showed the strongest effect. **Conclusion:** It is possible to develop an accurate and specific equation to estimate of body fat percent in elderly women using circumference measurements. The more important is that is easy to use by health professionals.

901 Board #80 May 31 3:30 PM - 5:00 PM  
**Motor Unit Action Potential Size In Young And Old Males**  
 Garrett Hester<sup>1</sup>, Zachary Pope<sup>2</sup>, Alejandra Barrera-Curiel<sup>2</sup>, Jason DeFreitas<sup>2</sup>. <sup>1</sup>*Kennesaw State University, Kennesaw, GA.* <sup>2</sup>*Oklahoma State University, Stillwater, OK.*  
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 (No relationships reported)

**PURPOSE:** To examine the effect of aging on action potential size (AP<sub>size</sub>) of motor units (MUs) across the relative recruitment threshold (rRT). **METHODS:** Nineteen young (YM: age = 21.68 ± 2.31 yrs., BMI = 26.07 ± 4.89 kg·m<sup>-2</sup>) and eighteen older (OM: 63.55 ± 8.02 yrs., BMI = 27.94 ± 4.12 kg·m<sup>-2</sup>) untrained males participated in this study. Upon completion of a familiarization, subjects performed 2 maximal voluntary isometric ramp contractions (MVCs) of the knee extensors using an isokinetic dynamometer while 4 surface electromyography (sEMG) signals were recorded from the vastus lateralis using a 5-pin surface array sensor. The raw sEMG signals were decomposed into their constituent MU action potential trains to determine the rRT and AP<sub>size</sub>. rRT was defined as the relative force level (%MVC) when the MU began firing, and AP<sub>size</sub> was considered the maximum peak-to-peak amplitude (mV). Linear regression was used on the pooled and individual data for YM and OM separately to examine the relationship between rRT and AP<sub>size</sub>. For the pooled data, bin widths of 20% were used for rRT. The means for individual slope coefficients (SLP<sub>c</sub>; mV/%MVC) were compared between the YM and OM using independent samples *t*-tests. **RESULTS:** A total of 810 MUs were detected (YM: 389; OM: 421). The regression equations for the pooled data were - YM:  $y = 2.82e^{-03}x + 7.18e^{-02}$ ; R<sup>2</sup> = 0.965 and OM:  $2.09e^{-03}x + 8.01e^{-02}$ ; R<sup>2</sup> = 0.991. SLP<sub>c</sub> was greater in YM compared to OM (+40.8%; *p* = 0.013). A qualitative, visual inspection of the regression lines for the pooled data (figure below) suggest that AP<sub>size</sub> for MUs at a higher rRT (i.e., >60%) were most affected in OM. **CONCLUSIONS:** Our findings indicate that aging negatively affects the relationship between rRT and AP<sub>size</sub>. Specifically, AP<sub>size</sub> for later-recruited MUs was substantially decreased in OM which may indicate a MU-specific decrease in sarcolemma area and/or excitability due to aging.



902 Board #81 May 31 3:30 PM - 5:00 PM  
**IGF-1 Response In Middle-aged And Older Men During Continuous And Intermittent Cycling At Lactate Threshold**  
 Kenji Narazaki<sup>1</sup>, Yukiya Tanoue<sup>2</sup>, Yoichi Hatamoto<sup>2</sup>, Yasuki Higaki<sup>2</sup>, Hiroaki Tanaka<sup>2</sup>. <sup>1</sup>*Fukuoka Institute of Technology, Fukuoka, Japan.* <sup>2</sup>*Fukuoka University, Fukuoka, Japan.*  
 (No relationships reported)

Insulin-like growth factor-1 (IGF-1) is a trophic factor promoting growth and survival in various types of cells including muscle cells and neurons. In our recent study, young men showed comparable IGF-1 responses in continuous and intermittent exercise at lactate threshold, whereas stress responses were smaller in the intermittent exercise. It is yet unclear if the exercise format affects the IGF-1 response in older individuals. **PURPOSE:** To compare changes in the circulating level of IGF-1 in middle-aged and older men during continuous and intermittent cycling at lactate threshold. **METHODS:** Six men, middle-aged and older (57.8 ± 11.6 years), randomly performed two cycling tests at lactate threshold load (108.8 ± 27.3 W) and a control test with rest on separate days. The cycling tests comprised a 20-min continuous cycling (CC) and an intermittent cycling (IC) consisting of 20 repetitions of 1-min bouts separated by 30-sec rests. The control test was administered with a schedule identical to CC. During each session, blood samples were drawn via peripheral cannulation at rest, at 25, 50, and 100% of cycling time, and 10 min after cycling. A blood concentration of IGF-1 and those of lactate, cortisol, and catecholamines were measured at each time point. Two-way analyses of variance for repeated measures with post-hoc tests, if appropriate, were performed to mainly compare changes between CC and IC. **RESULTS:** Significant interactions were found in all the indices (*p* < .05). Changes in IGF-1 concentration were comparable between CC (102.0 ± 29.3 to 116.0 ± 30.2 ng/ml, *p* < .05) and IC (104.2 ± 33.6 to 112.0 ± 38.6 ng/ml, *p* < .05). In contrast, although concentrations of lactate and norepinephrine increased in both CC and IC (*p* < .05), the effect was greater for CC (*p* < .05). Furthermore, dopamine concentration increased only in CC (*p* < .05) while cortisol concentration decreased in IC (*p* < .05) but not in CC. **CONCLUSIONS:** As previously shown in young men, intermittent cycling at lactate threshold evoked an IGF-1 response comparable to its continuous counterpart in men middle-aged and older, but the two cycling formats induced different stress responses. These results suggest that moderate intermittent exercise has the potential to stimulate the IGF-1 pathway without considerable stress in older individuals. Supported by JSPS 25242065.

903 Board #82 May 31 3:30 PM - 5:00 PM  
**Ageing Affects Cell Cycle Regulation In Human Skeletal Muscle Undergoing Atrophy And Regrowth**  
 Ulrik Frandsen<sup>1</sup>, Tatyana Prokhorova<sup>1</sup>, Line Jensen<sup>1</sup>, Lars G. Hvid<sup>1</sup>, Peter Scherling<sup>2</sup>, Per Aagaard<sup>1</sup>, Michael Kjaer<sup>2</sup>, Charlotte Suetta<sup>3</sup>. <sup>1</sup>*Faculty of Health, University of Southern Denmark, Odense, Denmark.* <sup>2</sup>*Faculty of Health, University of Copenhagen, Bispebjerg Hospital, Copenhagen, Denmark.* <sup>3</sup>*Rigshospitalet, University of Copenhagen, Copenhagen, Denmark.*  
 (No relationships reported)

Cellular senescence is an irreversible arrest of cell division, which could influence the regenerative potential of skeletal muscle stem cells (satellite cells) during aging. The molecular mechanism of senescence is complex and involves epigenetic control of the Polycomb repressive complexes, as well as CDKN2A (p16) and TP53 tumor mediated repression of cyclin dependent kinases and G1 cell cycle arrest. **PURPOSE:** To investigate the effect of ageing on satellite cell cycle regulation in human skeletal muscle undergoing atrophy and regrowth induced by short-term immobility and subsequent reloading. **METHODS:** Myofiber atrophy was induced by application

of a knee-brace for a period of 4 days in young (Y, ~20 yrs, n=9) and aged (O, ~70 yrs, n=9) individuals. Muscle regrowth after atrophy was induced by 6 days of re-ambulation supplemented by one session of supervised unilateral resistance training for the disused leg 3 days after brace removal. Muscle biopsies (VL) were collected pre and at 1d, 2d and 4d of immobility and after additional 6 days of re-mobilization (10d). Protein and mRNA expression levels of CDKN2A (p16), CDKN1A (p21), CDKN1B (p27), TP53 and PCNA were determined using real-time RT-PCR and Western blotting, respectively. Satellite cell content was determined by immunohistochemical expression of Pax7. **RESULTS:** Satellite cell content increased in Y at 4d and 10d with no changes in O ( $p < 0.05$ ). p16 mRNA was upregulated at 2d and 4d in O compared to Y and at 10d in Y and O compared to pre ( $p < 0.05$ ). TP53 mRNA was upregulated at 2d in O and at 4d in Y and O compared to pre, while downregulated at 10d in Y and O compared to 4d ( $p < 0.05$ ). p27 mRNA was downregulated in Y and O at 4d and 10d compared to pre ( $p < 0.05$ ). p16 protein increased in O at 1d (7.2-fold) and 2d (3.9-fold) compared to Y and decreased to pre levels in Y and O at 10d ( $p < 0.05$ ). PCNA protein was upregulated in Y (5.5-fold) but blunted in O (1.6-fold) at 10d compared to pre ( $p < 0.05$ ). **CONCLUSION:** p16 and TP53 early (2-4 days) were selectively upregulated during immobility in O compared with Y subjects, suggesting that cellular senescence and SC cycle arrest could be implicated in the defective regenerative response in O compared to Y. Further analysis of epigenetic modifications may provide further explanation for the present findings.

904 Board #83 May 31 3:30 PM - 5:00 PM  
**Age-Related Reductions in Muscle Quality Influence the Relative Differences in Strength and Power**  
 Gena R. Gerstner<sup>1</sup>, Hayden K. Giuliani<sup>1</sup>, Joseph G. Rosenberg<sup>2</sup>, Eric J. Sobolewski<sup>1</sup>, Michael J. Scharville<sup>2</sup>, Jacob A. Mota<sup>1</sup>, Eric D. Ryan<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Quintiles, Durham, NC. <sup>3</sup>Furman University, Greenville, SC. (Sponsor: Abbie Smith-Ryan, FACSM)  
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 (No relationships reported)

Recent studies have demonstrated that age-related changes in the relative differences in isokinetic strength and power may reflect fast twitch fiber alterations. It is possible skeletal muscle ultrasound (US) imaging may reflect these changes. **PURPOSE:** The purpose of this study was to examine the influence of muscle quality on the relative differences in strength and power in younger and older adults. **METHODS:** Twenty young (20.1±1.5 yrs) and 20 older (69.5±3.1 yrs) healthy, recreationally active men performed two plantar flexion maximal voluntary isometric actions (MVCs) and three maximal isokinetic actions on a calibrated isokinetic dynamometer. Panoramic brightness-mode US images of the medial and lateral gastrocnemius were taken to determine subcutaneous fat corrected echo intensity (EI) to represent muscle quality. Isokinetic peak torque (PT), mean power (MP), and peak power (PP) at 0.52 rad·s<sup>-1</sup> and 2.09 rad·s<sup>-1</sup> were normalized as %MVC. Six separate 2-way mixed factorial analyses of variance were used to evaluate absolute and normalized PT, MP, and PP. Independent samples t-tests were used to compare isometric PT, EI, %decrease in PT and %increase in MP and PP between the younger and older men. Pearson's correlation coefficients were used to examine the relationship between EI and the %decrease in PT, %increase in MP, and %increase in PP. An alpha of  $P \leq 0.05$  was used to determine statistical significance. **RESULTS:** The younger men exhibited greater absolute isometric PT, isokinetic PT, MP, and PP at 0.52 rad·s<sup>-1</sup> and 2.09 rad·s<sup>-1</sup> ( $P = 0.001-0.003$ ). After normalizing to isometric PT, age-related differences were eliminated. The older men exhibited higher EI ( $P < 0.001$ ), greater %decrease in PT (43.6% vs. 38.9%;  $P = 0.006$ ), and lower %increase in MP (167.5% vs. 186.3%;  $P = 0.049$ ) and PP (125.5% vs. 144.5%;  $P = 0.006$ ). Echo intensity was significantly related with the %decrease in PT ( $r = 0.605$ ;  $P < 0.001$ ), %increase in MP ( $r = -0.419$ ;  $P = 0.009$ ), and %increase in PP ( $r = -0.605$ ;  $P < 0.001$ ) from 0.52 rad·s<sup>-1</sup> to 2.09 rad·s<sup>-1</sup>. **CONCLUSIONS:** The absolute age-related reductions in isokinetic strength and power are eliminated with normalization. However, the relative differences from slow to fast velocities may reflect the age-related decreases in fast-twitch fiber and subsequent alterations in muscle quality.

905 Board #84 May 31 3:30 PM - 5:00 PM  
**Exercise Reduce The Rate Of mtDNA Deficiency And Mutation In Aged Muscle**  
 Yu Zhang, Xiang Lin, Jian Zhang, Yang Ren, Li Wen, Yong Zhang. Tianjin University of Sport, Tianjin, China.  
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 (No relationships reported)

Calorie restriction and exercise can relieve the oxidative damage in skeletal muscle caused by the aging, but it is still unclear that whether these two factors improved the rate of deficiency and mutation of mtDNA in skeletal muscle by the increase of mitochondrial repair enzyme (OGG1).

**Purpose:** Study the effect from the calorie restriction and exercise to the mitochondrial repair enzyme OGG1, nuclear-encoded COX I and mitochondria-encoded COX IV, and thus exploit the variation of the rate of mitochondrial deficiency and mutation (RMD) in aging mouse.

**Method:** Grouping 32 mice in 24 months into 4 groups: control (C), calorie restriction (CR, 60% diet of control group), exercise (E, running in treadmill in the angle of 5, the intensity of 64% VO<sub>2</sub> max for 60 min, the rate of 15m/min and the frequency of 5 days a week for 12 weeks) and calorie restriction combined exercise (CR+E). Decollated the model animal 24 h after the last intervention, and then collected the red muscle (gastrocnemius) and white muscle (rectus femoris) in hind legs.

**Results:** The rate of mutation and deficiency (ultraviolet spectroscopy and gel-imaging) was significantly lower in E (red: 0.089±0.007,  $P < 0.05$ ; white: 0.091±0.006,  $P < 0.01$ ) and CR+E (red: 0.081±0.004,  $p < 0.01$ ; white: 0.089±0.006,  $p < 0.01$ ) than in C. The level of  $\alpha$ -OGG1 (Western-blotting) in CR+E (1.302±0.086) was significantly higher than that in CR (0.859±0.073,  $P < 0.05$ ). The level of  $\beta$ -OGG1 was higher in CR+E (1.302±0.086) than in C (0.816±0.062,  $P < 0.01$ ). In red muscle, the level of COX I (Western-blotting) was significant higher in E (1.02±0.043,  $P < 0.01$ ) and CR+E (0.94±0.091,  $P < 0.01$ ) than in C compare to C (0.790±0.052), the level of COX IV was significant higher in CR+E (0.848±0.152,  $P < 0.01$ ) than in C (0.578±0.051). In white muscle, the level of COX I was significantly lower in E (0.807±0.072) than in C (0.990±0.080,  $P < 0.01$ ), and the level of COX IV was significant lower in CR+E (0.740±0.104,  $p < 0.01$ ) than in C (0.903±0.081).

**Conclusion:** Exercise and calorie restriction reduce mtDNA deficiency, increase the level of OGG1 in skeletal muscle, increase mitochondrial biogenesis in red muscle, but not in white muscle, thus enhance the ability of aging skeletal muscle to resist the oxidative damage. (This report is supported by NSF 31271275. Corresponding author: wenli34@hotmail.com)

906 Board #85 May 31 3:30 PM - 5:00 PM  
**Does Running And Bone Mineral Density Affect Blood Pressure In Non- And Post-menopausal Women**  
 Doris J. Morris, Inbar Naor-Maxwell, Anjuly Davis, Christina St. Martin, L. Jerome Brandon, FACSM. Georgia State University, Atlanta, GA.  
 (No relationships reported)

The literature is mixed as to the benefits of weight bearing activities such as running on osteogenic responses for non- (N-MEN) and postmenopausal (MEN) women. **PURPOSE:** Therefore, this study was designed to compare bone mineral density (BMD) in N-MEN and MEN women with a running (RUN) history and those who were not runners (N-RUN). **METHODS:** A repeated measures design was employed as 100 Women (30 N-RUN/N-MEN; 12 N-RUN/MEN; 42 RUN/N-MEN; 16 RUN/MEN) were evaluated for differences and relationships between BMD, blood pressure (BP) and body composition. **RESULTS:** Although the MEN women were older (MEN 55.6 yrs. vs N-MEN 36.2 yrs.) the MEN women did not differ for body fat% (MEN 38.5%; N-MEN 34.5%,  $p < 0.05$ ) but did differ for BMD (MEN 1.11 vs N-MEN 1.23). Weight and central adiposity as measured by waist circumference was related to BMD in both RUN ( $r = 0.43$ ;  $p < 0.01$ ) and N-RUN ( $r = 0.28$ ;  $p < 0.05$ ). Age was the only factor that produced a difference ( $p < 0.05$ ) in BMD in the N-MEN and MEN. The RUN/MEN had a trend toward a higher BP than the other groups and this may have contributed to their BMD response not being higher than the N-RUN. **CONCLUSIONS:** Although further study is needed to validate the findings in this study, these data indicate that a history of running does not result in a higher BMD or lower BP in MEN women. This may have been partially because body composition was not different between the groups and therefore the runners were not placing greater stress on the bone response.

907 Board #86 May 31 3:30 PM - 5:00 PM  
**Notch Reduces Muscle Injury in Aged Mice Following Downhill Running**  
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 (No relationships reported)

**PURPOSE:** It is known that Notch signaling regulates skeletal muscle repair and is suggested to be inhibited in aged muscle. However, little is known about the effects of Notch on muscle injury following exercise in aged mice. The purpose of this project is to determine the impact of Notch signaling on aged skeletal muscle injury following downhill running (DHR). **METHODS:** C57B/J6 and CBF1 mice (20-25 mo old) served as controls or performed a bout of DHR (~11m/min, -15% grade) until exhaustion. A Notch inhibitor (GSI) or Notch force-activator (FA) reagent were injected into the left gastrocnemius and PBS (control) was injected into right gastrocnemius starting at 24h post exercise. Haemotoxylin and Eosin staining was used to quantify muscle injury. **RESULTS:** In C57B/J6 mice, DHR induced injury in GSI (4D:  $P = < 0.001$ ; 5D:  $P = < 0.001$ ; and 6D:  $P = < 0.001$ ) and PBS-treated (4D:  $P$

= 0.016; 5D: P = 0.004) muscles. Relative to PBS, GSI increased muscle injury two-fold 4D-6D post-exercise (P < 0.001). DHR did not induce significant muscle injury in CBF1 mice (P = 0.12). FA reduced muscle injury compared to PBS (P = 0.04). **CONCLUSIONS:** Notch inhibition appears to increase muscle injury post-exercise, while Notch activation appears to reduce injury. Supported by UNC Charlotte Faculty Research Grant

908 Board #87 May 31 3:30 PM - 5:00 PM  
**Adiponectin Is Inversely Associated With Estimated Intramuscular Fat Index In Middle-aged And Elderly Adults**

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(No relationships reported)

Adiponectin is a fat tissue-derived adipokine, and it has beneficial effects on lipid metabolism, and plays a protective role in the development of metabolic syndrome. Adiponectin is inversely associated with insulin resistance, and low levels of adiponectin are correlated with visceral adipose tissue (VAT). Age-induced intramuscular fat accumulation is implicated in insulin resistance and type 2 diabetes. Therefore we hypothesized that intramuscular fat is also associated with adiponectin. **PURPOSE:** The present study aimed to determine the relationship between adiponectin and estimated intramuscular fat index in middle-aged and elderly adults. **METHODS:** Twenty-two physically active middle-aged and elderly adults (mean age 68.7±4.4 years, mean body mass index 22.2±2.2 kg/m<sup>2</sup>) participated in this study. We assessed echo intensity as the intramuscular fat content index by using ultrasonography. Echo intensity of the vastus lateralis at the mid-thigh was measured, which was calculated based on the mean of grey scale. Blood samples were collected for the measurement of adiponectin. Waist circumference was measured at the level of the navel as the VAT index. **RESULTS:** Echo intensity was 70.2±6.2 a.u. and adiponectin was 12.4±8.8 µg/mL in the subjects. Adiponectin was inversely correlated with echo intensity (r=-0.43, p<0.05), and waist circumference (r=-0.46, p<0.05). After controlling for waist circumference, there remained a significant inverse association between adiponectin and echo intensity (r=-0.47, p<0.05). **CONCLUSION:** This suggests that adiponectin affects intramuscular fat content; independent of VAT. This study was supported by KAKENHI grant #23650432 and the Descente and Ishimoto Memorial Foundation for the Promotion of Sports Science.

909 Board #88 May 31 3:30 PM - 5:00 PM  
**Age-related Changes In Contractile Function Of Mouse Soleus And Edl Muscles**

David W. Russ<sup>1</sup>, Eric X. Beck<sup>2</sup>, Eric Leach<sup>1</sup>, Kevin E. McElhanon<sup>2</sup>, Noah Weisleder<sup>2</sup>. <sup>1</sup>Ohio University, Athens, OH. <sup>2</sup>Ohio State University, Columbus, OH.  
(No relationships reported)

**PURPOSE:** Rodent models are often studied to gain insight into aging in human muscle. However, lifespan is not consistent across rodent species or strains, and muscular impairments may not occur at the same relative age (i.e., % survival). We have previously reported ~25% loss of muscle force in rats in early-stage aging, despite smaller (8-15%) declines in muscle mass. It has been suggested that mice, despite shorter lifespans, exhibit less sarcopenia than rats. The goal of the present study was to study the contractile responses of two muscles in aging mice of the same absolute age (24 months), but greater relative age (75% survival, ~ 75 yo in humans), as the rats we have previously studied. **METHODS:** *Ex vivo* contractility was studied in the soleus (SOL) and extensor digitorum longus (EDL) muscles of adult (n=6, 12 mo.) and aged (n=7, 24 mo.) male, C57Bl/6 mice. All muscles underwent force-frequency relation (FFR) testing and fatigue. Force, muscle quality (force/cross-sectional area (CSA)) and contractile properties for twitch and peak tetanic stimulation were determined for each muscle. **RESULTS:** Overall analysis of the FFR revealed a significant main effect of muscle and age x frequency and age x frequency x muscle interactions (all P < 0.001). Muscle mass did not differ with age, although there was a trend toward an effect in SOL (P = 0.062). Age significantly (P = 0.035) reduced twitch force in the EDL, but not the SOL, and maximum tetanic force showed no effect of age in either muscle. Twitch contractile properties did not differ with age or muscle. However tetanic rates of force development and relaxation in the EDL were reduced with age (P = 0.065 & 0.098, respectively), differences which became significant when normalized to force (P = 0.018 & 0.035, respectively). No differences in muscle fatigue were found in either muscle. **CONCLUSIONS:** Relative to aging rats, aging mice exhibit modest changes in muscle mass and force in both the EDL and SOL. Changes in force appear largely determined by changes in mass. Since many studies of human aging indicate that

loss of force exceeds loss of strength, these data suggest that mice may not fully recapitulate all aspects of aging human muscle. Future studies should make efforts to examine muscles other than the EDL and SOL to determine if other muscles more closely model aging human muscle.

910 Board #89 May 31 3:30 PM - 5:00 PM  
**Dysregulated Extracellular Matrix Remodeling Of Aged Human Skeletal Muscle Following Damaging Exercise.**

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(No relationships reported)

Aged skeletal muscle has a diminished capacity to regenerate following injury. Effective regeneration of skeletal muscle necessitates the widespread remodeling of its extracellular matrix (ECM). Tenascin C is an ECM protein that is markedly increased following skeletal muscle damage, and is critical for effective ECM remodeling and subsequent muscle regeneration. **Purpose:** To assess markers of muscle damage and extracellular matrix remodeling in skeletal muscle of old (65+ yrs) and young (18-30 yrs) adults. We hypothesized that tenascin C expression would be dysregulated in older adults following exercise-induced muscle damage. **Methods:** 10 young (22.7 ± 2.25 yrs) and 8 old (70.9 ± 7.5 yrs) participants completed 300 lengthening contractions (LC) on a biodex dynamometer to induce muscle damage. Soreness and muscle function were measured and muscle biopsies taken pre-exercise and at 3, 24, and 72 hours post-exercise from the vastus lateralis muscle. **Results:** Both age groups performed a similar amount of work during LC (young: 44,718 ± 13,730 vs old: 49,038 ± 10,217 J; p=0.47). Soreness increased in both groups, with no differences between age groups (p=0.1). Additionally, both age groups demonstrated a marked decrease in functional measures following LC, which remained reduced out to 72 hours post-exercise (p<0.05). As expected, young subjects showed significantly higher absolute values in each of the functional measures compared to old at the pre-exercise time point. However, young subjects showed a significantly higher percentage of torque (53.6 ± 5.19 vs 34.5 ± 7%), and power (57.4 ± 23 vs 34.4 ± 19%) loss following LC compared to old subjects. Expression of tenascin C was significantly elevated in both old and young groups 24h following LC (p<0.001). Overall, there was a significant main effect of group, with the older group demonstrating greater tenascin C expression. However, there was no significant timexgroup interaction, indicating that tenascin C responds similarly between young and old muscle following LC. **Conclusion:** Elevated expression of Tenascin C may contribute to the reduced capacity of aged muscle to adapt following muscle damage. These data also demonstrate increased functional sensitivity in young muscle compared to old following a damaging bout of lengthening contractions.

911 Board #90 May 31 3:30 PM - 5:00 PM  
**IMCL:EMCL and rVO2 Changes following Vitamin D Repletion and Aerobic Training In Aged Individuals**

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**Reported Relationships:** D. Thomas: Consulting Fee; Advisor to Wheat Foods Council.

Extramyocellular (EMCL) and intramyocellular (IMCL) lipid is associated with muscle metabolic dysfunction in aging. We recently reported a positive linear relationship between vitamin D status and IMCL in aged individuals that was independent of body mass and physical activity. The combined effect of vitamin D and exercise on muscle lipid has not been investigated. **PURPOSE:** Compare the magnitude of changes in myocellular lipid stores and local muscle oxygen consumption rate following combined treatment of vitamin D repletion and aerobic training (DAT) compared with vitamin D repletion alone (D), aerobic training alone (AT), and control conditions (Ctl). **METHODS:** Aged subjects (>60 YO) with vitamin D insufficiency (25(OH)D < 32 ng/mL) were randomized to a double blinded, 2X2, four group design. Vitamin D<sub>3</sub> (10,000 IU X 5 days/week) or placebo was provided for 12 weeks with 1 additional week (7 consecutive days) of aerobic training or no training. Gastrocnemius IMCL and EMCL were measured with magnetic resonance spectroscopy and fat segmentation. Hybrid near-infrared and diffuse correlative spectroscopy measured local tissue blood flow, oxygen saturation, and VO<sub>2</sub> during and following (recovery) a gastrocnemius fatiguing protocol. All measurements were completed at week 0 and at end-study. **RESULTS:** Ten males and 9 females completed all measures. Mean age and BMI were 67.2±6 YO and 25.9±4 kg/m<sup>2</sup>, respectively. Mean 25(OH)D concentrations increased significantly in subjects receiving vitamin D (45±16) vs. placebo (10±5)(p<0.05). Although not significant by group, DAT (n=5) experienced a mean reduction in IMCL:EMCL ratio of 33%, compared to a 9% reduction in AT (n=4), 6% reduction in D (n=6) and a gain of 12% in Ctl (n=4). This corresponded to a 26% increase in rVO<sub>2</sub> during full exercise recovery in DAT compared to an 11%, 24%, and 11% reduction in AT, D, and Ctl, respectively.

Abstracts were prepared by the authors and printed as submitted.

**CONCLUSIONS:** These data suggest a trend that vitamin D, when combined with exercise, may potentiate the metabolic benefits of exercise by affecting muscle lipid deposits and altering tissue-level  $VO_2$ . These data also provide an indication of effective metabolic response to a dietary supplement and exercise intervention. Future work will examine muscle mitochondrial function as a potential target of action of vitamin D + exercise on muscle metabolism.

912 Board #91 May 31 3:30 PM - 5:00 PM  
**Relationships of Muscle Quality among Back, Lower and Upper Limbs in Older Individuals**  
 Akito Yoshiko<sup>1</sup>, Takashi Kaji<sup>2</sup>, Hiroki Sugiyama<sup>3</sup>, Teruhiko Koike<sup>1</sup>, Yoshiharu Oshida<sup>1</sup>, Hiroshi Akima<sup>1</sup>. <sup>1</sup>Nagoya University, Nagoya, Japan. <sup>2</sup>Kajinoki Medical Clinic, Gifu, Japan. (Sponsor: Katsumi Asano, FACSM)  
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The ratio of fat tissue within a skeletal muscle (i.e. intramuscular fat) is accessed as muscle quality. It is well known that muscle quality becomes worse with aging by increasing of intramuscular fat and/or decreasing of muscle tissue. It is shown that intramuscular fat is related to physical dysfunction and insulin resistance. However, this result was given from only a selected region such as quadriceps femoris. It is not well understood that the relationships may also be found the other regions of muscle such as posterior of the thigh, low back or upper limb. **PURPOSE:** The purpose of this study was to assess the relationships of muscle quality among low back, anterior and posterior region of the thigh, and upper limbs in older men and women. **METHODS:** Seven men (age, 74 ± 5 years; height, 161 ± 7 cm; weight, 60 ± 7 kg) and fifteen women (age, 80 ± 8 years; height, 147 ± 5 cm; weight, 48 ± 8 kg) participated in this study. B-mode transverse ultrasonographic images were taken from rectus femoris (RF), biceps femoris (BF), multifidus (MF) and triceps brachii (TB). Echo intensity (EI) as an index of muscle quality was calculated in these muscles. We measured physical performance tests, i.e. isometric knee extension peak torque, functional reach, one-leg stand, 30-sec chair stand, hand grip strength, 5-m normal/maximal walk, and timed up and go, and blood biochemistry. **RESULTS:** There was significantly difference in EI in MF between men and women (men, 48.1 ± 7.3 a.u. vs. women, 59.5 ± 10.3 a.u.,  $P < 0.05$ ), but not in the other regions. Significant relationships were confirmed among EIs in RF, BF and TB ( $r = 0.46$  to  $0.50$ ,  $P < 0.05$ ), but not in MF and other muscles ( $r = 0.23$  to  $0.39$ ). Mean EI of upper and lower limbs ( $[(EI \text{ in RF}) + (EI \text{ in BF}) + (EI \text{ in TB})] / 3$ ) as a dependent variable was explained by leptin and insulin as a result of stepwise regression analysis ( $R = 0.55$ , adjusted  $R^2 = 0.45$ ,  $P < 0.01$ ), and EI in MF as another dependent variable was explained by age and 30-sec chair stand ( $R = 0.81$ , adjusted  $R^2 = 0.61$ ,  $P < 0.01$ ). **CONCLUSIONS:** These results suggest that the pattern of muscle quality is inconsistency between limbs and trunk. Furthermore, the factor to explain muscle quality may be different depending on the regions of the muscle.

913 Board #92 May 31 3:30 PM - 5:00 PM  
**Relationship Between Quadriceps Femoris Echo Intensity And Functional And Morphological Characteristics In Older Men And Women**  
 Hiroshi Akima<sup>1</sup>, Akito Yoshiko<sup>1</sup>, Aya Tomita<sup>1</sup>, Ryosuke Ando<sup>1</sup>, Akira Saito<sup>2</sup>, Madoka Ogawa<sup>1</sup>, Shohei Kondo<sup>1</sup>, Noriko I. Tanaka<sup>1</sup>. <sup>1</sup>Nagoya University, Nagoya, Aichi, Japan. <sup>2</sup>Waseda University, Tokorozawa, Saitama, Japan. (Sponsor: Katsumi Asano, FACSM)  
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The age-related decrease in human skeletal muscle mass; i.e. sarcopenia, has received much attention, but an age-related decrease in muscle quality; i.e. the ratio of adipose tissue to muscle tissue, has received noticeably less. A few studies have shown that muscle quality, as determined by ultrasonographic echo intensity, is negatively associated with functional capacity, but the best parameters by which to predict muscle quality have not yet been established for older individuals. **PURPOSE:** The purpose of this study was to assess the relationships between quadriceps femoris (QF) echo intensity and demographic, functional and morphological characteristics of older men and women.

**METHODS:** Sixty-four healthy men ( $n=27$ ; age, 72.9 ± 5.0 years; height, 164.1 ± 6.2 cm; weight, 60.6 ± 6.8 kg) and women ( $n=37$ ; age, 71.5 ± 5.3 years; height, 152.8 ± 4.8 cm; weight, 50.8 ± 6.8 kg) aged 62-88 years participated in this study. The echo intensity and muscle thickness of the QF at the mid-thigh were calculated using ultrasonography. Sit-up, supine-up, sit-to-stand, 5-m maximal walk and 6-min walk tests were performed.

**RESULTS:** As expected, QF muscle thickness in men was significantly larger than women (men, 3.1 ± 0.6 mm; women, 2.7 ± 0.6 mm,  $P = 0.01$ ); however, no significant differences were observed in QF echo intensity between sexes (men, 63.0 ± 8.7 a.u.; women, 69.9 ± 7.4 a.u.). QF echo intensity was significantly correlated with QF

muscle thickness as a result of simple linear regression analysis (men,  $r = -0.734$ ,  $P = 0.001$ ; women,  $r = -0.565$ ,  $P = 0.001$ ). Stepwise multiple regression analysis with QF echo intensity as a dependent variable revealed QF muscle thickness, age and sit-to-stand test in men ( $R = 0.875$ , adjusted  $R^2 = 0.734$ ), and QF muscle thickness and sit-to-stand test in women ( $R = 0.648$ , adjusted  $R^2 = 0.383$ ), to be significant independent variables.

**CONCLUSIONS:** These results suggest that functional ability and greater muscle size are essential factors in the maintenance of muscle quality; however, an age effect was present only in men.

914 Board #93 May 31 3:30 PM - 5:00 PM  
**Age-Dependent Responsiveness to Stretch-Shortening Contraction Training and Low Volume Isometric Contraction Training in Rats**  
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A growing body of research has highlighted the benefits of high-intensity exercise. However, concern exists that such high-intensity training, especially in resistance training, is potentially deleterious at advanced age. Recently, we have addressed this issue in part by demonstrating in a rat model of resistance-type training, that training with maximally activated stretch-shortening contractions (SSCs) has no detrimental effect on performance and increases muscle mass at advanced age provided the frequency of training is moderated (i.e. 80 SSCs 2 days per week rather than 3 days per week). A major question remained from this research - whether reducing or altering other parameters when training with high-intensity contractions would also demonstrate similar outcomes at old age. **PURPOSE:** To determine whether decreasing repetition number (i.e. 40 SSCs 3 days per week) and/or changing contraction mode (i.e. 4 isometric contractions (ISOs) 3 days per week and 8 ISOs 2 days per week) induces muscle mass and performance gains in young (3 months old) and old (30 months old) male Fischer Brown Norway hybrid rats. **METHODS:** Dorsiflexor muscles (9-10 per group) were exposed to 1 month of training using a custom-built dynamometer. Dynamic performance was monitored, tibialis anterior muscle mass was normalized to tibia length, and muscle quality determined by dividing performance by normalized muscle mass. ANOVA was used for statistical analysis; significance was set at  $p < 0.05$ . **RESULTS:** Independent of training protocol, peak force increased by ~20% for young rats while peak force was not significantly altered for old rats. In contrast with performance, muscle mass gains were dependent on the training protocol. For young rats, the normalized muscle mass increase of 18 ± 2% after 40 SSCs 3 days per week training was greater than the increases of 7 ± 2% and 11 ± 1% after 4 ISOs 3 days per week or 8 ISOs 2 days per week training, respectively ( $p < 0.05$ ). For old rats, only 40 SSCs 3 days per week training induced a muscle mass gain, 12 ± 3% ( $p < 0.001$ ), without a decrease in muscle quality relative to values for the other training protocols. **CONCLUSIONS:** These findings demonstrate the extreme adaptability of muscle to various training protocols at a young age and the selectivity at old age especially in regards to muscle mass gain.

## B-63 Free Communication/Poster - Altitude/Hypoxia

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
 Room: Hall F

915 Board #94 May 31 2:00 PM - 3:30 PM  
**"BEet On Alps": Ergogenic Effects Of Dietary Nitrate Supplementation During Prolonged Exposure To Hypobaric Hypoxia**  
 SIMONE PORCELLI<sup>1</sup>, Letizia Rasica<sup>2</sup>, Desy Salvadego<sup>3</sup>, Simona Mrakic-Spota<sup>1</sup>, Fabrizio Gelmini<sup>2</sup>, Giangiacomo Beretta<sup>2</sup>, Mauro Marzorati<sup>1</sup>. <sup>1</sup>Italian National Research Council, Segrate (MI), Italy. <sup>2</sup>Università degli Studi di Milano, Milan, Italy. <sup>3</sup>University of Udine, Udine, Italy.  
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**PURPOSE:** Several studies have demonstrated that dietary nitrate supplementation reduces  $O_2$  consumption ( $VO_2$ ) during steady-state exercise and enhances endurance performance in young healthy subjects, both in normoxia and acute hypoxia. No data have been provided during acclimatization to high altitude, a condition that affects exercise tolerance and may change nitric oxide bioavailability. Aim of this study was to investigate the effects of dietary nitrate supplementation on oxygen cost of exercise and exercise tolerance during a prolonged sojourn at high altitude.

**METHODS:** In a double-blind randomized crossover study, fourteen young (29±4 yr) healthy subjects were supplemented for three days with beetroot juice (2x70mL/day, 8.4 mmol nitrate/day [BEET-IT]) or nitrate-depleted juice (PLA). At the end of each supplementation period, subjects performed on a cycle ergometer one 8 min moderate-intensity constant work rate (MOD) exercise and a high-intensity (HIGH) constant work rate exercise up to exhaustion. Experimental sessions were conducted in a refuge at 3269m a.s.l. after 7 and 14 days of exposure to hypobaric hypoxia.

**RESULTS:** [Nitrate] and [nitrite] were significantly higher in BEET-IT than in PLA. In MOD, oxygen cost of exercise was significantly reduced in BEET-IT vs. PLA (12.7±1.8 vs. 11.8±1.4 mL·min<sup>-1</sup>·w<sup>-1</sup>, p<0.01). In HIGH, VO<sub>2</sub> was significantly lower in BEET-IT than in PLA after 6 min of exercise (2.588±0.424 vs. 2.686±0.438 L·min<sup>-1</sup>, p<0.01) whereas no difference was observed at exhaustion (2.728±0.450 in BEET-IT and 2.763±0.467 L·min<sup>-1</sup> in PLA). Time to exhaustion during high-intensity exercise was significantly improved (9%) by dietary nitrate supplementation. Interestingly, two subjects with the higher aerobic fitness level were “non-responder”.

**CONCLUSION:** After prolonged exposure to hypobaric hypoxia, nitric oxide metabolism was modified at rest. Dietary nitrate supplementation enhanced exercise efficiency during moderate-intensity exercise and improved high-intensity exercise tolerance. These effects were not evident in two highly trained subjects, suggesting an apparent relationship between aerobic fitness and ergogenic potential of beetroot juice supplementation during prolonged exposure to hypobaric hypoxia.

916 Board #95 May 31 2:00 PM - 3:30 PM  
**Effects Of Normobaric Hypoxia And Exercise On Cold-induced Vasodilation, Body Temperature, And Oxygen Saturation**

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**PURPOSE:** The purpose of the current study was to investigate the effects of normobaric hypoxia on the thermoregulatory and the cold-induced vasodilation (CIVD) response before and following submaximal exercise. **METHODS:** Ten apparently healthy men (23±3 years) volunteered for two experimental trials during which they were exposed to differing O<sub>2</sub> saturations (13% O<sub>2</sub> and 21% O<sub>2</sub>) in an environmental chamber. Trials were counterbalanced and blinded from the participant. Following a 60-min acclimation the experimental trials consisted of two 15-min exposures to 5°C water of the non-dominant hand. The exposures were separated by a 30-min bout of submaximal exercise producing the equivalent of 400 watts (W) of metabolic heat. Mean body temperature (MBT), oxygen saturation (SaO<sub>2</sub>), and thermal sensation (TS) were collected during the final 5 min of each stage. CIVD was measured pre- and post-exercise during each of the cold water exposures on the nailbed of the middle finger on the non-dominant hand. **RESULTS:** ANOVA revealed a significant time (baseline, acclimation, CIVDpre, exercise, and CIVDpost) by condition (13% O<sub>2</sub>, 21% O<sub>2</sub>) interaction for SaO<sub>2</sub> ( $F = 38.4, p < 0.001$ ). Significant differences ( $p < 0.001$ ) between conditions existed at all time-points with the exception of baseline ( $p = 1.0$ ). A main effect of time was observed for amplitude temperature ( $F = 20.034, p < 0.001$ ), which was significantly greater ( $p < 0.001$ ) at CIVDpost compared to CIVDpre (CIVDpost: 1.13°C; CIVDpre: 0.28°C). No significant difference across time or condition exists for MBT or TS. In the 13% O<sub>2</sub> condition, the reduction in SaO<sub>2</sub> during exercise (81.5%) was positively associated ( $r = 0.656, p = 0.039$ ) with amplitude temperature at CIVDpost (0.69°C), which was significantly greater ( $p < 0.05$ ) compared to CIVDpre (0.14°C). **CONCLUSION:** It appears that during rest in normobaric hypoxia, a cold stress test has minimal effect on the CIVD response. During exercise, reduced CIVD amplitude is associated with reduced SaO<sub>2</sub>. It appears that a submaximal bout of cycling exercise is not the proper stimulus to acutely induce a CIVD response to the magnitude at which physiological changes ensue.

917 Board #96 May 31 2:00 PM - 3:30 PM  
**The Effects Of Cold-Water Hand Immersion On Executive Function, Mood, And Memory In Normobaric Hypoxia**

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**PURPOSE:** The purpose of the present study was to investigate the effects of cold-water hand immersion (CWI) on changes in executive function, mood, and memory during normobaric hypoxia and normoxia. **METHODS:** Ten apparently healthy men (23±3 years) volunteered for this study. The two experimental trials (13% O<sub>2</sub>, 21%

O<sub>2</sub>) were counterbalanced and blinded from the participant. The non-dominant limb was exposed to 5°C water for 15-min after a passive acclimation to the randomized experimental condition. Executive function (Stroop), total mood disturbance (TMD), and memory (RMCPT) were recorded during the final 8 min. of the following time points: baseline, acclimation, and CWI. **RESULTS:** Condition (13% O<sub>2</sub>, 21% O<sub>2</sub>) by time (baseline, acclimation, CWI) ANOVA's revealed no significant interaction or main effects of time or condition for any score of executive function ( $F \leq 3.12, p \geq 0.069$ ) or mood ( $F \leq 0.773, p \geq 0.477$ ). A significant time by condition interaction exists for throughput score ( $F = 3.19, p = 0.039$ ), a measure of RMCPT. The score during CWI in the 13% O<sub>2</sub> condition was significantly lower compared to the 21% O<sub>2</sub> condition ( $p = 0.05$ ), as well as when compared to acclimation of the 13% O<sub>2</sub> condition ( $p = 0.02$ ). The worsening TMD trend led to positive associations between skin temperature during CWI and TMD scores at baseline ( $r = 0.753, p = 0.012$ ), acclimation ( $r = 0.653, p = 0.041$ ), and CWI ( $r = 0.657, p = 0.039$ ) in the 13% O<sub>2</sub> condition. In the 21% O<sub>2</sub> condition, TMD at acclimation was significantly associated with skin temperature during CWI ( $r = 0.716, p = 0.02$ ). **CONCLUSION:** Despite no effect on executive function in both normoxia and normobaric hypoxia, it appears CWI impairs measures of memory. Decreased skin temperature observed during CWI correlates to reduced mood throughout all time points in a hypoxic state. Further research is necessary to elucidate mechanisms to improve mood and memory in normobaric hypoxia.

918 Board #97 May 31 2:00 PM - 3:30 PM  
**Human Cognitive Function During Acute Hypoxic Exposure**

Manabu Shibasaki<sup>1</sup>, Shigehiko Ogoh, FACSM<sup>2</sup>, Tadayoshi Miyamoto<sup>3</sup>, Hiroki Nakata<sup>1</sup>. <sup>1</sup>Nara Women's University, Nara, Japan. <sup>2</sup>Toyo University, Kawagoe, Japan. <sup>3</sup>Morinomiya University of Medical Science, Osaka, Japan. (Sponsor: Shigehiko Ogoh, FACSM)  
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The execution or inhibition of decision making is critical for survival in a severe environment. Although cognitive performance (behavioral executive response such as reaction times) appears to be impaired at a given level of high altitude, the effect of hypoxia on cognitive processing including executive and inhibitory responses remains unclear. **PURPOSE:** The aim of present study was to test our hypothesis that not only executive processing but also inhibitory processing may be impaired during acute hypoxic exposure.

**METHODS:** We investigated two neural activities in motor execution and inhibition processing evaluated by the Go/No-go task with electroencephalographic event-related potentials before and during acute (~30 min) hypoxic condition. As a time control, subjects performed the same sessions in normoxia.

**RESULTS:** The amplitudes of the Go-P300 (i.e. execution) and No-go-P300 (i.e. inhibition) components were unchanged during normoxic trial. However the amplitudes of the Go- and No-go-P300 components were significantly reduced during acute hypoxic trial ( $p < 0.05$ ), whereas reaction times and error rates were not changed. **CONCLUSIONS:** These results suggest that acute hypoxia impaired human cognitive processing including response execution and inhibition.

919 Board #98 May 31 2:00 PM - 3:30 PM  
**Inspiratory Muscle Training and Endurance Performance in Hypoxia**

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Ventilation is higher at any submaximal workload in hypoxia as compared to normoxia. Whether or not training the respiratory muscles helps to improve exercise performance in hypoxia is unclear. **Purpose:** To determine if improvements in ventilatory strength with chronic inspiratory muscle training (IMT) improves 20km cycling time trial (TT) performance in hypoxia (FIO<sub>2</sub> = 16.1%). **Methods:** Ten highly-trained men were pair-matched based on pre-exercise values of maximal inspiratory pressure (MIP) and randomly placed into either a sham (n = 5, VO<sub>2</sub>max = 61.7 ± 4.1 ml·kg<sup>-1</sup>·min<sup>-1</sup>) or an IMT (n = 5, VO<sub>2</sub>max = 61.5 ± 6.8 ml·kg<sup>-1</sup>·min<sup>-1</sup>) group. Subjects completed 6 weeks of flow resistive IMT (80% of MIP) or a sham protocol (30% of MIP), with each session consisting of up to 6 sets of 8 MIP maneuvers performed to failure with descending rest intervals 3 times per week. Pre- and post-training, subjects performed tests of pulmonary function, lung volume, MIP, maximal expiratory pressure (MEP), lung diffusion capacity (DLCO), and a 20km cycling TT in hypoxia (FIO<sub>2</sub> = 16.1%). **Results:** After 6 weeks of IMT or sham, the IMT group significantly improved MIP (145.3 ± 27.9 cmH<sub>2</sub>O vs 171.7 ± 38.7 cmH<sub>2</sub>O, p < 0.05), while MIP in the sham group remained unchanged. MEP, DLCO, lung volumes, and pulmonary function values remained unchanged in both groups post-training. 20km TT mean

ventilation was higher post-IMT ( $98.9 \pm 15.9$  l·min<sup>-1</sup> vs  $109.3 \pm 22.4$  l·min<sup>-1</sup>,  $p = 0.055$ ) and unchanged in sham ( $p = 0.65$ ). 20km TT mean breathing frequency was also higher post-IMT ( $43.5 \pm 6.4$  b·min<sup>-1</sup> vs  $47.8 \pm 8.0$  b·min<sup>-1</sup>,  $p < 0.01$ ) and unchanged in sham ( $p = 0.46$ ). 20km TT mean  $\dot{V}_{O_2}$  was higher post-IMT ( $45.5 \pm 6.4$  ml·kg<sup>-1</sup>·min<sup>-1</sup> vs  $47.5 \pm 7.1$  ml·kg<sup>-1</sup>·min<sup>-1</sup>,  $p = 0.05$ ) and unchanged in sham ( $p = 0.65$ ). In the IMT group, 20km TT performance time pre-training was  $37:46 \pm 4:39$  min:sec and post-training was  $37:16 \pm 4:02$  min:sec ( $-1.2 \pm 2.2\%$ ,  $p = 0.14$ ). 20km TT performance time was unchanged in the sham group ( $+0.2 \pm 2.1\%$ ,  $p = 0.90$ ). 20km TT heart rate and  $SpO_2$  were unchanged in both groups post-training. **Conclusion:** In a small cohort, IMT-induced improvements respiratory muscle strength resulted in greater ventilation and oxygen uptake during a 20km time trial in hypoxia. IMT should be explored as a useful strategy for improving the quality of cycle exercise training and/or endurance exercise performance at altitude.

920 Board #99 May 31 2:00 PM - 3:30 PM

### The Effect of Inspiratory Resistance on Exercise Performance in Moderate Normobaric hypoxia

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(No relationships reported)

Various respirators are used to protect workers against toxic airborne substances and pathogens. However, the use of respirators increases inspiratory resistance known to adversely affect physiological and psychological performance in some workers. **PURPOSE:** To evaluate the effect of inspiratory resistances on physical performance and subjective comfort during exercise in normobaric hypoxia. **METHODS:** Nine healthy men (Age:  $25 \pm 2$  years, Height:  $181.4 \pm 6.1$ , Weight:  $92.5 \pm 2.6$  kg) participated in this study. Subjects breathed through a respiratory mask outfitted with one of four different inspiratory resistors (R) (0, 1.5, 4.5, 7.5 cm H<sub>2</sub>O·L<sup>-1</sup>·sec<sup>-1</sup>) while exercising in normobaric hypoxia (17% O<sub>2</sub>) for 10 minutes each at 50, 100, and 150 Watts followed by incremental exercise to maximal exertion ( $\dot{V}_{O_{2max}}$ ). **RESULTS:** At exhaustion, added inspiratory resistance in hypoxia significantly decreased the maximal power output ( $0R=272.2 \pm 44.1$ ,  $1.5R=263.9 \pm 41.7$ ,  $4.5R=255.6 \pm 34.9$ , and  $7.5R=241.7 \pm 50.0$  W, respectively,  $p=0.009$ ), respiration rate ( $0R=41.9 \pm 6.5$ ,  $1.5R=39.6 \pm 7.6$ ,  $4.5R=37.2 \pm 6.2$ , and  $7.5R=35.8 \pm 6.7$  bpm, respectively,  $p<0.009$ ), and minute ventilation ( $0R=106.7 \pm 18.5$ ,  $1.5R=98.4 \pm 13.2$ ,  $4.5R=93.2 \pm 13.2$ , and  $7.5R=86.7 \pm 12.2$  L/min, respectively,  $p=0.002$ ) while oxygen consumption ( $0R=31.8 \pm 4.1$ ,  $1.5R=31.7 \pm 3.4$ ,  $4.5R=30.4 \pm 3.4$ , and  $7.5R=31.4 \pm 6.4$  ml/kg/min, respectively,  $p=0.750$ ) and heart rate ( $0R=174.3 \pm 10.9$ ,  $1.5R=173.9 \pm 11.9$ ,  $4.5R=177.4 \pm 10.1$ , and  $7.5R=171.9 \pm 14.3$  bpm, respectively,  $p=0.265$ ) were not significantly changed. Breathing comfort ( $0R=3.0 \pm 1.8$ ,  $1.5R=2.7 \pm 1.3$ ,  $4.5R=4.2 \pm 1.9$ , and  $7.5R=4.1 \pm 2.0$ , respectively,  $p=0.014$ ) and breathing effort ( $0R=3.7 \pm 1.6$ ,  $1.5R=3.9 \pm 1.5$ ,  $4.5R=5.4 \pm 1.2$ , and  $7.5R=5.1 \pm 1.4$ , respectively,  $p=0.001$ ) were significantly increased with additional inspiratory resistance, but rating of perceived exertion (RPE) was not significantly increased ( $0R=17.8 \pm 1.7$ ,  $1.5R=18.1 \pm 1.6$ ,  $4.5R=18.2 \pm 0.8$ , and  $7.5R=18.1 \pm 1.6$ , respectively,  $p=0.664$ ). **CONCLUSIONS:** Low-to-moderate inspiratory resistance in normobaric hypoxia did not have a detrimental effect on oxygen consumption and RPE at maximal work rates. However, added inspiratory resistance significantly decreased maximal power output and increased perception of breathing discomfort and breathing effort.

921 Board #100 May 31 2:00 PM - 3:30 PM

### Impact of Inspiratory Resistance on Cognitive Function in Normobaric Hypoxia After Exercise

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**PURPOSE:** To determine the effects of added inspiratory resistance on cycling in normobaric hypoxia on cognitive function. **METHODS:** Nine healthy adult males (mean  $\pm$  SD: age =  $25 \pm 2$  yr, height =  $1.81 \pm 0.06$  m, mass =  $92.5 \pm 21.6$  kg, BMI =  $28.0 \pm 5.3$  kg·m<sup>-2</sup>,  $\dot{V}_{O_2} = 46.32 \pm 9.01$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) data were analyzed. The protocol consisted of a counterbalanced design involving four visits involving a normoxic (21% O<sub>2</sub>) condition with zero added inspiratory resistance (NORM0) and three hypoxic (17% O<sub>2</sub>) conditions with 3 levels of added inspiratory resistance (HYPOX0, HYPOX1.5 and HYPOX4.5 cmH<sub>2</sub>O) attached to a two-way valve facemask. Data were collected at baseline and during 30 min seated rest in the hypoxia chamber with resistor added. This was followed by three submaximal stages on the cycle ergometer (50, 100, and 150 W) which was then immediately followed by a  $\dot{V}_{O_{2max}}$  test. After completion of the  $\dot{V}_{O_{2max}}$  test the participants recovered in the hypoxia chamber for an additional 30 min. Cognitive function was assessed via a computerized cognitive test battery with the participants performing the running memory continuous performance task (RMCPT) and Stroop Color Word Test (SCWT). A 2 factor repeated measures ANOVA were used to evaluate condition (NORM0, HYPOX0, HYPOX1.5,

HYPOX4.5) by time (baseline in normoxia, 30 min of rest, after  $\dot{V}_{O_{2max}}$  test, and after 30 min recovery in hypoxia) were performed on RMCPT and SCWT with post-hoc significance ( $p<0.05$ ). **RESULTS:** A main effect of condition ( $p = 0.001$ ): NORM0 =  $126 \pm 20$ ; HYPOX0 =  $126 \pm 19$ ; HYPOX1.5 =  $116 \pm 23$ ; HYPOX4.5 =  $115 \pm 19$ ) and a main effect of time ( $p = 0.031$ : base =  $117 \pm 21$ ; rest =  $120 \pm 19$ ; max =  $123 \pm 16$ ; recovery =  $124 \pm 18$ ) existed on throughput of RMCPT. A main effect of time ( $p = 0.001$ : base =  $62 \pm 11$ ; rest =  $67 \pm 11$ ; max =  $69 \pm 9$ ; recovery =  $70 \pm 11$ ) existed on word-color association for SCWT. **CONCLUSION:** No significant interactions between time or condition was demonstrated on cognitive function with added inspiratory resistance in hypoxia after cycling performance. It appears from these data that the respirators do not impair cognitive function during work at the selected levels of resistance in normobaric hypoxia. Further research may be performed on this device to elucidate other markers of cognitive function in more extreme environmental conditions.

922 Board #101 May 31 2:00 PM - 3:30 PM

### The Effects of Added Inspiratory Resistance during Exercise in Hypoxia on Lactate and Hemoglobin

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(No relationships reported)

**PURPOSE:** To determine the effects of adding different levels of inspiratory resistance to submaximal and maximal exercise performance in normobaric hypoxia on blood lactate (Lac) and hemoglobin (Hb) values. **METHODS:** Nine apparently healthy, male adults (mean  $\pm$  SD; age =  $25 \pm 2$  yr, height =  $1.81 \pm 0.06$  m, mass =  $92.5 \pm 21.6$  kg, BMI =  $28.0 \pm 5.3$  kg·m<sup>-2</sup>,  $\dot{V}_{O_2} = 46.32 \pm 9.01$  ml/kg·min<sup>-2</sup>) were analyzed. The participants visited the laboratory on four separate visits in a counterbalanced design. The four conditions consisted of a normoxic (21% O<sub>2</sub>) condition with zero added inspiratory resistance (Normox0) and 3 hypoxic (17% O<sub>2</sub>) conditions with 3 levels of added resistance (Hypox0, Hypox1.5, and Hypox7.5 cm H<sub>2</sub>O) attached to a two-way non re-breathing face-mask. The exercise protocol consisted of data collection at baseline and after 30 min rest in the hypoxia chamber. Three submaximal stages followed on the cycle ergometer with increasing levels of intensity (50, 100, and 150 W) which were then immediately followed by a  $\dot{V}_{O_{2max}}$  test. After completion of the  $\dot{V}_{O_{2max}}$  test the participants recovered in the hypoxia chamber for an additional 30 min. Lac and Hb data were collected by a finger prick and analyzed. A 2 factor repeated measures ANOVA was used to evaluate condition (Normox0, Hypox0, Hypox1.5 and Hypox7.5) by time (baseline, 30 min of rest in hypoxia chamber, immediately after the  $\dot{V}_{O_{2max}}$  test, and during 30 min recovery period) on Lac and Hb. Paired-samples t-test were performed as the post-hoc test ( $p < 0.05$ ) level of significance set apriori. **RESULTS:** A significant interaction was found between condition and time for Lac ( $p = 0.014$ ) and was attenuated during Hypox7.5 condition at recovery compared to the other conditions (Normox0:  $6.3 \pm 3$  mmol; Hypox0:  $6.5 \pm 3.2$  mmol; Hypox1.5:  $6.3 \pm 3.4$  mmol; Hypox7.5:  $4.5 \pm 3$  mmol). Also, a main effect of time for Hb ( $p < 0.001$ ) such that there was a 6.7% increase in Hb at max compared to base and rest, and 5.6% higher Hb at recovery compared to base and rest. **CONCLUSION:** Individuals who wear respirator masks with 7.5 cmH<sub>2</sub>O in a hypoxic condition may clear Lac faster (turnover) which might improve recovery time. Future research may focus on Lac, Hb and other hemodynamic variables and the mechanism underlying lactate clearance in varying hypoxic conditions.

923 Board #102 May 31 2:00 PM - 3:30 PM

### The Effect of Acute Simulated Altitude on the Lactate Thresholds of Well-Trained Cyclists

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(No relationships reported)

**PURPOSE:** Endurance cyclists often race or train at altitudes ranging from 1,000-3,000 m above sea level. It is well known that peak oxygen consumption ( $\dot{V}_{O_{2peak}}$ ) and mean power output (PO) decrease with increasing altitude. However, factors such as lactate thresholds are also important for endurance performance. Research investigating the response of the lactate thresholds to acute hypoxia is however scarce. The aim of this study was to quantify and titrate the acute effect of simulated altitude on the lactate thresholds of well-trained cyclists. **METHODS:** Ten well-trained, non-altitude acclimatized male cyclists and triathletes completed a graded cycling exercise test in a hypobaric chamber at each of four simulated altitudes (200, 1,200, 2,200, 3,200 m). The test protocol comprised 5 x 5-min submaximal efforts (50, 100, 150, 200 and 250 W), to determine  $\dot{V}_{O_{2max}}$ , heart rate (HR) and blood lactate concentration ([La<sup>-</sup>]) responses. Following a 10 min

passive rest, a 5-min maximal time-trial (5-minTT) was performed to determine peak physiological and performance responses. Combining these measures allowed a modified 2-in-1 protocol to be applied to calculate the lactate thresholds (LT1, LT2) using customized software (ADAPT).

**RESULTS:**  $\text{VO}_2$  decreased by  $5.5 \pm 1.1\%$ ,  $15.9 \pm 1.5\%$  and  $26.3 \pm 1.4\%$  at LT1 and by  $6.5 \pm 1.2\%$ ,  $13.4 \pm 1.3\%$  and  $23.2 \pm 1.8\%$  at LT2 at 1,200, 2,200 and 3,200 m compared with 200 m respectively,  $P < 0.05$ . Mean PO declined by  $5.4 \pm 1.1\%$ ,  $17.7 \pm 1.7\%$  and  $30.3 \pm 1.9\%$  for LT1 and by  $5.2 \pm 1.3\%$ ,  $13.9 \pm 1.4\%$  and  $25.7 \pm 1.8\%$  at LT2 at 1,200, 2,200 and 3,200 m compared with 200 m respectively,  $P < 0.05$ . HR and  $[\text{La}^-]$  at these thresholds remained unchanged. 5-minTT  $\text{VO}_{2\text{peak}}$  and PO both followed the same pattern of decline with increasing altitude,  $P < 0.05$ .

**CONCLUSIONS:** A dose response effect of acute hypobaric hypoxia on  $\text{VO}_2$  and PO was found at both submaximal (LT1 and LT2) and maximal (5-minTT) intensities. No such effects were seen for HR or  $[\text{La}^-]$  at any intensity.

924 Board #103 May 31 2:00 PM - 3:30 PM  
**Resistance Exercise In Hypoxia Combined With Blood Flow Restriction**

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The use of blood flow restriction (BFR) or systemic normobaric hypoxia (NH) during resistance exercise to increase metabolic stress and the subsequent muscular development is increasingly popular. However, the extent to which local and systemic hypoxic conditions in combination influence resistance exercise and accompanying physiological responses remains undetermined.

**Purpose:** To determine separate and combined effects of BFR and NH during resistance exercise on performance, perceptual cues, as well as muscle activation and oxygenation.

**Methods:** 14 physical education students were tested for 1 repetition maximum (1-RM) in the *barbell biceps curl* (biceps) and *dumbbell pull over* (triceps). On separate visits, they performed 6 separate randomized trials of 4 sets at 70% 1-RM to failure of each exercise (90-s and 10-min rest between sets and exercises, respectively) in normoxia ( $\text{FiO}_2$  20.9%) or NH ( $\text{FiO}_2$  12.9%) combined with 3 different levels of vascular occlusion (0%, 45% or 60% of maximal occlusion). Arterial oxygen saturation, heart rate, and perceptual responses were assessed following each set. Muscle activation and oxygenation were monitored via surface electromyography (EMG) and near-infrared spectroscopy, respectively.

**Results:** Compared to set 1, the number of repetitions before muscular failure decreased in sets 2, 3, and 4 for both the *biceps* ( $-44 \pm 6\%$ ,  $-59 \pm 7\%$  and  $-63 \pm 6\%$ , respectively; all  $P < 0.001$ ) and *triceps* ( $-39 \pm 10\%$ ,  $-56 \pm 7\%$  and  $-62 \pm 7\%$ , respectively; all  $P < 0.001$ ), independently of the condition ( $P > 0.065$ ). Arterial oxygen saturation was lower with NH ( $P < 0.001$ ), but not BFR, while heart rate ( $P > 0.341$ ) did not differ between conditions. A significant main effect of time was observed for overall perceived discomfort, difficulty breathing and limb discomfort (all  $P < 0.001$ ), but no difference between conditions (all  $P > 0.235$ ). Overall, markers of metabolic stress (tissue saturation index during exercise and subsequent recovery; all  $P > 0.206$ ) and muscle activation (Root Mean Square value; all  $P > 0.626$ ) remained unaffected by environmental conditions.

**Conclusion:** Local and systemic hypoxic stimuli, or a combination of both, during resistance exercise to failure did not alter performance, perception of strenuous exercise, nor trends of muscle activation or oxygenation.

925 Board #104 May 31 2:00 PM - 3:30 PM  
**Effects of Hypobaric and Normobaric Hypoxia on Mitochondrial Related Gene Expression**

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(No relationships reported)

Environmental stimuli such as temperature and hypoxia can influence cellular signaling in the skeletal muscle. Previously we have reported no changes in gene expression related to mitochondrial development with acute exposure to normobaric hypoxia. However, exposure to hypobaric hypoxia may elicit different physiological responses. **Purpose:** To determine the response of skeletal muscle mitochondrial related gene expression after 4-h exposure to normobaric hypoxia (NH), hypobaric hypoxia (HH) and normobaric normoxia (NN) after exercise. **Methods:** Recreationally trained participants ( $n = 15$ , age:  $24 \pm 4$  y, height:  $178 \pm 12$  cm, weight:  $72.47 \pm 13.84$  kg, body fat:  $14 \pm 7\%$ ,  $\text{VO}_{2\text{max}}$ :  $3.60 \pm 0.83$  L  $\cdot$  min<sup>-1</sup>,  $\text{W}_{\text{max}}$ :  $274 \pm 72$  W) each completed three trials of 1-h cycling at 70% of  $\text{W}_{\text{max}}$ . Following exercise, participants sat in an environmentally controlled chamber for a 4-h recovery period in NH (4,420

m), HH (4,420 m), or NN (975 m) environmental conditions. Blood oxygen saturation was measured using pulse oximetry at baseline, 30 min into exercise, immediately after exercise, and 30 min into each hour of recovery. Muscle biopsies were taken from the *vastus lateralis* pre-exercise and after a 4-h exposure period. Samples were analyzed using qRT-PCR to assess gene expression related to mitochondrial development.

**Results:** Arterial oxygen saturation was lower in HH and NH trials compared to the NN trial ( $p < 0.001$ ) and lower in the HH compared to NH ( $p = 0.001$ ). PGC-1 $\alpha$ , GABPA, ERR $\alpha$ , and NRF1 mRNA were not different between the three conditions or from pre-exercise ( $p = 0.804$ ,  $0.650$ ,  $0.956$ ,  $0.563$ , respectively). TFAM mRNA increased in NH from pre-exercise to post-exercise ( $p = 0.036$ ) and was higher than NN ( $p = 0.011$ ). **Conclusion:** These data indicate that gene expression related to mitochondrial development is only marginally affected (TFAM) by the type of hypoxic environment after a 4-h treatment despite differences in arterial oxygen saturation. Funding provided by the Department of Defense United States Army Medical Research and Materiel Command (DOD USAMRMC: W81XWH-15-2-0075).

926 Board #105 May 31 2:00 PM - 3:30 PM  
**Effects of Hypobaric and Normobaric Hypoxia on Myogenic and Proteolytic Gene Expression in Humans**

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(No relationships reported)

Muscle mass is reduced during extended exposure to a hypoxic environment. Current research suggests that the physiological response to normobaric and hypobaric hypoxia may be different. It is currently unknown if these previously described differences extend to the skeletal muscle and transcriptional response regulating muscle mass.

**PURPOSE:** To determine the effects of normobaric and hypobaric hypoxia on myogenic and proteolytic gene expression. **METHODS:** Recreationally trained subjects ( $n = 15$ ; age =  $24 \pm 4$  y;  $\text{VO}_{2\text{max}}$  =  $3.60 \pm 0.83$  L  $\cdot$  min<sup>-1</sup>) completed three trials of 60-min cycling at 70% of  $\text{W}_{\text{max}}$  followed by 4-h of recovery at ambient control conditions (975 m), normobaric hypoxia (4,420 m), and hypobaric hypoxia (4,420 m). For each trial, a muscle biopsy was taken from the *vastus lateralis* before exercise and at the end of the 4-h recovery period for analysis of gene expression (RT-qPCR).

**RESULTS:** There were no differences in the myogenic gene expression of MYOD ( $p = 0.713$ ), MYF-5 (0.053), or MYOG (0.832) between trials. MYF-6 was higher after exercise ( $p = 0.002$ ) regardless of trial. MSTN decreased from pre- to post-exercise ( $p < 0.001$ ) in all conditions and was lower in hypobaric hypoxia compared to control condition ( $p = 0.02$ ) and normobaric condition ( $p = 0.037$ ). There were no differences in the proteolytic gene expression of atrogen-1 with exercise ( $p = 0.811$ ) or between trials ( $p = 0.419$ ). However, FOXO3 ( $p = 0.009$ ) and MuRF-1 ( $p < 0.001$ ) gene expression increased with exercise but were not different between conditions ( $p = 0.543$ ,  $p = 0.327$ , respectively). **CONCLUSION:** These data indicate that hypoxic recovery from exercise, regardless of whether normobaric or hypobaric, does not affect the expression of genes related to myogenesis and proteolysis with the exception of a modest attenuation of myostatin in hypobaric hypoxia.

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927 Board #106 May 31 2:00 PM - 3:30 PM  
**Prior Heat or Hypoxic Acclimation Does Not Attenuate the Cytokine Response to Hypoxic Exercise**

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**BACKGROUND:** Heat acclimation activates the cellular heat shock response (HSR), inhibiting NF- $\kappa$ B and reducing heat stress-mediated cytokine production and limiting stress-induced inflammation. Hypoxia-mediated intestinal ischemia activates the NF- $\kappa$ B pathway and stimulates pro-inflammatory responses linked to acute mountain sickness and pulmonary and cerebral oedema. The upregulation of the HSR via heat acclimation may therefore reduce inflammatory responses following subsequent hypoxic exercise.

**PURPOSE:** To determine whether prior heat acclimation attenuates the cytokine response following hypoxic exercise. **METHODS:** Plasma TNF- $\alpha$ , IL-6, IL-10 and IL-1ra were determined at rest and following a 60 minute cycling normoxic stress test (NST) and hypoxic stress test (HST1;  $\text{F}_2\text{O} = 0.14$ , 50%  $\text{VO}_{2\text{peak}}$ ) in 21 men (age  $22 \pm 5$  years; stature  $1.76 \pm 0.07$  m; mass  $71.8 \pm 7.9$  kg;  $\text{VO}_2$  peak  $51 \pm 7$  mL  $\text{kg}^{-1}$   $\text{min}^{-1}$ ). Participants formed 3 groups and completed 10 x 60 minute acclimation sessions (50%  $\text{VO}_{2\text{peak}}$ ) in control ( $n = 7$ ; 18°C, 35% RH), hypoxic ( $n = 7$ ;  $\text{F}_2\text{O} = 0.14$ , 18°C, 35% RH), or hot ( $n = 7$ ; 40°C, 25% RH) conditions. A second HST (HST2) was completed 48 hours after the final acclimation session. Cytokine data are presented as mean change in ng  $\text{mL}^{-1}$  with 95% confidence intervals and comparisons made

using mixed ANOVA. **RESULTS:** Following the NST plasma IL-6 (+0.6, 95% CI 0.3 - 0.9 ng mL<sup>-1</sup>), IL-10 (+1.1, 95% CI -2.8 - 5.0 ng mL<sup>-1</sup>) and IL-1ra (-16.6, 95% CI -60.5 - 27.2 ng mL<sup>-1</sup>) exhibited minimal change ( $p > 0.05$ ). TNF- $\alpha$  was unaltered throughout the study. IL-6 (+3.9, 95% CI 2.8 - 4.9 ng mL<sup>-1</sup>), IL-10 (+26.2, 95% CI 15.0 - 37.3 ng mL<sup>-1</sup>) and IL-1ra (+1506, 95% CI 746 - 2266 ng mL<sup>-1</sup>) were elevated following HST1 ( $p < 0.01$ ), with no main effect for acclimation group ( $p > 0.05$ ). A similar trend was observed after acclimation (HST2), with IL-6 (+3.1, 95% CI 2.5 - 3.7 ng mL<sup>-1</sup>), IL-10 (+23.2, 95% CI 14.0 - 32.5 ng mL<sup>-1</sup>) and IL-1ra (+1237, 95% CI 721 - 1753 ng mL<sup>-1</sup>) increased ( $p < 0.01$ ), and no main effect for trial or acclimation group observed ( $p > 0.05$ ). **CONCLUSIONS:** Neither prior heat nor hypoxic acclimation attenuated the systemic cytokine response following acute exercise in hypoxia. Future work investigating the effectiveness of different acclimation modalities on improving inflammatory outcomes to hypoxic stress is recommended.

928 Board #107 May 31 2:00 PM - 3:30 PM  
**Validity of the Load Velocity for Power Resistance Training Adjustment at Real Moderate Altitude**

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The relationship between muscle power and hypoxia represents a new way to improve the potential benefits of altitude training, especially in sports involving explosive movements. Monitoring workload through velocity (mean propulsive velocity, MPV), seems appropriate since both the neuromuscular demands and the training effect itself largely depend on the velocity at which loads are lifted. **PURPOSE:** To study whether the MPV could be used to adjust the workload during an oriented resistance training program (RT) at moderate real altitude. **METHODS:** 23 collegiate-men volunteers (23±3 yr) followed 4 weeks RT oriented to optimize muscle power development in either normoxia (N) or intermittent hypoxia (IH, 2320 m living at sea level). The RT (2 sessions/wk, 8 in total) was the same for both groups and the training load (TL) was weekly adjusted to elicit 1m·s<sup>-1</sup> of MPV. The TL was controlled by a linear velocity transducer, and the session loss-velocity in % (L) was estimated. Maximal isometric handgrip (Din) and SaO<sub>2</sub> were monitored before and after each session (s). The peak relative power at 1 ms<sup>-1</sup> of MPV (P<sub>1</sub>), was determined before and after the RT. Intra (s) and inter (N vs. IH) comparisons were made by using mean comparison tests. **RESULTS:** Similar increases in TL were found between N and IH (P=0.716), with both groups showing significant increases when comparing s1 vs. s8 values (N: 9.84%, P=0.03; IH: 8.18%, P=0.007). Interestingly no significant changes in L were found between groups (N: 5.0 vs. IH: 5.9%, P=0.360). Pr increased significantly only in IH (s1: 50.66±5 vs. s8: 54.12±4.9 W·Kg<sup>-1</sup>, P=0.002). As expected, lower values of SaO<sub>2</sub> were found in IH when compared with N (P<0.05) with no differences among s (P=0.571). No significant changes were found for Din between groups (N: 50.7 vs. IH: 56.3 Kg, P=0.137) or s (P=0.216). **CONCLUSIONS:** Monitoring the MPV allows to adjust the workload during RT. The lack of differences in L between groups, mobilizing similar TL, with an increase of Pr only in IH, supports the idea that intermittent exposure to moderate real altitude would have a positive effect on strength responses. A possible explanation could be the combination of the reduced air density and the stimulation of physiological factors. Supported by the Ministry of Education, Culture and Sport of Spain. Ref. DEP2015-64350-P, MINECO/FEDER

929 Board #108 May 31 2:00 PM - 3:30 PM  
**Effects Of Supplemental Oxygen On Submaximal And Maximal Cycling Performance At Altitude**

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**Purpose:** Reduced partial pressure of oxygen (PO<sub>2</sub>) at altitude reduces maximal oxygen consumption (VO<sub>2</sub>). When O<sub>2</sub> is supplemented, maximal exercise performance at altitude has been shown to improve. We questioned whether supplemental O<sub>2</sub> would also increase performance during self-regulated, moderate-intensity exercise performed at 1890m. **Methods:** Twelve (7 male) 26.6±6.7 year-old healthy participants (height, 174.8±9.7cm; weight, 71.4±8.4kg) performed one familiarization trial and two experimental trials (double blind, cross over) while breathing either room air or supplemental O<sub>2</sub> to simulate sea level (FIO<sub>2</sub>=0.265). To evaluate submaximal exercise performance, participants cycled an electrically braked ergometer (Velotron Elite) at a self-selected cadence and work rate corresponding to an RPE of 9 (very light) for 5 min and RPE of 13 (somewhat hard) for 10 min. Following a 2 min rest, participants performed an incremental test (25W + 25W/min) to maximal exertion. Watts, VO<sub>2</sub>, VE, RER, HR, SpO<sub>2</sub>, and RPE were recorded each

min. Differences between trials were evaluated by paired t-tests. Chi-square was used to determine subjects' ability to correctly identify the FIO<sub>2</sub> after each phase of the protocol. **Results:** Supplemental O<sub>2</sub> at 1890m increased SpO<sub>2</sub> during submaximal exercise at RPE 9 and 13 (3±3 and 4±2%, respectively P<0.01); Watts, VO<sub>2</sub>, VE, RER, and HR were unaffected. Supplemental O<sub>2</sub> at 1890m increased SpO<sub>2</sub> (5±3%), power output (16±8 Watts), and VO<sub>2</sub> (0.28±0.16 L/min) at maximal intensity (all P<0.02). Subjects were not able to correctly identify the FIO<sub>2</sub> (P range: 0.25 to 1.00). **Conclusion:** Although supplemental O<sub>2</sub> improves maximal exercise performance at 1890m, it had little effect on short-duration, moderate-intensity exercise, such as might be performed during a warm-up for a competitive event.

930 Board #109 May 31 2:00 PM - 3:30 PM  
**Cerebral and Skeletal Muscle Oxygen Response During Exercise With and Without an Altitude Simulation Mask**

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 (No relationships reported)

Altitude as well as hypoxic chambers cause a greater exercise-induced decrease in both cerebral oxygen response (COR) and skeletal muscle oxygen response (SMOR) when compared to exercise in normoxic conditions. Altitude simulating masks (ASM) such as restrictive breathing devices have promoted their products as respiratory muscle trainers that also expose the body to hypoxic conditions.

**PURPOSE:** To determine if a significant difference in COR and SMOR measured by near-infrared spectroscopy (NIRS) exists during maximal exercise under normoxic conditions with and without an ASM. **METHODS:** Thirteen healthy individuals (F=3, M=10, 24.2 ± 2.7 yr) completed three separate bicycle ergometer maximal exercise tests. Test 1 consisted of respiratory gas analysis to identify  $\dot{V}O_{2max}$ , ventilatory threshold 1 (VT1), and the respiratory compensation point (RCP). Tests 2 and 3 were with and without the ASM in a counterbalanced crossover design. Heart rate (HR), blood pressure (BP), pulse oximetry (S<sub>p</sub>O<sub>2</sub>), and blood lactate (BL) were assessed for all tests. COR was calculated by taking the peak 5-second average of oxygenated hemoglobin (O<sub>2</sub>Hb) and subtracting it from the O<sub>2</sub>Hb at the end of exercise. SMOR was measured by calculating the difference in tissue saturation index (TSI) at the onset and end of exercise. Dependent t-tests were used to assess differences between ASM and non ASM. Significance was set at  $p < 0.05$ . **RESULTS:** There were no significant differences in COR (non ASM 6.01 ± 3.54 vs. ASM 3.75 ± 1.92 μM · L<sup>-1</sup> O<sub>2</sub>Hb;  $p = 0.078$ ) or SMOR (non ASM 17.97 ± 8.08 vs. ASM 19.61 ± 10.92%, TSI;  $p = 0.462$ ) during maximal exercise. There was, however, a reduced S<sub>p</sub>O<sub>2</sub> during exercise in the ASM condition (ASM 3.1 ± 3.3 vs. non ASM 1.0 ± 2.2%;  $p < 0.001$ ). A significantly higher exercise capacity (non ASM 284.2 ± 74.6 vs. ASM 271.6 ± 65.8 watts,  $p = 0.007$ ) and BL (non ASM 11.5 ± 3.7 vs. ASM 9.5 ± 2.3 mM · L<sup>-1</sup>;  $p = 0.008$ ) was observed in the non ASM exercise trial compared to ASM. **CONCLUSIONS:** These results suggest that the use of the ASM during exercise in normoxic conditions did not show a significant difference in COR or SMOR when compared to exercise without the ASM. Although this study did not analyze the respiratory muscle training effect of the ASM, there was no evidence of a cerebral or muscle hypoxic effect during the acute bout of exercise.

931 Board #110 May 31 2:00 PM - 3:30 PM  
**Influence of Exercise Modality on Hypoxia-Mediated Decrements in Endurance Exercise Performance**

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Low oxygen environments, such as high altitude, impair endurance exercise performance. The magnitude of performance decrements are highly variable and may in part be explained by the exercise modality and volume of active muscle mass. For example, it is unclear if an exercise modality engaging both the upper and lower body, such as rowing, would be more impaired than a predominantly lower body exercise, such as cycling. **PURPOSE:** To determine the influence of exercise modality on hypoxia-mediated decrements in endurance exercise performance.

**METHODS:** Endurance trained men and women (n=8; 4 female; age: 30±11 years; maximal oxygen uptake: 3.51±1.01 L/min or 48.1±8.2 ml/kg/min (mean±SE)), participated in a Latin Square experimental design. Four time trials were completed: two on a stationary cycle (4km) and two on a rowing (2km) ergometer, in normoxia (FiO<sub>2</sub>=0.210) and simulated high-altitude (hypoxia; FiO<sub>2</sub>=0.150). Potential differences were analyzed using two-way analysis of variance with repeated measures. **RESULTS:** Hypoxia slowed time trial performance (P>0.001) in both exercise modalities (Cycling: 6.7±0.7 vs. 7.3±1.0; Rowing: 8.0±0.9 vs. 8.5±1.0 min); the proportional magnitude of hypoxia-mediated decrements were not different (P=0.45) between cycling (9.5±4.6%) and rowing (6.3±3.7%).

**CONCLUSIONS:** Endurance exercise performance is attenuated in hypoxia. Our preliminary data suggest the magnitude of decrements may not be appreciably different between exercise modalities engaging upper and lower body, such as rowing, compared with modalities relying predominantly on lower body, such as cycling.

932 Board #111 May 31 2:00 PM - 3:30 PM  
**Effect of Acute Simulated Altitude Exposure on Excess Postexercise Oxygen Consumption**

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Oxygen consumption ( $\text{VO}_2$ ) that remains elevated above the baseline after exercise termination is known as excess post-exercise oxygen consumption (EPOC). Arrival at altitude decreases maximal oxygen uptake, however studies are mixed with respect to the effect of altitude on resting metabolic rate (RMR). To our knowledge, the EPOC response has not been studied with altitude as an independent variable. **PURPOSE:** To observe the EPOC to constant-load cycle exercise performed under acute simulated altitudes of 3353 m and 6401 m.

**METHODS:** Subjects (N = 7 female, 7 male) reported to the laboratory between 0600 and 0830 hours and RMR was obtained. Constant workload cycle exercise was then performed (10-min at 100 W) while breathing air from an altitude simulator under one of the following conditions: control (CON), 3353 m (MID), 6401 m (HI). Subjects returned to complete the remaining conditions in a counterbalanced order. Upon completion of the exercise bout, participants were reconnected to the metabolic system and rested until a running 5-min average of  $\text{VO}_2$  values returned to or below baseline (EPOC duration). Magnitude was determined by summing the net oxygen consumption for each minute during the EPOC period. Data were analyzed using 2 x 3 repeated measures ANOVA.

**RESULTS:** Since no sex differences were detected, data were collapsed and analyzed using one-way repeated measures ANOVA. There was no difference between condition for RMR (CON=3.9±0.5, MID=3.9±0.3, HI=3.9±0.4 ml/kg/min), or cycle performance variables including average power (CON=98±4, MID=100±4, HI=95±9 W). EPOC duration was significant at each altitude increase (CON=15.2±1.9 vs MID=20.7±1.7 min, p=0.002) (MID vs HI=28.1±2.6 min, p=0.006). Likewise, EPOC magnitude was significant at each altitude (CON=73.5±9.9 vs MID=99.1±9.3 ml O<sub>2</sub>, p=0.002) (MID vs HI=139.7±14.3 ml O<sub>2</sub>, p=0.001).

**CONCLUSIONS:** Determining the EPOC response to altitude is important because it represents a source of elevated caloric expenditure that must be accounted for given that carbohydrates are preferentially utilized with altitude exposure. This has an influence on recovery from exercise as well as future bouts of work. Thus, individuals who are active at altitude must account for this increased caloric deficit despite a loss of appetite that is common with altitude exposure.

933 Board #112 May 31 2:00 PM - 3:30 PM  
**Efficacy of Normobaric Intermittent Hypoxic Training to Improve VO<sub>2</sub>peak During Acute Hypobaric Hypoxia Exposure**

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Environmental conditions pose additional threats to the health of soldiers during military operations. Missions conducted at high altitude increase the relative workload for military personnel and unacclimatized warfighters may endure performance decrements.

**PURPOSE:** To examine the effects of normobaric intermittent hypoxic training (NIHT), when compared to normobaric normoxia (NN) training, on peak aerobic capacity ( $\text{VO}_{2\text{peak}}$ ) in hypobaric hypoxia (HH). **METHODS:** Eleven male Reserve Officers' Training Corps (ROTC) cadets (age 19.55±1.44 y, mass 75.80±8.82 kg, stature 177.45±6.67 cm) completed the 6 week training intervention in either the NIHT (EXP, n=6) or NN (CON, n=5) conditions. Pre- and post-assessment of  $\text{VO}_{2\text{peak}}$  was conducted in an HH setting equivalent to 3033 m. The EXP group also completed a follow-up  $\text{VO}_{2\text{peak}}$  assessment after a 1 week detraining period. Mixed ANOVA was performed to analyze differences between the within-subjects factor (time) and between-subjects factor (group). Repeated measures ANOVA were also performed to analyze differences between the pre-, post-, and follow-up results of the EXP group. **RESULTS:** There was no significant interaction of time x group,  $F(1,9)=1.17$ ,  $P=0.31$ , partial  $\eta^2=0.12$ , nor significant main effect of group,  $F(1,9)=0.03$ ,  $P=0.86$ , nor was there a significant main effect of time  $F(1,9)=3.35$ ,  $P=0.10$ , on time-to-exhaustion (TE) measured in HH. Neither was there a significant interaction of time x group for relative  $\text{VO}_{2\text{peak}}$  ( $\text{RVO}_{2\text{peak}}$ ),  $F(1,9)=1.64$ ,  $P=0.23$ , partial  $\eta^2=0.15$ . Further, there was no

significant main effect of group for  $\text{RVO}_{2\text{peak}}$ ,  $F(1,9)=0.61$ ,  $P=0.45$ . However, there was a significant main effect of time for  $\text{RVO}_{2\text{peak}}$ ,  $F(1,9)=6.88$ ,  $P=0.03$ . Finally, there was no significant difference of  $\text{RVO}_{2\text{peak}}$  in the EXP group between pre-, post-, and follow-up assessments in the HH chamber,  $F(2,3)=6.53$ ,  $P=0.06$ . **CONCLUSION:** NIHT, compared to NN, failed to elicit significantly greater aerobic endurance enhancements in acute HH. However, while statistical significance for TE,  $\text{VO}_{2\text{peak}}$ , and  $\text{RVO}_{2\text{peak}}$  may not have been attained, moderate effect sizes for the aforementioned variables reveal a potential practical significance was achieved via increases of 7.37%, 15.99%, and 14.71% for the EXP group, respectively. Supported by NSCA Foundation Doctoral Research Grant

934 Board #113 May 31 2:00 PM - 3:30 PM  
**Maximum Oxygen Consumption Returns to Sea Level Values after Two Weeks of Altitude Acclimatization in a Large Multi-Year Study**

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While it is generally agreed that maximum oxygen consumption ( $\text{VO}_{2\text{max}}$ ) declines upon acute ascent to altitude, there has been some disagreement about the effects of acclimatization on  $\text{VO}_{2\text{max}}$ . Some of the disagreement reflects a small sample size and lack of control of physical activity during the stay at altitude. To our knowledge, no studies with a large subject pool that controls for physical activity have looked at  $\text{VO}_{2\text{max}}$  after acute exposure, acclimatization and upon return to sea level in the same study. **Purpose:** Therefore, the purpose of this study was to determine the effect of moderate altitude exposure on maximum oxygen consumption acutely, after acclimatization, and upon return to sea level. **Methods:** Over the course of a 6-year period, eighty-eight active subjects (age = 23.3 + 3.5 yrs, weight = 78.5 + 17.5 kg,  $\text{VO}_{2\text{max}} = 42.4 + 5.7$  ml/kg/min) completed a graded-exercise test on a cycle ergometer at sea level (SL1), upon acute exposure to 3417 m (ALT1), two weeks following acclimatization at 3417 m (ALT2), and upon return to sea level (SL2). Workloads were increased every two minutes following a two-minute warmup until volitional fatigue. Maximum oxygen consumption was measured using a Parvo TruOne 2400 Metabolic cart. Subject's activity levels were assessed during the 2-week period and were unchanged relative to sea level. **Results:** Maximum oxygen consumption significantly declined ( $P<0.05$ ) from SL1 to ALT 1 (3.48 + .39 l/min vs. 3.04 + .32 l/min). However, by ALT2  $\text{VO}_{2\text{max}}$  was not different from SL1 (3.48 + .39 l/min vs. 3.31 + .51 l/min). Maximum oxygen consumption was slightly, but not significantly higher upon return to sea level (SL2 = 3.65 + .66 l/min). While body weight changes occurred in some subjects, overall there was no difference in average body weight between any of the testing points. **Conclusions:** These data suggest that exposure to acute altitude results in a reduction in maximum oxygen consumption. However, after two weeks of acclimatization maximum oxygen consumption returns to pre-sea level values in a large multi-year study.

935 Board #114 May 31 2:00 PM - 3:30 PM  
**Does Arterial Oxyhemoglobin Saturation Influence the Hemoglobin Mass-VO<sub>2</sub>Peak Relationship in Endurance Athletes at Moderate Altitude?**

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 (No relationships reported)

Total hemoglobin mass (tHb) is a well-established, key predictor of maximal oxygen uptake ( $\text{VO}_{2\text{peak}}$ ) across aerobic fitness levels. Arterial oxyhemoglobin saturation ( $\text{S}_{\text{a}}\text{O}_2$ ) has the potential to modify this relationship, especially in populations that experience exercise-induced arterial desaturation. **PURPOSE:** To examine how variability in  $\text{S}_{\text{a}}\text{O}_2$  at  $\text{VO}_{2\text{peak}}$  modifies the relationship between tHb and  $\text{VO}_{2\text{peak}}$  at moderate altitude (1625m) in highly trained athletes.

**METHODS:** 16 male and 17 female competitive, highly trained (>10 hr training per week) cyclists/triathletes took part. On visits one and four tHb was assessed via the optimized carbon monoxide rebreathing method. Visits two and three were identical graded exercise tests (GXT) on a cycle ergometer to determine  $\text{VO}_{2\text{peak}}$  and  $\text{S}_{\text{a}}\text{O}_2$  at  $\text{VO}_{2\text{peak}}$ ; the workload began at 4 and 3 W kg<sup>-1</sup> for men and women respectively, rounded down to the nearest 20 W increment, and power increased 20 W every minute until volitional exhaustion.  $\text{VO}_2$  was measured using indirect calorimetry and  $\text{VO}_{2\text{peak}}$  was calculated as the highest average 30 sec  $\text{VO}_2$ .  $\text{S}_{\text{a}}\text{O}_2$  was measured at rest and during exercise using forehead pulse oximetry;  $\text{S}_{\text{a}}\text{O}_2$  at  $\text{VO}_{2\text{peak}}$  was calculated as the average  $\text{S}_{\text{a}}\text{O}_2$  during the same 30 sec used to determine  $\text{VO}_{2\text{peak}}$ . Duplicate measures of tHb were averaged in order to reduce measurement error. In order to control for the effect of body mass on  $\text{VO}_{2\text{peak}}$  and tHb, both variables were normalized by body mass prior to analysis.

**RESULTS:**  $\text{VO}_{2\text{peak}}$  was significantly higher for the second GXT (+0.06 ± 0.17 L O<sub>2</sub> min<sup>-1</sup>, p = 0.05) and the difference in  $\text{VO}_{2\text{peak}}$  was related to the difference in  $\text{S}_{\text{a}}\text{O}_2$  ( $r = -0.42$ , p = 0.02), so results from the second GXT were used.  $\text{VO}_{2\text{peak}}$  ranged from

62.5 – 83.0 and 44.5 – 67.3 ml kg<sup>-1</sup> min<sup>-1</sup> in men and women respectively; tHb ranged from 12.1 – 17.5 and 9.1 – 13.0 g kg<sup>-1</sup> and S<sub>a</sub>O<sub>2</sub> at VO<sub>2peak</sub> ranged from 81.7 – 94.0 and 85.7 – 95.0%. tHb explained 32% of the variability in VO<sub>2peak</sub> (p = 0.02) in men and 42% in women (p = 0.01), but correcting by end exercise S<sub>a</sub>O<sub>2</sub> did not improve either relationship.

**CONCLUSION:** Across a range of highly trained athletes at moderate altitude, correcting tHb by S<sub>a</sub>O<sub>2</sub> at VO<sub>2peak</sub> does not appear to explain additional variability in VO<sub>2peak</sub>, despite large variability in the levels of observed desaturation.

936 Board #115 May 31 2:00 PM - 3:30 PM  
**Cardiopulmonary Responses, Brain And Muscle Oxygenation During Incremental Exercise On Acute Hypoxia And Hyperoxia**

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Changes in inspired oxygen concentration will affect the peak oxygen uptake compared with normoxia. These underlying mechanisms are not fully understood, but peripheral and central mechanisms have been proposed. **PURPOSE:** Our study focuses on the effect of acute moderate hypoxia and hyperoxia on cardiopulmonary responses, brain and muscle oxygenation during exercise. **METHODS:** Seven healthy male subjects performed on incremental maximal exercise test under normoxia (Norm: 20.9 FIO<sub>2</sub>), hypoxia (Hypo: 14.5% FIO<sub>2</sub>) and hyperoxia (Hyper: 28.5% FIO<sub>2</sub>) conditions. We measured cardiopulmonary measurements (VE, VO<sub>2</sub>, HR and Q) and blood gas (PO<sub>2</sub> and PCO<sub>2</sub>) on incremental exercise. Near-infrared spectroscopy (NIRS) was also used to monitor concentration (μM) changes of oxy- and deoxyhemoglobin (Δ[O<sub>2</sub>Hb], Δ[HbHb]) in left frontal cortex region of the forehead and ipsilateral vastus lateralis muscle. Changes in total Hb and StO<sub>2</sub> were calculated and used as index of change in regional blood volume. Repeated-measures ANOVA were performed across treatments. **RESULTS:** VO<sub>2peak</sub> decreased in Hypo (38.5±3.1 ml/kg/min, p<0.05) and no difference in Hyper (42.6±3.4 ml/kg/min) compared with Norm (42.2±3.9 ml/kg/min). But blood PO<sub>2</sub> at rest and moderate exercise was low in Hypo (57.7±3.1 and 52.2±5.4 mmHg, p<0.05) and high in Hyper (98.6±8.8 and 105.3±9.3 mmHg, p<0.05) compared with Norm (79.3±12.6 and 84.3±4.7 mmHg). Muscle oxygenation dropped progressively during Hypo, and also changes in muscle oxygenation during Hyper were similar to Norm. Interestingly, Brain oxygenation (Δ[O<sub>2</sub>Hb]) was slightly increased and deoxygenation (Δ[HbHb]) was increased during exercise under each three conditions, respectively. Furthermore, changes brain and muscle oxygenation was also greater in Hypo compared with Norm and Hyper (p>0.05). **CONCLUSIONS:** Acute hypoxia decrease oxygen uptake with decreased muscle oxygenation and slightly increased brain oxygenation. But it is unlikely that changes in brain and muscle oxygenation was related with oxygen uptake in hyperoxia, despite a similar difference absolute PO<sub>2</sub> in inspired oxygen and blood from hypoxia and/or hyperoxia to normoxia.

937 Board #116 May 31 2:00 PM - 3:30 PM  
**Passive And Active Intermittent Hypoxic Exposure Pre-acclimatization Does Not Alter Heart Rate Variability At Altitude.**

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**PURPOSE:** This study evaluated the impact of passive and active intermittent hypoxic (IH) exposure pre-acclimatization strategies on temporal and spectral power measures of heart rate variability (HRV) in normobaric hypoxia (NH), and natural altitude.

**METHODS:** Thirty participants (17 male and 13 female, aged 20-62 years), matched by sex, age and maximal aerobic capacity (VO<sub>2peak</sub>), were randomly allocated to either a control, passive IH or active IH group. Experimental groups completed 10 x 2-h, passive (PIH) or active (AIH), normobaric IH exposures (FIO<sub>2</sub> = 0.124, ~4,011 m) over the 14-day intervention period (weekends excluded). The control group received no IH exposure. During the intervention period, participants completed 20 minutes daily running training, at an individualised intensity equivalent to 80% heart rate reserve (HRR). Training workload was determined by regressing HR and running speed data from individual VO<sub>2peak</sub> tests in normal ambient conditions (control and PIH groups) or NH (AIH group, FIO<sub>2</sub> = 0.124). AIH participants completed the exercise training sessions under supervision, during scheduled IH exposure sessions, while control and PIH groups completed training unsupervised in normal ambient conditions. Within 48 hours of completing pre-acclimatization, participants travelled by air from the

UK to Nepal, a journey time of approximately 36 hours. Participants then trekked from 2800 m to 5300 m over 14 days. Temporal (RR, SDNN, RMSSD) and spectral power measures (LFnu, HFnu and LFHF ratio) of HRV were recorded, at rest with spontaneous breathing, in normal ambient conditions (FIO<sub>2</sub> = 0.209), NH (FIO<sub>2</sub> = 0.124, ~4011 m) and in hypobaric hypoxia (HH) at 4356 m and 5350 m, during ascent. **RESULTS:** Two-way ANOVA (group x condition) with repeated measures revealed neither significant interactions (P>0.05), nor between-group (P>0.05) nor within-group (P>0.05) differences for temporal or power spectral HRV measures between baseline, pre-IH and post-IH. No significant interactions, between-group or within-group changes were noted between post-IH, 4300 m and 5300 m (P>0.05) natural altitude. **CONCLUSION:** Pre-acclimatization using active and passive intermittent hypoxic exposure did not significantly alter heart rate variability responses during ascent to very high altitude.

938 Board #117 May 31 2:00 PM - 3:30 PM  
**Hematological Response to Uncontrolled Use of Altitude Training by Elite Distance Runners**

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Elite endurance athletes typically use “live high - train low” altitude training to enhance sea level performance. Perhaps the most commonly utilized and expected experimental control in altitude training research concerns iron stores and supplementation. Whether elite athletes and coaches independently follow evidence-based best-practice principles regarding iron status and training at altitude, outside of a controlled research setting, is unknown. **PURPOSE:** To examine logistical decisions elite U.S. distance runners make regarding altitude training and the hematological outcomes that result from those decisions. **METHODS:** Elite U.S. distance runners (n = 58) completed altitude training (living elevation = 2,000 - 2,600m) at their own cost and volition. Total hemoglobin (tHb) mass was measured using CO rebreathing upon arrival and departure from altitude. Questionnaires asked athletes to self-report pre-altitude serum ferritin values, if iron was taken (pill or liquid) at altitude, and workout specifics. **RESULTS:** Of the 40 athletes who knew their serum ferritin level at the start of the camp, those with ferritin < 50 ng·ml<sup>-1</sup> (n = 11) demonstrated a ΔtHb of 0.6 ± 2.0% (ns) and those with ferritin > 50 ng·ml<sup>-1</sup> (n = 29) significantly increased tHb by 3.7 ± 3.0%. Of those with ferritin levels > 50 ng·ml<sup>-1</sup>, athletes who lived at altitude < 23 days (n = 9) showed a ΔtHb mass of 1.3 ± 1.7% (ns) and those who lived at altitude for > 27 days (n = 20) significantly increased tHb mass by 3.8 ± 2.6%. Of the total cohort, 49 athletes answered questions regarding iron supplementation. Those who supplemented iron in liquid form (n = 27) significantly increased tHb mass by 4.2 ± 3.4%. Those who did not supplement iron (n = 3) or supplemented in pill form (n = 19) showed a ΔtHb mass of 1.5 ± 0.5% (ns) and 1.4 ± 2.7% (ns). Athletes who answered questions regarding training (n = 47) reported completing 8.5 ± 2.5 “higher intensity workouts,” and 3.6 ± 1.1 of those workouts were done at <1,500m. Only 4 of the 47 athletes completed all higher intensity sessions at <1,500m. **CONCLUSION:** A substantial number of elite U.S. distance runners do not follow what would be considered evidence-based best-practice principles regarding altitude training. Coaches, sport scientists, and clinicians would be prudent to strongly advocate for athletes to follow these principles.

939 Board #118 May 31 2:00 PM - 3:30 PM  
**No Sex Differences in the Cardiac Response to Acute Normobaric Hypoxia**

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Acute hypoxia reduces arterial oxygen content, thereby increasing cardiac work to maintain oxygen delivery. Hypoxia may be accompanied by impairments in cardiac function which may be subject to sex differences, although this remains inadequately described. **PURPOSE:** Explore sex differences in the cardiac response to acute hypoxia. **METHODS:** Thirty healthy participants (15 men, 22±4 yrs, BMI 25.3±3.0 kg/m<sup>2</sup>; 15 women, 20±3 yrs, BMI 22.6±1.2 kg/m<sup>2</sup>) underwent echocardiographic measures with simultaneous 1-Lead electrocardiogram-gating following ~1.5 hour sham condition (20.0% O<sub>2</sub>) and normobaric hypoxic (12.5% O<sub>2</sub>) exposure on two separate days, in a randomized order. Systolic function (M-mode, tissue Doppler imaging [TDI]) and diastolic function (mitral filling velocities, TDI) were assessed in triplicate. Systolic function was assessed using fractional shortening (FS), ejection fraction (EF) from 2D Teicholz M-mode (parasternal short-axis), and S-wave velocity from tissue Doppler Imaging (TDI, apical 4-chamber). Diastolic function was assessed

using ratios between early (E) and late (A) filling waves assessed from Doppler (E, A) and TDI (E', A'). **RESULTS:** EF, FS, S-velocity (septal) were greater in hypoxia vs sham (p<0.05). Markers of diastolic function (E:A, E':A') were lower in hypoxia vs sham (p<0.05). Men had higher EF vs women across conditions (p<0.05). No significant condition by sex interactions were noted. **CONCLUSION:** Hypoxia resulted in greater systolic function but impaired diastolic function compared to the sham condition. Although men tended to have greater cardiac systolic function vs women there were no sex differences in the cardiac systolic or diastolic response to acute hypoxic exposure. Supported by a Foundation Research Grant from ACSM

Table 1: Myocardial function in sham condition and acute hypoxia in males and females (mean± SD)

	Sham		Hypoxia		P value			
	Men	Women	Men	Women	Condition	Sex	CxS	df
<b>Systolic Function</b>								
EF (%)	57± 7	63± 5	63± 8	66± 6	<b>0.01</b>	<b>0.02</b>	0.25	26
FS (%)	30± 5	34± 4	35± 6	36± 5	<b>0.01</b>	0.06	0.33	26
<b>Tissue Doppler velocities</b>								
Lateral S (cm/s)	11.3± 1.9	11.8± 1.4	12.6± 2.6	11.8± 2.5	0.12	0.85	0.14	23
Septal S (cm/s)	8.4± 1.1	8.5± 1.1	9.0± 1.2	9.2± 1.1	<b>0.01</b>	0.68	0.86	22
<b>Diastolic Function</b>								
Mitral E:A	2.0± 0.4	2.0± 0.5	1.6± 0.3	1.7± 0.4	<b>&lt;0.01</b>	0.60	0.93	24
<b>Tissue Doppler velocities</b>								
Lateral E":A"	2.92± 0.75	2.71± 0.91	2.38± 0.60	2.19± 0.38	<b>&lt;0.01</b>	0.42	0.91	23
Lateral E:E"	3.50± 0.63	3.77± 0.68	3.32± 0.58	3.76± 1.00	0.55	0.16	0.62	23
Septal E":A"	2.92± 0.75	2.71± 0.91	2.38± 0.60	2.19± 0.38	<b>&lt;0.01</b>	0.42	0.91	22
Septal E:E"	5.03± 0.86	5.06± 0.87	4.79± 0.71	4.86± 1.15	0.39	0.86	0.92	22

CxS, condition x sex interaction; EF, ejection fraction; FS, fractional shortening

940 Board #119 May 31 2:00 PM - 3:30 PM  
**Effect Of Additional Overnight Hypoxic Exposure In Combination With Intermittent Hypoxic Training On MART**  
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 (No relationships reported)

We previously demonstrated that 7 days of intermittent hypoxic training (IHT) improved performance in the maximal anaerobic running test (MART) (ACSM 2015). However, it is unclear whether additional overnight hypoxic exposure in combination with IHT can further enhance MART. **PURPOSE:** The purpose of the present study was to compare the physiological adaptations in well-trained 400m or 800m runners following either 7 days of intermittent hypoxic overnight exposure (IHE), IHT, or a combination of IHE and IHT (IHE+IHT). **METHODS:** Thirty-two well-trained university female 400m or 800m runners were assigned to either IHE (n=9), IHT (n=9), IHE+IHT (n=6) or Control (n=8) groups. IHE and IHE+IHT slept in a normobaric hypoxic room (FIO<sub>2</sub>=16.4%; 2000m; 10 h/d). IHT and IHE+IHT trained in a normobaric hypoxic room (FIO<sub>2</sub>=14.4%; 3000m; 4 h/d). Control, non-IHE hours, and non-IHT hours were spent in ambient normobaric normoxia (60m). Subjects trained for 7 days and performed MART and an incremental maximal running test before and after the 7 days training period. Training consisted of high intensity interval training (5 x 30s maximal effort pedaling) and endurance training (30min incremental running and 30min steady pedaling). VO<sub>2</sub>max and the velocity equivalent to 4mmol lactate (V4mM) were measured in the incremental running test. **RESULTS:** Maximal power in the MART increased significantly (P<0.05) in IHT (109.5±1.4 vs. 111.7±2.8 ml/kg/min). However, there were no significant changes in IHE, IHE+IHT or Control (IHE: 111.0±4.2 vs. 111.6±4.0, IHE+IHT: 109.4±3.3 vs. 110.2±3.6, Control: 112.1±3.0 vs. 111.5±3.9 ml/kg/min). No significant change in VO<sub>2</sub>max in any groups was found. V4mM increased significantly (P<0.05) in IHT and

IHE+IHT (IHT: 248.4±13.7 vs. 255.3±15.6, IHE+IHT: 221.8±16.1 vs. 237.8±9.9 ml/min), whereas there were no significant changes in IHE or Control (IHE: 253.1±24.2 vs. 251.6±22.8, Control: 246.7±16.8 vs. 250.6±21.0 ml/min). **CONCLUSIONS:** These results suggest that 7 days of IHT (3000m) enhances maximal anaerobic capacity (MART) in well-trained female middle distance runners, which supports our earlier findings (ACSM 2015). However, there does not appear to be further enhancement of anaerobic running performance with the addition of overnight hypoxic exposure to IHT.

941 Board #120 May 31 2:00 PM - 3:30 PM  
**Influence Of Altitude Difference On Residents' Physical Function**  
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 (No relationships reported)

**Purpose:** To compare the physical characteristics and function between the residents in different altitude. **Methods:** 441 Tujia-Nationality men (24.6±3.2 yr) from high (H = 1500 M, N = 196) and low (L = 800 M, N = 215) mountain areas in Enshi Tujia and Miao Autonomous Prefecture, Hubei province of China who had the same social-economic status were compared with the physical characteristics and physiological functions. **Results:** Compared with the H group, the L group were taller (167.5 ±5.3 vs 165.0 ±5.2cm, P < 0.001) and had lower waist-to-height ratio (0.51 ±0.04 vs 0.52 ±0.04, P < 0.001), but no significant difference in body weight and circumferences. The L group had higher heart rate (79.5 ±10.8 vs 76.7 ±9.4 bpm, P = 0.034), greater vital capacity (3225 ±677 vs 2839 ±731 ml, P < 0.001), lower systolic pressure (112.0 ±10.4 vs 115.7 ±12.4 mmHg, P = 0.007), and lower diastolic pressure (74.5 ±8.0 vs 79.8 ±11.7 mmHg, P < 0.001). The L group had lower sit-and-reach (6.6 ±7.9 vs 8.5 ±5.3 cm, P = 0.015), but had greater vertical jump (34.2 ±9.0 vs 30.4 ±8.4 cm, P < 0.001), longer time to stand on one foot with eyes closed (31.7 ±31.2 vs 20.5 ±21.4 sec, P < 0.001), more push-up (26±13 vs 23±12, P < 0.031) and shorter reaction time (0.46 ±0.08 vs 0.51 ±0.15 sec, P < 0.001). **Conclusion:** Residents in low mountain area are taller, have lower arterial pressure and better neuromuscular function as compared to their counterparts in high mountain area.

942 Board #121 May 31 2:00 PM - 3:30 PM  
**Losartan Does Not Affect Maximal Exercise Performance at High Altitude (5000 m)**  
 Stephen D. Myers<sup>1</sup>, Sam Lucas<sup>2</sup>, Kimberly Ashdown<sup>1</sup>, Will Malein<sup>3</sup>, Owen D. Thomas<sup>4</sup>, Mark Edsell<sup>5</sup>, Mark Edsell<sup>5</sup>, Cassim Ladha<sup>6</sup>, Arthur Bradwell<sup>2</sup>, Alex Wright<sup>2</sup>, Carla A. . Gallagher<sup>1</sup>.  
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 (No relationships reported)

Exposure to high altitude induces hypertension that likely exacerbates arterial hypoxia via pulmonary vasoconstriction and ventilation-perfusion mismatching. Research has shown that inhibition of the renin-angiotensin-aldosterone system (RAAS) via an inhibitor provides an antihypertensive effect at rest during acute exposure to high altitude. Such effects may have benefits for exercise performance given the potential for improved arterial saturation, but has not been studied. **PURPOSE:** To assess the effects of the RAAS inhibitor losartan on maximal exercise performance at 5000 m. **METHODS:** Eighteen lowlanders were paired-matched for age, ACE gene status, previous altitude exposure and sex, with each of the pair randomly assigned to a group (men:women: losartan 6:3, placebo 6:3; age 40 ± 18 years; height 175 ± 9 cm; body mass 72.4 ± 12.4 kg; BMI 23.7 ± 2.2 kg/m<sup>2</sup>). A 100 mg once daily dose of either losartan or placebo (starch) was administered in a double-blind manner for 21 days, which included a slow 8-day ascent to 5000 m (Whymper Hut, Chimborazo, Ecuador). At sea-level and within 48 h of arrival at 5000 m, participants (pairs exercised within ~1 h of each other) completed a graded exercise test (GXT) to exhaustion on a supine cycle ergometer (Altcycle, BMRES). Ventilation (VE) and end-tidal gases were measured breath-by-breath (K4b2, Cosmed), and heart rate (HR, ECG), arterial oxygen saturation (SpO<sub>2</sub>, pulse oximeter) and beat-to-beat blood pressure (finometer) were measured continuously at rest and during exercise. Data are mean ± SD and group differences at peak power output were analyzed using independent t-tests, with significance set at p<0.05. **RESULTS:** At 5000 m, resting measures of SpO<sub>2</sub> between losartan and placebo groups were not significantly different (79 ± 5 vs. 76 ± 6%, p=0.40). Peak power was similarly

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reduced relative to sea level ( $p < 0.01$ ) in both groups (down  $100 \pm 29$  vs.  $91 \pm 28$  W,  $p = 0.55$ ), while  $\text{SaO}_2$  ( $70 \pm 6$  vs.  $70 \pm 5\%$ ,  $p = 0.96$ ),  $\text{VO}_{2\text{peak}}$  ( $31.3 \pm 4.6$  vs.  $34.0 \pm 7.2$   $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ,  $p = 0.35$ ),  $\text{VE}$  ( $142 \pm 38$  vs.  $146.2 \pm 31.2$   $\text{L} \cdot \text{min}^{-1}$ ,  $p = 0.81$ ) and  $\text{HR}$  ( $146 \pm 21$  vs.  $149 \pm 24$   $\text{b} \cdot \text{min}^{-1}$ ,  $p = 0.78$ ) were similar between groups at peak power, as was the increase in BP from rest to peak power (increased by  $31 \pm 17$  vs.  $25 \pm 16$   $\text{mmHg}$ ,  $p = 0.71$ ).

**CONCLUSION:** Losartan (100 mg) taken daily for 21 days had no observable effect on exercise performance at 5000 m.

943 Board #122 May 31 2:00 PM - 3:30 PM  
**Ischemic Preconditioning Attenuates Acute Mountain Sickness in Hypobaric Hypoxia during Recreational Mountaineering**  
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 (No relationships reported)

**Purpose:** Acute mountain sickness (AMS) is a syndrome commonly experienced in non-acclimatized mountaineers when ascent is too high and too rapid. Ischemic preconditioning (IPC) is a noninvasive experimental technique that has been shown to protect remote organs from ensuing hypoxic damage. In this study we sought to determine if IPC would 1) mitigate the effects of altitude on arterial  $\text{O}_2$  saturation ( $\text{SpO}_2$ ) and 2) attenuate the symptoms of AMS. **Methods:** Ten (6 men and 4 women) physically active individuals (Age:  $26.7 \pm 5.0$  yrs,  $\text{VO}_{2\text{max}}$ :  $45.0 \pm 7.1$   $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ) who were acclimated to 2350m were randomized to either a treatment (IPC) or control (CON) group. An IPC protocol consisting of 3x5 min bilateral leg occlusion/reperfusion bouts at 200 mmHg was administered to the IPC group. The CON group was administered a protocol identical in time and frequency, but with an inflation pressure of 40 mmHg. To examine the potential late phase protective effects of IPC on  $\text{SpO}_2$  and symptoms of AMS, 36 hours post-IPC or CON, all participants hiked 9km at a standardized pace to an elevation of 3800m. Symptoms of AMS were evaluated by Lake Louise score (LLS). **Results:** It was found that  $\text{SpO}_2$  was significantly higher ( $p < 0.05$ ) in the IPC group when compared to the CON group (IPC  $89.6 \pm 3.9\%$  vs. CON  $86.9 \pm 4.2\%$ ). A LLQ score of less than 3 is considered mild AMS, whereas a score of 3 or more is considered severe AMS. Incidence of severe AMS was significantly lower ( $p < 0.05$ ) in the IPC (0%) vs. CON (50%) group. Moreover, the IPC group (when compared to CON group) had significantly ( $p < 0.05$ ) lower incidence of dizziness/lightheadedness (IPC=0% vs. CON=50%), fatigue/weakness (IPC=25% vs. CON=66.6%), change in mental status (IPC=0% vs. CON=33.3%) and ataxia (IPC=0% vs. CON=16.6%). **Conclusion:** Our findings suggest that IPC may be a strategy to increase  $\text{SpO}_2$  and decrease AMS symptoms at high altitude.

944 Board #123 May 31 2:00 PM - 3:30 PM  
**Locomotor-Respiratory Coupling is Maintained in Hypoxia in Trained Distance Runners**  
 Timothy J. Fulton<sup>1</sup>, Hunter L. Paris<sup>1</sup>, Abigail SL Stickford<sup>2</sup>, Allison H. Gruber<sup>1</sup>, Timothy D. Mickleborough, FACSM<sup>1</sup>, Robert F. Chapman, FACSM<sup>1</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>Appalachian State University, Boone, NC. (Sponsor: Robert Chapman, FACSM)  
 (No relationships reported)

**PURPOSE:** To determine if acute exposure to normobaric hypoxia alters locomotor-respiratory coupling (LRC) patterns typically observed in trained runners, and to determine if any changes in LRC influence running economy (RE) and/or perceptions of ventilatory effort.

**METHODS:** Trained male distance runners ( $n = 13$ ) with  $\text{VO}_{2\text{max}} = 66.8 \pm 1.1$   $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  completed two laboratory visits, each in a different inspired gas condition, either normoxia (NORM) or hypoxia (HYP) ( $\text{FIO}_2 = 15.8\%$ ;  $\sim 2500\text{m} / 8000\text{ft}$ ). During each visit, subjects ran for 5 min at each of three constant submaximal speeds of 12.9, 14.3, and 16.1  $\text{km} \cdot \text{hr}^{-1}$  with 4 min standing rest between speeds. Following the third stage, an incremental incline ramp protocol was used to determine  $\text{VO}_{2\text{max}}$ . RE and LRC measures were taken during the 4<sup>th</sup> min of each speed (3:00-4:00), while ratings of perceived exertion (RPE) and dyspnea (DYS) were taken during the first 30 seconds of the final minute at each speed (4:00-4:30), and again at the conclusion of the test. The degree of LRC was calculated as the highest number of inspirations or expirations beginning in the same decile of the step divided by the total number of breaths.

**RESULTS:** Compared with NORM, the degree of LRC was not significantly different at any of the three common submaximal speeds with exposure to HYP, however it was increased at  $\text{VO}_{2\text{max}}$  ( $43.8 \pm 3.4\%$  vs.  $57.1 \pm 3.8\%$ ;  $p < 0.05$ ). Breathing frequency (breaths  $\text{min}^{-1}$ ) was significantly increased at each submaximal speed in HYP compared to NORM ( $30.3 \pm 1.9$  vs.  $35.9 \pm 2.2$ ,  $34.8 \pm 2.0$  vs.  $39.8 \pm 2.2$ ,  $40.4 \pm 2.4$  vs.  $45.2 \pm 1.9$ ;  $p < 0.05$ ), but was not significantly different at  $\text{VO}_{2\text{max}}$ . Stride frequency-to-breathing frequency quotients were significantly lower at each submaximal speed in HYP ( $2.91 \pm 0.20$  vs.  $2.45 \pm 0.17$ ,  $2.53 \pm 0.17$  vs.  $2.21 \pm 0.14$ ,  $2.22 \pm 0.14$  vs.  $1.95 \pm 0.09$ ;  $p < 0.05$ )

due to increases in breathing frequency while maintaining stride frequency. RE and RPE were not significantly different at any speed. DYS was only significantly different between NORM and HYP at 16.1  $\text{km} \cdot \text{hr}^{-1}$  ( $p < 0.05$ ).

**CONCLUSIONS:** Trained distance runners are able to maintain LRC in hypoxia, even when breathing frequency is increased at any submaximal pace. It is possible that within this unique population, years of training enhance and optimize the ability to make adjustments to LRC in order to minimize metabolic costs.

945 Board #124 May 31 2:00 PM - 3:30 PM  
**Acute Hypoxia Exacerbates Central Fatigue but not the Fatigue-related Reduction in Motor Neuron Responsiveness**  
 Luca Ruggiero, Alexandra F. Yacyshyn, Jane Nettleton, Chris J. McNeil. *The University of British Columbia - Okanagan, Kelowna, BC, Canada.* (Sponsor: Charles L. Rice, FACSM)  
 (No relationships reported)

It has been shown recently that acute hypoxia (AH) exacerbates fatigue through both muscular and neural mechanisms. At a supraspinal level, the voluntary drive from the motor cortex during fatiguing efforts was impaired compared to normoxia (NM). However, it is currently unknown whether hypoxia acutely affects motor neuron properties and their contribution to fatigue. **PURPOSE:** To examine motor neuron responsiveness and voluntary activation (VA) during fatiguing contractions in AH and NM. **METHODS:** On separate days, 11 males ( $31 \pm 8$  years) completed a 16-minute fatigue protocol composed of submaximal (25% maximal torque; MVC) intermittent (10s contraction, 5s rest) isometric elbow flexions in NM ( $\text{F}_{\text{O}_2} = 21\%$ ) and AH ( $\text{F}_{\text{O}_2} = 11\%$ ). For the last contraction of each minute, participants matched the integrated electromyographic activity (EMG) to that recorded during brief contractions at 25% MVC prior to fatigue; motor neuron responsiveness was measured by delivering cervicomedullary stimulation in the silent period evoked by transcranial magnetic stimulation (TMS) of the motor cortex (100ms inter-stimulus interval). Every 2 minutes, VA was measured by delivery of TMS during contractions at 100, 75 and 50% MVC, separated by 3s. **RESULTS:** Prior to fatigue, arterial saturation and cerebral tissue oxygenation index were significantly lower in AH compared to NM ( $98 \pm 1$  vs.  $76 \pm 3\%$  and  $65 \pm 7$  vs.  $48 \pm 12\%$ , respectively;  $p < 0.01$ ). MVC torque was equivalent ( $76.2 \pm 9.5$  vs.  $80.6 \pm 13.0$   $\text{Nm}$ , respectively;  $p > 0.05$ ) but VA was significantly lower in AH compared to NM ( $90.4 \pm 5.0$  vs.  $93.5 \pm 5.4\%$ , respectively;  $p < 0.05$ ). At the end of the fatigue protocol, the reductions of MVC torque and VA (relative to control values) were greater in AH compared to NM ( $20.5 \pm 8.2$  vs.  $11.6 \pm 9.8\%$  and  $14.4 \pm 12.3$  vs.  $4.0 \pm 7.1\%$ , respectively;  $p < 0.05$ ). Conversely, the reduction in motor neuron responsiveness (area of the cervicomedullary motor evoked potential normalized to the maximal compound muscle action potential) was not significantly greater during AH compared to NM ( $47.6 \pm 30.8$  vs.  $31.2 \pm 37.2\%$ ,  $p > 0.05$ ). **CONCLUSION:** While AH elicited a marked effect in the CNS, such impairment was only confined to the cortical compartment (a greater reduction in VA), without affecting the responsiveness of motor neurons to a fatiguing task.

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946 Board #125 May 31 2:00 PM - 3:30 PM  
**Training Periodisation During LHTH at Various Altitudes Improves Performance in Elite Runners**  
 Avish P. Sharma<sup>1</sup>, Laura A. Lewis<sup>1</sup>, Brad Clark<sup>2</sup>, Christopher J. Gore, FACSM<sup>1</sup>, Philo U. Saunders<sup>1</sup>, Kevin G. Thompson, FACSM<sup>2</sup>. <sup>1</sup>Australian Institute of Sport, Canberra, Australia. <sup>2</sup>University of Canberra, Canberra, Australia. (Sponsor: Kevin G. Thompson, FACSM)  
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 (No relationships reported)

Previous studies have reported improved sea level performance and increased haemoglobin mass ( $\text{Hb}_{\text{mass}}$ ) following hypoxic doses of varying magnitude. Less research has focused on the periodisation of training during hypoxic exposure which may influence subsequent performance.

**PURPOSE:** To determine the effect of intensified training and tapering during different doses of Live High Train High (LHTH) altitude on sea level performance and  $\text{Hb}_{\text{mass}}$  in elite runners.

**METHODS:** Twenty one runners completed one of three LHTH altitude camps following 4 weeks of sea level training; 22 days at 1720 m (MOD22;  $n = 7$ ;  $\text{VO}_2\text{max} = 71 \pm 4$   $\text{mL} \cdot \text{min} \cdot \text{kg}^{-1}$ ), 22 days at 2100 m (HI22;  $n = 4$ ;  $67 \pm 3$   $\text{mL} \cdot \text{min} \cdot \text{kg}^{-1}$ ) or 30 days at 2100 m (HI30;  $n = 10$ ;  $70 \pm 4$   $\text{mL} \cdot \text{min} \cdot \text{kg}^{-1}$ ).  $\text{Hb}_{\text{mass}}$  was assessed via CO rebreathing immediately pre and post LHTH, and sea level performance was measured in competitive races completed pre and within 2 weeks post. For each training session, Training Load (TL) was calculated using the session RPE method. Training Stress Balance (TSB) was calculated as the ratio between 7 and 28 day exponentially weighted moving averages. Differences between groups were assessed using one-way ANOVA, with the Kruskal-Wallis test used when assumptions were violated (TSB).

**RESULTS:** Race performance improved by  $0.6 \pm 1.5\%$  overall, with similar improvements in HI22 ( $0.9 \pm 0.5\%$ ) and HI30 ( $0.9 \pm 0.9\%$ ); however these were not significantly different to MOD22 ( $0.1 \pm 2.3\%$ ). Performance improvements were achieved by all 4 participants in HI22, 9 of 10 in HI30 and 4 of 7 in MOD22 (4, 7 and 3 lifetime bests respectively).  $HB_{mass}$  was increased from baseline in all groups (MOD22 =  $4.4 \pm 4.6\%$ ; HI22 =  $6.0 \pm 2.1\%$ ; HI30 =  $4.0 \pm 3.1\%$ ). Weekly TL during the first 2 weeks of LHTH was similarly increased in all groups compared to preceding sea level training (range  $58 \pm 13\%$  to  $72 \pm 27\%$ ). TSB at the start of LHTH in MOD22 ( $132 \pm 21$ ) was significantly higher ( $p < 0.03$ ) than HI22 ( $94 \pm 11$ ) but not HI30 ( $95 \pm 11$ ;  $p = 0.10$ ). TL for the final week of LHTH was reduced significantly less ( $p \leq 0.03$ ) from weeks 1 and 2 in MOD22 ( $23 \pm 13\%$ ) than in HI22 ( $44 \pm 5\%$ ) or HI30 ( $41 \pm 10\%$ ).

**CONCLUSIONS:** Lifetime best sea level performances were achieved following various doses of LHTH. Substantial increases in training load were observed within the first 2 weeks at altitude, and tapering concluding LHTH appeared beneficial for optimal performance.

947 Board #126 May 31 2:00 PM - 3:30 PM

### Performance and Muscle Damage Responses during Repeated Sprint Exercise in Hypoxia among Athletes

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(No relationships reported)

The influence of repeated sprint exercise in moderate hypoxia on muscle damage and inflammatory responses in athletes has not been fully elucidated. **PURPOSE:** The purpose of the present study was to determine the effects of repeated sprint exercise in moderate hypoxia on performance and muscle damage responses among competitive athletes. **METHODS:** Ten sprinters (height;  $175.7 \pm 1.9$  cm, body weight;  $67.3 \pm 2.0$  kg, BMI;  $21.7 \pm 0.2$  kg/m<sup>2</sup>) participated in this study. They performed two trials under either hypoxic (HYP,  $F_{O_2}$ : 14.5%, a simulated altitude of 3000m) or normoxic (NOR,  $F_{O_2}$ : 20.9%) conditions. The exercise in each trial consisted of three sets of repeated maximal sprints ( $5 \times 6$ -s sprint) with a 30-s rest period between sprints. All subjects were exposed under hypoxic or normoxic conditions during exercise and 3h of post-exercise period. Time-course changes in percutaneous oxygen saturation (SpO<sub>2</sub>), power output during exercise, blood lactate, glucose, serum myoglobin (Mb) and plasma interleukin-6 (IL-6) concentrations, and respiratory variables were evaluated. **RESULTS:** During exercise, a significant interaction was observed for mean power output (trial  $\times$  number of sprint,  $P < 0.001$ ). However, no significant difference in total power output over all sprints was observed between the two trials. There were significant interaction (trial  $\times$  time,  $P < 0.001$ ) and main effect for trial ( $P < 0.001$ ) for blood lactate concentration. The post-hoc test revealed that blood lactate concentrations immediately after exercise was significantly higher in the HYP than in the NOR ( $P < 0.05$ ). Serum Mb concentration increased significantly after exercise (main effect for time,  $P < 0.001$ ), but no significant interaction ( $P = 0.804$ ) or main effect for trial ( $P = 0.268$ ) was observed. Accumulated VO<sub>2</sub> during exercise was significantly lower in the HYP ( $P < 0.001$ ), whereas average RER values during exercise were significantly higher in the HYP than in the NOR ( $P < 0.001$ ). There was no significant difference between trials for any respiratory variables during post-exercise period.

**CONCLUSIONS:** Repeated sprint exercise in hypoxia elicited blood lactate elevation compared with the same exercise in normoxia. However, magnitude of exercise-induced muscle damage response (elevation of serum Mb) was not affected.

948 Board #127 May 31 2:00 PM - 3:30 PM

### Factors Predicting Performance during a High Altitude Hike

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(No relationships reported)

Civilian and military personnel often endure heavy exercise loads at high altitude. To improve performance at high altitude, it is important to understand what factors predict human performance in that setting. **PURPOSE:** To assess whether a physical fitness test at sea-level can be used to predict exercise performance at high altitude. **METHODS:** Subjects were recruited from mid-Michigan (sea level) and were required to pass a medical screening and achieve a high score on the Army Physical Fitness Test (APFT) in order to participate. The APFT performance trial consisted of a pushup test (maximum number of pushups in 2 min), a sit-up test (maximum number of sit-ups in 2 min), and a timed two-mile run. Ninety-nine subjects completed APFT testing at sea-level before being transported to Breckenridge, Colorado (9,075

ft; 2766 m) to undergo APFT testing immediately upon arrival. On day two in Colorado, subjects wore a 35-pound rucksack during a timed, 3.7-mile uphill hike from 10,627 feet (3239 m) to 12,595 feet (3840 m). Multivariable regression analysis was performed to predict which variable(s) (height, weight, pushup score on APFT, sit-up score on APFT, 2 mile run time at the performance trial and at altitude) were most important in determining hike time. **RESULTS:** One multi-variable linear regression model indicated a significant correlation ( $p < .05$ ) between subjects' weight and two-mile run time at the APFT performance trial at sea level relative to hike time ( $r^2 = .33$ ). These findings indicate that as body weight increases hike time was slower, and that a faster 2-mile run time resulted in a faster hike time. A second multi-variable linear regression analysis indicated a significant relationship between the 2-mile run time, sit-ups, and push-ups at high altitude, and subjects' weight relative to hike time ( $r^2 = .52$ ). **CONCLUSIONS:** Overall, the APFT high-altitude trial was a better predictor of hike performance given that the model accounted for 52% of the variance relative to hike performance. Furthermore, in both the sea level and high-altitude trials, subjects' weight and two-mile run time had the greatest influence on hike performance.

## B-64 Free Communication/Poster - Blood Flow

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM

Room: Hall F

949 Board #128 May 31 3:30 PM - 5:00 PM

### Prolonged Improvement In Hemodynamic Parameters At Rest And During Stress Testing After High-intensity Interval Training

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(No relationships reported)

**Purpose:** As demonstrated earlier, one bout of aerobic exercise has been shown to result in a prolonged lowering of peripheral and central blood pressure (BP) and pulse wave velocity (PWV) in normotensive and hypertensive individuals. Therefore, a study was initiated to evaluate if faster and more intense forms of exercise, such as HIIT, can also bring about similar blood pressure and PWV reductions. Since cardiovascular hyper-reactivity to stress has a higher prognostic value than measurements conducted at rest, the responses during a following cold pressor test (CPT) were studied as well. **Methods:** In 39 healthy men (34±8 years, BMI 24±2 kg/m<sup>2</sup>) peripheral BP (pBP), central BP (cBP) and PWV were measured non-invasively at rest and at the end of a 2 minute CPT using 24 PWA monitor. Following a HIIT (6 x 1 min., 98% of previously determined maximum workload, 4 min. rest between intervals) pBP, cBP and PWV were measured throughout 60 minutes of rest and thereafter during a CPT. **Results:** Even 45 minutes after HIIT, there was a significant reduction in systolic pBP ( $127 \pm 9$  mmHg to  $124 \pm 10$  mmHg;  $p = 0.029$ ), systolic cBP ( $116 \pm 8$  mmHg to  $112 \pm 9$  mmHg;  $p = 0.003$ ) and PWV ( $5.92 \pm 0.7$  m/sec. to  $5.84 \pm 0.7$  m/sec.;  $p = 0.037$ ) compared with pre-exercise. Furthermore there were significant reductions in diastolic pBP ( $81 \pm 8$  mmHg to  $79 \pm 7$  mmHg;  $p = 0.031$ ) compared to pre-exercise as well. Moreover, pBP ( $144 \pm 13/96 \pm 12$  mmHg to  $137 \pm 12/93 \pm 11$  mmHg), cBP ( $130 \pm 13/98 \pm 12$  mmHg to  $125 \pm 12/94 \pm 11$  mmHg) and PWV ( $6.4 \pm 0.7$  m/sec to  $6.2 \pm 0.8$  m/sec.) during CPT after HIIT were significantly ( $p < 0.01$ ) lower when compared with pre-exercise measurements.

60 minutes after exercise, there were no more significant differences compared with pressures at rest before exercise. In contrast, 60 minutes after HIIT the increases in systolic pBP ( $\Delta = 16.2 \pm 10$  mmHg vs.  $\Delta = 11.8 \pm 11$  mmHg;  $p = 0.019$ ), systolic cBP ( $\Delta = 14.5 \pm 11$  mmHg vs.  $\Delta = 9.8 \pm 11$  mmHg;  $p = 0.017$ ) and PWV ( $\Delta = 0.47 \pm 0.36$  m/sec. vs.  $\Delta = 0.29 \pm 0.42$  m/sec;  $p = 0.026$ ) due to CPT were still significantly lower when compared with measurements during CPT before exercise.

**Conclusion:** HIIT leads to a reduction in pBP, cBP and PWV, which was still established 45 minutes after completion of the training. Moreover, pressures and PWV during a CPT increased less after HIIT, indicating attenuated hemodynamic response to stress testing after a single HIIT-session.

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**Arterial Compliance Response To Aerobic Exercise With and Without Blood Flow Restriction In Pre-hypertensive Males**Murat Karabulut<sup>1</sup>, Margarita Gonzalez<sup>1</sup>, Brittany Esparza<sup>1</sup>, Ulku Karabulut<sup>1</sup>, Ryan Russell<sup>1</sup>, Michael G. Bembem, FACSM<sup>2</sup>.  
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(No relationships reported)

**PURPOSE:** The aim of the study was to assess the effects of acute aerobic exercise with and without blood flow restriction on arterial compliance in pre-hypertensive males.**METHODS:** Ten pre-hypertensive male subjects (age= 23.1±3.2) performed two randomized exercise sessions. Anthropometric measurements, questionnaires, and Bruce protocol were completed at screening. Baseline measurements were obtained each testing day following subjects reaching a normal hydration status. Subjects then ran at 65% VO<sub>2</sub> for a 60 min or 20 min at 40% VO<sub>2</sub> with blood flow restriction (BFR). Arterial elasticity was measured at 0, 10, 20, and 40 minutes and pulse wave velocity (PWV) was measured at 5, 15, 25, and 35 minutes post-exercise.**RESULTS:** There were no significant condition\*time interactions or no main effects for condition and time for carotid to radial, carotid to femoral, femoral to distal PWV, small (SAE) or large arterial elasticity (LAE). Significant condition\*time interaction (p<.03) and time main effect (p<.01) were found in systolic blood pressure (p<.03). There were also significant condition\*time interaction (p<.03) and condition main effect (p<.03, BFR higher) in diastolic blood pressure (p<.03). Significant condition\*time interaction (p<.01) and condition (p<.01, 60 min higher) and time main effects (p<.01) were found in heart rate (HR). Significant condition\*time interaction (p<.01) and condition (p<.05, BFR higher) and time main effects (p<.01) were found in stroke volume (SV). Significant condition\*time interaction (p<.01) and time main effects (p<.02) were found in cardiac output (CO). Significant condition\*time interaction (p<.01) and condition (p<.01, 60 min lower) and time main effects (p<.02) were found in systemic vascular resistance (SVR). A significant condition main effect for total vascular impedance (TVI) was detected (p<.05, 60 min lower).**CONCLUSIONS:** Since subjects were in supine position for post-testing, significantly lower SV values could be due to lower venous return and/or sweat-related blood volume loss and lower SVR and TVI could be because of endothelium derived nitric oxide following the 60 min session. The findings also indicate that the 20 min with BFR session may not be intense and/or long enough to cause significant changes in variables tested.

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**Central Cardiovascular Hemodynamics and Vascular Stiffness during Handgrip Exercise with and without Blood Flow Restriction**Edward T. Kelley<sup>1</sup>, Jeffrey D. Miller<sup>1</sup>, Lee Stoner<sup>2</sup>, Daniel P. Credeur<sup>1</sup>.  
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(No relationships reported)

Walking, coupled with bilateral blood flow restriction (BFR) in legs, augments the central cardiovascular adjustment to activity (e.g., greater blood pressure, and aortic wave reflection) as compared to walking without BFR. Whether the same occurs in response to unilateral, upper-body exercise performed with BFR is unknown.

**PURPOSE:** To examine the central cardiovascular hemodynamics and vascular stiffness responses to low- and high-intensity, unilateral handgrip exercise performed with and without BFR. **METHODS:** Eight college-aged males (Age=24±5 yrs; BMI=30±7 kg/m<sup>2</sup>, handgrip max voluntary contraction-MVC=52±8 kg) underwent three 5-minute bouts (counter-balanced, 10 mins rest between) of rhythmic handgrip dynamometry (1-2 sec duty cycle, 20 squeezes/min) performed at a low (40% MVC) and high-intensity (60% MVC) with and without proximal occlusion (80-100mmHg, 50-80% arterial occlusion assessed via radial artery Doppler-ultrasound). Brachial pulse wave analysis and carotid applanation tonometry (heart rate-HR, mean arterial pressure-MAP, augmentation index-*AIx*, aortic pulse wave velocity-PWV, wave reflection magnitude-RM%) were performed at baseline and at the end of each 5-min bout of handgrip. To provide an index of peripheral vasoconstriction, perfusion of the vastus lateralis (oxy-hemoglobin, via Near-Infrared Spectroscopy) was also examined during these time points. **RESULTS:** HR increased more during high-intensity handgrip, both with and without BFR, as compared to low-intensity with BFR (60% with BFR=+9±7, vs. 60% without BFR=+9±7, vs. 40% with BFR=+4±5 bpm, P<0.001). Central MAP increased during all handgrip bouts, with the greatest change during high-intensity with BFR (+17±4 mmHg, P<0.001), but comparable responses observed between low-intensity with BFR and high-intensity without (low-intensity with BFR=+9±4, P<0.001; vs. high-intensity without BFR=+13±3 mmHg, P<0.001).No change was observed for *AIx*, RM%, aortic PWV, or microvascular perfusion across all handgrip bouts (P>0.05). **CONCLUSIONS:** These preliminary findings indicate that unilateral, handgrip exercise performed with and without BFR produces an intensity-dependent increase in HR and central MAP, with no change occurring in aortic wave reflection, vascular stiffness or leg vasoconstriction.

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**Acute Effects of Aerobic Exercise with Blood Flow Restriction on Pulse Wave Velocity**

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(No relationships reported)

**PURPOSE:** To investigate the acute effects of a 20-minute walk/run at 40% VO<sub>2</sub> with and without blood flow restriction on pulse wave velocity (PWV). **METHODS:** Seventeen female subjects, between the ages of 18 and 40, signed informed consent and were familiarized with the study protocol, on the same day measurements were assessed: height, weight, body composition, and thigh circumference. Followed by each subject performing the Bruce Protocol on a treadmill. Subjects were asked to come back to the lab hydrated and 8 hours fasted on two different days (separated by at least 48 hours). After reaching hydration, participants were asked to lie down in the supine position for a minimum of 10 minutes and baseline hemodynamics and measurement of PWV using SphygmoCor® CPV Pulse Wave Analyzer. The sites tested were carotid to radial (C-R), carotid to femoral (C-F), and femoral to posterior tibial (F-PT). The randomized testing sessions consisted of two 20-minute walk/run sessions at 40% VO<sub>2</sub> intensity with BFR cuffs inflated (BFR), and the BFR cuffs uninflated (CON). Tightness of the cuffs was set at 55-60 mmHg for BFR, and the cuffs were placed snug enough that they don't move during exercise for the CON session. The final cuff pressures were achieved by starting at 120 mmHg and increasing progressively by 20 mmHg with 10 s rest in between increments. Upon completion of exercise, post exercise PWV was assessed at immediately, 15, 25, and 45 minutes. **RESULTS:** No condition\*time interaction or condition and time main effects were observed for C-R and C-F sites (p>0.05). There were no significant condition\*time interaction or time main effect for the F-PT site (p>0.05), but a significant condition main effect was detected at the 15 minute mark post exercise following the BFR session (p<.01). **CONCLUSION:** The results suggest that the BFR session resulted in an improved arterial compliance at the F-PT site. This may have been caused by the increased shear stress from blood pooling during the BFR session resulting in a greater release of nitric oxide therefore vasodilation in the lower body. There may be a practical application of using this combination of exercise and settings to help improve cardiovascular health. Since this was an acute study, future training studies should look at the chronic effects on pulse wave velocity using these settings.

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**Exercise-Induced Blood Flow Patterns Changes Based on Lactate Levels**

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Exercise improves cardiovascular health. However, only 45% of the mechanisms for its beneficial effects for cardiovascular diseases are known. Blood flow patterns and endothelial shear stress during exercise may explain part of the remaining unknown cardiovascular protective mechanisms.

**PURPOSE:** To identify blood flow patterns of the brachial artery at specific lactate levels of 0-2, 2-4, and 4+ mmol/L to help standardize exercise intensities in cardiac rehabilitation.**METHODS:** Fifteen young healthy subjects (Age 18-35) (9 males and 6 females) were recruited to perform two exercise tests on a cycle ergometer in fasting and exercise-free conditions for at least 10 hours prior the tests. The first test was a maximal, graded exercise test. The second one, performed 48-72 hours after the first exercise test, was a 3-workload steady state test at lactate levels of 0-2, 2-4, and 4+ mmol/L determined during the first exercise test. Oxygen consumption (VO<sub>2</sub>), blood pressure, blood lactate levels, and ultrasound imaging of the brachial artery (assessing vessel diameter and blood flow direction and velocity) were continuously monitored during both tests. Repeated measurements ANOVA comparing all three intensities for all variables were performed at alpha=0.05.**RESULTS:** There were no significant changes in brachial artery diameter between exercise intensities and baseline conditions (3.70±0.21 mm vs. 3.76±0.20 mm vs. 3.68±0.21 mm vs. 3.75±0.21 mm, baseline vs. 0-2 mmol/L vs. 2-4 mmol/L vs. 4+ mmol/L, respectively). However, both antegrade and retrograde shear rates significantly increased with exercise in an intensity-dependent manner from baseline to 2-4

mmol/L (antegrade shear rate:  $178 \pm 18 \text{ s}^{-1}$  vs.  $260 \pm 22 \text{ s}^{-1}$  vs.  $309 \pm 24 \text{ s}^{-1}$ , baseline vs. 0-2 mmol/L vs. 2-4 mmol/L, respectively,  $p < 0.01$ ; retrograde shear rate:  $42 \pm 5 \text{ s}^{-1}$  vs.  $84 \pm 9 \text{ s}^{-1}$  vs.  $102 \pm 10 \text{ s}^{-1}$ , baseline vs. 0-2 mmol/L vs. 2-4 mmol/L, respectively,  $p < 0.05$ ). No significant difference was observed between the 2-4 and 4+ mmol/L intensities.

#### CONCLUSIONS:

The data shows that exercise-induced blood flow patterns are exercise intensity-dependent. However, high intensity exercise (lactate 4+ mmol/L) appears to offer little changes in blood flow patterns in comparison with moderate exercise (lactate 2-4 mmol/L).

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**Autonomic Modulation After an Acute Bout of Bench Press With and Without Blood Flow Restriction**  
 Olivia Gilmour, Alaina Glasgow, Erica Marshall, Yu Lun Tai, J. Derek Kingsley. *Kent State University, Kent, OH.* (Sponsor: Ellen L. Glickman, FACSM)  
*(No relationships reported)*

Traditional resistance exercise may decrease vagal tone up to 30 minutes, which may increase the risk of cardiovascular events. However, the effects of resistance exercise with blood flow restriction (BFR) on autonomic modulation are unclear. **PURPOSE:** To evaluate autonomic modulation after resistance exercise with and without BFR in active men. **METHODS:** Sixteen resistance-trained men volunteered for the study. Autonomic modulation was assessed at rest, 15 (Rec1), and 25 (Rec2) minutes after three different conditions. The low-intensity bench press with BFR (LI-BFR) consisted of 4 sets of 30, 15, 15, and 15 repetitions at 30% 1-repetition maximum (1RM) with 30 second rest between sets. The traditional high-intensity bench press (HI) consisted of 4 sets of 8 repetitions at 70% 1RM with 60 seconds rest between sets, and control (CON) consisted of supine rest. Autonomic modulation was expressed as natural logarithm (Ln), and included total power (LnTP), high-frequency power (LnHF), low-frequency power (LnLF), and sympathovagal balance (LnLF/LnHF ratio). A repeated measures ANOVA was used to evaluate conditions (LI-BFR, HI and CON) across time (Rest, Rec1, and Rec2) on autonomic modulation. **RESULTS:** There was a significant condition by time interaction for LnTP (LI-BFR: Rest:  $8.6 \pm 0.9\%$ , Rec1:  $7.9 \pm 1.0\%$ , Rec2:  $7.9 \pm 1.2\%$ ; HI: Rest:  $8.6 \pm 1.6\%$ , Rec1:  $7.7 \pm 0.9\%$ , Rec2:  $7.3 \pm 1.0\%$ ; CON: Rest:  $8.7 \pm 0.8\%$ , Rec1:  $8.7 \pm 0.7\%$ , Rec2:  $8.5 \pm 0.8\%$ ,  $p < 0.05$ ), LnHF (LI-BFR: Rest:  $7.3 \pm 1.1\%$ , Rec1:  $5.5 \pm 1.2\%$ , Rec2:  $6.6 \pm 1.5\%$ ; HI: Rest:  $7.4 \pm 1.2\%$ , Rec1:  $5.9 \pm 1.4\%$ , Rec2:  $6.5 \pm 1.5\%$ ; CON: Rest:  $7.5 \pm 1.1\%$ , Rec1:  $7.5 \pm 1.8\%$ , Rec2:  $7.4 \pm 1.3\%$ ,  $p < 0.05$ ), and LnLF (LI-BFR: Rest:  $7.3 \pm 0.9\%$ , Rec1:  $5.9 \pm 0.9\%$ , Rec2:  $6.5 \pm 1.2\%$ ; HI: Rest:  $7.3 \pm 1.1\%$ , Rec1:  $6.4 \pm 0.8\%$ , Rec2:  $6.6 \pm 1.2\%$ ; CON: Rest:  $7.1 \pm 1.0\%$ , Rec1:  $7.1 \pm 1.8\%$ , Rec2:  $7.1 \pm 1.0\%$ ,  $p < 0.05$ ) such that they were reduced at Rec1 and Rec2 after LI-BFR and HI compared to Rest and CON. There was a significant ( $p < 0.05$ ) of time effect for LnLF/LnHF ratio (Rest:  $1.0 \pm 0.1\%$ ; Rec1:  $1.0 \pm 0.2\%$ ; Rec2:  $1.0 \pm 0.1\%$ ) such that it was increased at Rec1 and Rec2 compared to Rest. **CONCLUSIONS:** These data suggest that LI-BFR and HI significantly alters autonomic modulation for at least 30 minutes, with no difference between LI-BFR and HI.

Funded by School of Health Sciences at Kent State University

955 Board #134 May 31 3:30 PM - 5:00 PM  
**Pressor Responses To High And Low-intensity Continuous Or Interval Cycling With/without Blood Flow Restriction.**

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*(No relationships reported)*

A single bout of continuous or high-intensity interval cycling has been able to induce post-exercise hypotension (PEH). However, it is not clear if low-intensity continuous cycling with blood flow restriction (CLI-BFR) induces PEH. **PURPOSE:** To compare post-exercise pressure responses between high-intensity interval cycling (HII), continuous low-intensity cycling (CLI), and continuous low-intensity cycling with blood flow restriction (CLI-BFR). **METHODS:** Eleven young obese adults (age=24.63  $\pm$  5.7 yrs, body mass index=33.42  $\pm$  2.04 kg/m<sup>2</sup>, body fat percentage=27.7  $\pm$  3.0 %, and peak oxygen consumption [ $\text{VO}_{2\text{peak}}$ ]=26.26  $\pm$  3.54 mL·kg<sup>-1</sup>·min<sup>-1</sup>) participated in a crossover randomized counterbalanced study design. Subjects completed four separate visits, each separate by 4-9 days. Following the first visit, assessing  $\text{VO}_{2\text{peak}}$ , subjects completed three different cycling sessions which included: CLI – continuous cycling at 45%  $\text{VO}_{2\text{peak}}$  for 15 min; HII – high-intensity interval cycling at 90% of  $\text{VO}_{2\text{peak}}$  consisting of 5 sets of 90 second exercise intervals with 90 second active rest periods at 45%  $\text{VO}_{2\text{peak}}$ ; and CLI-BFR – continuous low-intensity cycling with BFR at 45% of  $\text{VO}_{2\text{peak}}$  for 15 min. BFR was applied at the proximal portion of the thigh using a

76 mm wide elastic knee wraps based upon the thigh circumference. Systolic (SBP) and diastolic blood pressures (DBP) were assessed at rest, immediately post-exercise, 10 min, 20 min, 30 min, 40 min, 50 min, and 60 min post-exercise. To compare SBP, DBP, and mean arterial pressure (MAP) measurements, a two-way ANOVA with Newman-Keuls post hoc was used. **RESULTS:** The main effect of condition was not significant for any of the pressor responses ( $p > 0.05$ ), however there was a significant main effect for time. When compared to rest there were significant increases immediately post-exercise for SBP, DBP, and MAP ( $p < 0.05$ ), and a significant increase in DBP at 60 min post-exercise ( $p < 0.05$ ). **CONCLUSION:** CLI-BFR, HII, CLI were not capable of inducing PEH in young obese adults up to 60 min post-exercise.

956 Board #135 May 31 3:30 PM - 5:00 PM  
**Hemodynamic Response to Resistance Blood Flow Restriction Exercise at Different Degrees of Arterial Occlusion Pressure**

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*(No relationships reported)*

Although resistance exercise involving the application of an external arterial occlusion pressure (AOP) have been widely discussed in the literature, the hemodynamic response to this type of exercise when performed at different degrees of AOP remains unclear. **PURPOSE:** To investigate the hemodynamic response to resistance exercise performed at different degrees of AOP. **METHODS:** Twelve healthy trained males (2.67 yrs, 73.46  $\pm$  7.89 kg, 1.81  $\pm$  0.07 m, and 22.50  $\pm$  1.66 kg/m<sup>2</sup>) were randomly assigned to four exercise conditions: CON (no occlusion), AOP-50 (50% of AOP), AOP-75 (75% of AOP), and AOP-100 (100% of AOP) in a within subjects cross-over design. A standard 15 cm wide cuff was placed on the thigh, inflated to the target pressure, and four sets of 10 repetitions of unilateral knee extension at 20% of 1RM were executed with 30 s between sets. Subjects performed the same protocol for the CON condition but without occlusion. There was an interval of 7 days between each trial. Total AOP was set as the amount of pressure needed to fully occlude the auscultatory pulse in the lower limbs. Systolic (SBP) and diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), and cardiac product (DP) were assessed at rest, between the second and the third set (during), immediately post-exercise, and every 15 minutes until 60 minutes post-exercise. **RESULTS:** SBP and DP significantly ( $p < 0.05$ ) increased from rest, during and immediately post-exercise for each condition. Significant ( $p < 0.05$ ) elevations from rest were observed in DBP for all experimental conditions during exercise. MAP significantly ( $p < 0.05$ ) increased during exercise from rest for all experimental conditions and for AOP-50, and AOP-100 immediately post-exercise. HR was significantly ( $p < 0.05$ ) increased during exercise only for CON and for all conditions immediately post-exercise. All these parameters returned to baseline 15 minutes post, and remained unchanged up to 1 h post-exercise. **CONCLUSION:** Similar hemodynamic responses were observed for the AOP conditions during, immediately post-exercise, and until 60 minutes post-exercise, regardless of the amount of pressure applied.

957 Board #136 May 31 3:30 PM - 5:00 PM  
**Importance of Venous Return for Muscle Metaboreflex-mediated Stroke Volume and Cardiac Output Responses**

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*(No relationships reported)*

It has been shown in animals that activation of the muscle metaboreflex during dynamic exercise increases cardiac output (CO) via rises in heart rate (HR) with sustained stroke volume (SV). In addition, to maintain CO at higher level, venous return also needs to increase. Indeed, decrease in venous return abolishes the muscle metaboreflex-induced rise in CO. However, importance of venous return for the muscle metaboreflex-mediated SV and CO responses has never been examined in humans. **PURPOSE:** We aimed to investigate the influences of decreases in venous return from exercising limbs on the muscle metaboreflex-mediated SV and CO responses in humans. **METHODS:** We studied 9 healthy male volunteers. After resting measurements, the subjects performed cycling exercise for 8-min at 30% and 60% of  $\text{VO}_{2\text{peak}}$  (EX30 and EX60), respectively. Beginning 3 min after the start of the exercise, inner pressure of the occlusion cuffs placed on the both thighs were increased by 80, 100, 120, 140 and then 160 mmHg in stepwise fashion with 1-min step durations. The purpose of the progressive application of thigh cuff pressure was to reduce venous return from exercising limbs as well as to decrease arterial blood flow (i.e., oxygen supply) to exercising skeletal muscles to activate the

muscle metaboreflex. The thigh cuff pressure was not applied in control conditions. **RESULTS:** During exercise at both intensities, the application of thigh cuff pressure progressively increased HR and mean arterial pressure (at last 1-min during exercise in control vs. thigh cuff pressure conditions in EX30:  $97 \pm 3$  vs.  $108 \pm 3$ ,  $82 \pm 3$  vs.  $104 \pm 2$ , EX60:  $140 \pm 3$  vs.  $155 \pm 3$  beats/min,  $95 \pm 2$  vs.  $116 \pm 2$  mmHg,  $p < 0.05$ ) indicating activation of the muscle metaboreflex. Meanwhile, SV decreased gradually (EX30:  $108 \pm 6$  vs.  $96 \pm 5$ , EX60:  $119 \pm 5$  vs.  $108 \pm 5$  ml,  $p < 0.05$ ) reflecting reductions in venous return. Consequently, in despite of the rise in HR, CO was maintained at control level (EX30:  $10.4 \pm 0.5$  vs.  $10.3 \pm 0.5$ , EX60:  $16.6 \pm 0.6$  vs.  $16.8 \pm 0.8$  L/min,  $p > 0.05$ ). **CONCLUSIONS:** Our results demonstrate that the muscle metaboreflex-induced rise in HR cannot increase CO due to decrease in SV when venous return from exercising limbs is reduced. We conclude that the venous return from exercising limbs plays a pivotal role in the muscle metaboreflex-mediated SV and CO responses in humans.

958 Board #137 May 31 3:30 PM - 5:00 PM  
**Effects of Inversion Table Postural Positions on Cardiovascular Hemodynamics in Apparently Healthy Young Adults**

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Treatment of low back pain by inverting one's body on a tilt table permits unloading of bones, joints and discs of the low back. This traction force through the spine has been theorized to decrease low back pain. Randomized controlled studies to evaluate the efficacy of this practice for low back pain are limited. Although the gravitational traction is short lived, patients with hypertension, glaucoma, or cardiovascular disease are cautioned to avoid the inversion treatment because of excessive elevations in blood pressure, heart rate and intraocular pressure. **PURPOSE:** To evaluate the influence of postural change on cardiovascular hemodynamics, 12 subjects (age  $22.6 \pm 1.8$  yrs, ht  $170.4 \pm 9.2$  cm, body mass  $74.0 \pm 13.0$  kg, 7 ♀) volunteered to participate in 6 assessments in the following positions: seated (S), 45° head up (45HI), horizontal [H], modified Trendelenburg (-30° head down) [T], -60° head down [60HD], and -90° inversion [I]. **METHODS:** Baseline measures of hemodynamic function (cardiac output [Q], stroke volume [SV], heart rate [HR], systemic vascular resistance [SVR] and cardiac index [CI]) were obtained with an impedance cardiography system, and blood pressure [BP] by auscultation in a seated position [S], followed by a 5 minute assessment in each of the 6 aforementioned positions. Reliability was ensured with repeat trials separated by 48 hours. ANOVA with repeated measures ( $p < .05$ ) was applied to the data. **RESULTS:** Total mean BP (mmHg), EDV (mL) & SVR (dyn.s/cm) were  $114.6/70.5$ ,  $129.7$  &  $1164.6$ , respectively, with NSD among trials. Q (L/min) of 6.6, 6.9, 6.1, 5.9, 5.8, & 6.2; SV [mL/b] of 87.7, 87.9, 88.1, 86.2, 85.1, & 83.8; HR [b/min] of 75.5, 78.8, 68.6, 65.9, 68.3, & 74.7; SVR [dyn.s/cm] of 1030, 986, 1248, 1280, 1288, & 1212; and CI (L/m<sup>2</sup>) of 3.5, 3.7, 3.2, 3.1, 3.1, & 3.3 were obtained for S, 45HI, H, T, 60HD, and I, respectively. Although statistical analysis revealed differences among several conditions ( $p < .05$ ), they do not appear clinically significant. **CONCLUSION:** Postural changes induced by acute exposure to tilt table inversion did not provide clinically significant changes in measures of cardiovascular hemodynamics in a healthy population and thus appears relatively safe.

**B-65 Free Communication/Poster - Body Composition**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
 Room: Hall F

959 Board #138 May 31 3:30 PM - 5:00 PM  
**Total and Segmental Body Composition Examination in Collegiate Football Players Using Multifrequency BIA and DXA**

Christiana J. Raymond, Tyler A. Bosch, Donald R. Dengel, FACSM. *University of Minnesota, Minneapolis, MN.* (Sponsor: Donald R. Dengel, FACSM)  
 (No relationships reported)

**PURPOSE:** To examine the influence of player position on the agreement between multi-frequency bioelectrical impedance analysis (BIA) and dual x-ray absorptiometry (DXA) when assessing percent body fat (BF%) and total and segmental (arms, legs, trunk) fat mass (FM) and lean mass (LM) in male NCAA Division I collegiate football athletes.

**METHODS:** Forty-four male collegiate athletes (age=19±1 yrs; height=1.9±1.0 m; weight=106.4±18.9 kg; body mass index=30.1±4.2) participated in this study. Player

positions included: offensive linemen (OL; n=7), tight ends (TE; n=4), wide receivers (WR; n=9), defensive linemen (DL; n=6), defensive backs (DB; n=8), linebackers (LB; n=6), and running backs (RB; n=4). Total and segmental body composition was measured using multi-frequency BIA and compared with values obtained using DXA. Paired t-tests using a Bonferroni-adjusted p-value of 0.007 examined differences between the two methods and Bland-Altman analyses evaluated agreement. ANOVA assessed effect of position on total and segmental differences between methods and Tukey's HSD determined differences between each position.

**RESULTS:** Compared with DXA multi-frequency BIA significantly underestimated BF% ( $3.0 \pm 3.8\%$ ), total FM ( $2.5 \pm 4.3$ kg), leg FM ( $2.8 \pm 2.0$ kg), and leg LM ( $3.6 \pm 2.3$ kg) (all  $p < 0.001$ ) and significantly overestimated total LM ( $-6.9 \pm 4.5$ kg) ( $p < 0.001$ ). Limits of agreement (1.96\*SD of the mean difference) were:  $\pm 7.39\%$  (BF%),  $\pm 10.45$ kg (total FM),  $\pm 3.83$ kg (leg FM),  $\pm 2.28$ kg (leg LM), and  $\pm 8.89$ kg (total LM). No significant differences were found between the two devices for trunk FM ( $-0.3 \pm 3.0$ kg;  $p = 0.565$ ) and trunk LM ( $-1.0 \pm 2.4$ kg;  $p = 0.009$ ) measures, with limits of agreement  $\pm 5.92$ kg for trunk FM and  $\pm 4.71$ kg for trunk LM. Player position had a significant effect on the mean difference of all measures, including BF%, total FM and LM, leg FM and LM, and trunk FM and LM (adjusted  $p < 0.05$ ). OL demonstrated the greatest effect on the mean difference of each variable.

**CONCLUSIONS:** Compared to DXA, multi-frequency BIA does not appear to be a valid way to assess segmental measures of body composition in collegiate football players. BIA may thus be limited by non-traditional body types (e.g. football players) indicating between-player comparisons should be limited. Further research in other athletic populations is warranted.

960 Board #139 May 31 3:30 PM - 5:00 PM  
**Body Composition And Bone Mineral Density Of Division I Collegiate Track And Field Athletes**

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**PURPOSE:** To examine the effect of gender and event on total and regional measures of body composition in male and female NCAA Division I collegiate track and field athletes using dual X-ray absorptiometry (DXA). Data was used from the Consortium of College Athlete Research (C-CAR) group.

**METHODS:** A total of 590 [male (M)/female (F) = 274/316] athletes had their height, weight, total and regional fat mass (FM), lean mass (LM), and bone mineral density measured (BMD). Athletes were classified into one of seven categories: Jumps (M/F=28/30); Long Distance (LD; M/F=104/110), Middle Distance (MD; M/F=27/24), Multi-Event (ME; M/F=11/9), Pole Vault (PV; M/F=21/27), Sprints (M/F=54/96), and Throws (M/F=29/20). Total and segmental differences between categories and gender were assessed by ANOVA.

**RESULTS:** Events that were significantly different than each other were the same for M and F (Table). Only M and F throwers were classified as overweight based on BMI ( $> 25$  kg/m<sup>2</sup>). Except for throwers, mean percent body fat for the other events was low, but healthy (M:10.3-12.6%, F:17.5-21.6%) and low visceral fat mass ( $< 500$  g). As expected throwers had significantly ( $p < 0.05$ ) higher total and regional FM and LM than other events (Table). One area of concern is that some events (i.e., LD) had negative z-scores for BMD (range M: -1.5 to 3.5, F: -1.5 to 6.3).

**CONCLUSIONS:** The data presented here provide normative data for total and regional FM, LM, and BMD in NCAA Division I male and female track and field athletes. Most athletes had relatively low body fat and visceral fat, which is important for the health of collegiate athletes during and after their playing career. However, some athletes had low BMD, which may have health consequences.

Event	Total Mass (kg)		Fat Mass (kg)		Lean Mass (kg)		BMD (g/cm <sup>2</sup> )	
	Male	Female	Male	Female	Male	Female	Male	Female
Throws	103.5+ 6.5 <sup>a</sup>	89.5+ 16.0 <sup>a</sup>	21.6+ 10.8 <sup>a</sup>	27.5+ 9.9 <sup>a</sup>	78.0+ 9.2 <sup>a</sup>	58.5+ 8.1 <sup>a</sup>	1.5+ 0.1 <sup>a</sup>	1.4+ 0.1 <sup>a</sup>
Sprints	76.5+ 7.6 <sup>bc</sup>	61.6+ 6.1 <sup>bc</sup>	8.3+ 2.1 <sup>b</sup>	10.8+ 2.9 <sup>b</sup>	65.0+ 6.8 <sup>bc</sup>	48.2+ 4.8 <sup>b</sup>	1.4+ 0.1 <sup>bc</sup>	1.3+ 0.1 <sup>ab</sup>
MD	70.9+ 6.8 <sup>cd</sup>	59.0+ 4.9 <sup>cd</sup>	7.3+ 1.7 <sup>b</sup>	12.2+ 2.7 <sup>b</sup>	60.8+ 6.5 <sup>c</sup>	44.3+ 4.2 <sup>c</sup>	1.3+ 0.1 <sup>c</sup>	1.1+ 0.1 <sup>c</sup>
LD	66.0+ 6.5 <sup>d</sup>	54.8+ 5.5 <sup>d</sup>	7.9+ 2.1 <sup>b</sup>	11.4+ 3.2 <sup>b</sup>	55.4+ 5.2 <sup>d</sup>	41.2+ 3.8 <sup>d</sup>	1.2+ 0.1 <sup>d</sup>	1.2+ 0.1 <sup>d</sup>
ME	81.6+ 7.5 <sup>b</sup>	67.1+ 10.1 <sup>b</sup>	9.9+ 3.1 <sup>b</sup>	13.7+ 3.4 <sup>b</sup>	68.6+ 6.4 <sup>b</sup>	50.8+ 6.8 <sup>b</sup>	1.4+ 0.1 <sup>bc</sup>	1.4+ 0.1 <sup>ab</sup>
Jumps	78.7+ 6.5 <sup>b</sup>	63.3+ 5.5 <sup>bc</sup>	9.2+ 2.5 <sup>b</sup>	12.7+ 3.4 <sup>b</sup>	65.7+ 5.3 <sup>b</sup>	47.9+ 3.6 <sup>bc</sup>	1.4+ 0.1 <sup>b</sup>	1.2+ 0.1 <sup>bc</sup>
PV	78.5+ 5.5 <sup>b</sup>	60.2+ 4.5 <sup>bc</sup>	9.9+ 3.1 <sup>b</sup>	13.0+ 2.4 <sup>b</sup>	65.4+ 4.7 <sup>bc</sup>	44.6+ 3.8 <sup>c</sup>	1.4+ 0.1 <sup>b</sup>	1.2+ 0.1 <sup>c</sup>

For each column by gender, if an event does not share a letter it is significantly different at an adjusted ( $p < 0.05$ ). BMD=Bone Mineral Density, MD=Middle Distance, LD=Long Distance, ME= Multi-Event, PV=Pole Vault

961 Board #140 May 31 3:30 PM - 5:00 PM  
**A Comparison of Body Composition Methods Across Two Phases of the Menstrual Cycle.**

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Estimating body fat percent (BF%) is an important fitness assessment for determining health status, monitoring weight loss and improving athletic performance. Women have a unique consideration when assessing BF% due to possible fluid retention, weight gain, and hormonal fluctuations that are happening throughout the menstrual cycle, and it has been questioned as to whether or not menses could negatively impact the accuracy of BF% assessments. **PURPOSE:** To identify whether or not body composition results would be affected by a woman during menses and to investigate the effects of birth control on the accuracy of body composition results. **METHODS:** 40 women (26.1  $\pm$  7.1 yrs) had their BF% estimated with dual energy x-ray absorptiometry (DXA), air displacement plethysmography (ADP), and 3 different hand-to-foot bioelectrical impedance analyzers (BIA1, BIA2, and BIA3). Participants completed BF% testing during 2 different phases of their menstrual cycle. Visit 1 was on day 1 or 2 of menses and visit 2 was 7 to 14 days later. Visit 2 was estimated to be in the pre-ovulatory phase of the menstrual cycle. Prior to testing participants did not exercise for 12 hours, consume alcohol for 24 hours, or eat or drink for 4 hours with the exception of water. All testing was administered per manufacturer specifications. **RESULTS:** 24 women were not on birth control (non-BC) and 16 were on a form of hormonal birth control (H-BC). The BF% means  $\pm$  SE between visits for non-BC were: DXA = 30.6  $\pm$  1.3 vs. 30.3  $\pm$  1.4,  $p = 0.077$ , ADP = 28.8  $\pm$  1.6 vs. 28.3  $\pm$  1.6,  $p = 0.083$ , BIA1 = 26.7  $\pm$  1.5 vs. 27.1  $\pm$  1.5,  $p = 0.122$ , BIA2 = 26.1  $\pm$  1.5 vs. 26.3  $\pm$  1.5,  $p = 0.498$ , BIA3 = 27.0  $\pm$  1.4 vs. 26.8  $\pm$  1.5,  $p = 0.523$ . The BF% means  $\pm$  SE between visits for H-BC were: DXA = 30.1  $\pm$  1.5 vs. 30.2  $\pm$  1.5,  $p = 0.677$ , ADP = 29.3  $\pm$  1.8 vs. 28.8  $\pm$  1.8,  $p = 0.215$ , BIA1 = 26.2  $\pm$  2.0 vs. 26.4  $\pm$  1.9,  $p = 0.508$ , BIA2 = 26.3  $\pm$  1.9 vs. 26.3  $\pm$  1.7,  $p = 0.988$ , BIA3 = 26.9  $\pm$  1.9 vs. 26.9  $\pm$  1.6,  $p = 1.000$ . **CONCLUSIONS:** For the H-BC group there were no differences for BF% between visits for all methods indicating that results should not be affected by menstrual cycle phase. However, the non-BC group had mixed results with no differences with the 3 BIAs but  $p$ -values near 0.05 for DXA and ADP methods. These data suggest that non-BC women should be tested post menses with certain methods, especially when BF% is being tracked over time.

962 Board #141 May 31 3:30 PM - 5:00 PM  
**A-mode and B-mode Ultrasound Measurement of Subcutaneous Fat Thickness: A Cadaver Analysis Validation Study**

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With technological advances, there has been a resurgence in the use of ultrasound as a method to measure subcutaneous fat thickness. Despite the increased interest in this methodology, there is a lack of research comparing A-mode and B-mode ultrasound devices. **PURPOSE:** Compare subcutaneous fat thickness measured by a low resolution A-mode ultrasound and a high resolution B-mode ultrasound to the actual fat thickness in dissected cadavers. **METHODS:** Six cadavers (3 male, 3 female), 80.8  $\pm$  8.9 y at the time of death, were measured. Subcutaneous fat thickness was measured at six sites (chest, abdomen, thigh, triceps, suprailiac, calf) with both ultrasound devices before the cadavers were dissected and site-specific thickness was measured. **RESULTS:** Correlations between both ultrasounds and the dissected measurement exceeded 0.90 at all sites with a few exceptions. At the abdomen, the relationship between the two devices was 0.76, and the B-mode and dissected measurement was also 0.76. The correlation between dissection and A-mode was 0.75 for the suprailiac site, but it was not possible to discern the separation of tissue at this site when using the B-mode device. There were no significant differences ( $P > 0.05$ ) between the devices and the dissected measurement at any of the six sites. The mean difference in fat thickness between A-mode and B-mode was  $< 0.7$  mm at all sites except the calf (1.2 mm). **CONCLUSION:** With the exception of the suprailiac site, which was difficult to measure, both A-mode and B-mode ultrasound are equally capable of providing measurements of subcutaneous fat thickness with an accuracy of  $< 1$  mm at most sites.

963 Board #142 May 31 3:30 PM - 5:00 PM  
**Effect of Water Consumption and Moderate Intensity Exercise on Body Composition Measures**

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Although the data are not clear, manufacturers of body composition devices often recommend that users avoid exercise prior to measurement. These measures can potentially be impacted by acute exercise and hydration levels. **Purpose:** To determine the effect of water consumption and moderate intensity exercise on body composition measurements using air displacement plethysmography (ADP) and three bioelectrical impedance devices (T, O5, and O3). **Methods:** Twenty four participants (age = 22.3  $\pm$  23.9y; height = 166.8  $\pm$  9.9 cm; mass = 77.4  $\pm$  17.8 kg) completed the study. Pre-exercise (PreE) body composition was measured following manufacturers' guidelines. Participants then exercised on a treadmill at moderate intensity (~50% of HRR) for 30 minutes on two separate occasions. During one visit, participants were allowed water ad libitum following exercise (W) while no water was allowed during the other session (NW). Body composition was measured immediately post-exercise (PE0), 15 minutes post-exercise (PE15), 30 minutes post-exercise (PE30), 45 minutes post-exercise (PE45) and 60 minutes post-exercise (PE60). Repeated measures ANOVA (2 x 6) were used to determine if water consumption and moderate intensity exercise influenced body composition measures for each device. Where appropriate, pairwise comparisons with Bonferroni adjustment were performed to locate differences among the post-exercise time points. **Results:** All devices showed a significant effect of time ( $P < 0.01$ ) and O5 was the only device to demonstrate a significant interaction of group and time ( $P < 0.05$ ). ADP showed no significant differences among the time points during either condition. PreE was significantly greater than all other time points ( $P < 0.01$ ) for T and O5 and was significantly greater than PE0, PE15, PE30, and PE45 for O3 ( $P < 0.01$ ). **Conclusion:** Moderate intensity exercise can impact body composition to varying degrees. Ingestion of water post exercise does not appear to impact most measurements of body composition. Investigators should consider limitations of the device(s) which could impact the interpretation of data.

964 Board #143 May 31 3:30 PM - 5:00 PM  
**Predictive Validity Of The Body Adiposity Index In Obese Adults Using Dual-Energy X-Ray Absorptiometry**

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**PURPOSE:** The body adiposity index (BAI) is a recent anthropometric measure proven to be valid in predicting body fat percentage (BF%) in some populations. However, the results have been inconsistent across populations. The study was designed to verify the validity of BAI in predicting BF% in a sample of obese adults, using dual-energy X-ray absorptiometry (DEXA) as the reference method. **METHODS:** A cross-sectional study was conducted in 48 participants (54% female, mean age 41.0  $\pm$  7.3 years old). DEXA was used as the "gold standard" to determine BF%. Pearson's correlation coefficient was used to evaluate the association between BAI and BF%, as assessed by DEXA. A paired sample t-test was used to test differences in mean BF% obtained with BAI and DEXA methods. To evaluate the concordance between BF% as measured by DEXA and as estimated by BAI, we used Lin's concordance correlation coefficient and Bland-Altman agreement analysis. **RESULTS:** The correlation between BF% obtained by DEXA and that estimated by BAI was  $r = 0.844$ ,  $p < 0.001$ . Paired t-test showed a significant mean difference in BF% between methods (BAI = 33.3  $\pm$  6.2% vs. DEXA 39.0  $\pm$  6.1;  $p < 0.001$ ). The bias of the BAI was  $-6.0 \pm 3.0$  BF% (95% CI =  $-12.0$  to  $1.0$ ), indicating that the BAI method significantly underestimated the BF% compared to the reference method. Lin's concordance correlation coefficient was considered stronger ( $\rho_c = 0.923$ , 95% CI = 0.862 to 0.957). **CONCLUSIONS:** In obese adults BAI presented low agreement with BF% measured by DEXA; therefore, BAI is not recommended for BF% prediction in this Latin American obesity sample studied. Supported by Universidad del Rosario (Code N° FIUR DN-BG001)

965 Board #144 May 31 3:30 PM - 5:00 PM

**A Longitudinal Retrospective Study of Body Composition Trends in Police Recruits**

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Mapping body composition patterns of those hired as police officers has implications not only to the health of officers during their careers but also in their ability to perform in emergency situations.

**PURPOSE:** To evaluate body composition changes that occur in police recruits from 1990 to 2013 with gender comparisons. **METHODS:** During the first week of police recruit training in a large southeastern metropolitan area, physical fitness levels were evaluated in 2,468 recruits. This study's variables of interest are: body mass (kg), lean mass (kg), and % body fat. ANOVA and Bonferroni post hoc procedures were used to evaluate data. **RESULTS:** The initial ANOVA shows significance for males in all three variables at  $p < 0.05$ . Males tended to increase in body mass and lean mass from 1990 to 2000 (80.6±1.2kg to 87.3±1.2kg,  $p < 0.05$ ) (68.9±0.8kg to 73.4±0.8kg,  $p < 0.05$ ), respectively. These values remained relatively constant between 2000 and 2013. No discernable pattern was seen in female lean mass nor body mass. Males tended to increase in % body fat from 1994 to 2010 (13.6±5.0 to 16.7±7.2,  $p < 0.05$ ). Although not significant, female % body fat means increased from 1990 to 2013 (22.9±1.0 to 26.2±1.2). **CONCLUSIONS:** Even though there was an increase in body mass, pre lean mass and % body fat over time in males, these increases were low. In addition, these increases were lower in females.

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**Creating an Overall Body Composition Index to Predict 1.5-Mile Run Performance among University Students**

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**PURPOSE:** While body mass index (BMI), body fat percent (%BF), and waist circumference (WC) each can be used as a body composition index (BCI) to establish associations with cardiorespiratory fitness, it is desirable to use an overall BCI to establish the association. This study was intended to create an overall BCI from the above three BCIs and see how the overall BCI could predict 1.5-mile run performance among university students.

**METHODS:** Three different BCIs (BMI, %BF, WC) and 1.5-mile run were measured for 123 university students (mean age: 20.71±.98; 70 males and 53 females), and an overall BCI was created by converting the three BCIs into z scores and then adding them together. The overall BCI was used to predict students' 1.5-mile run performance with linear regression. All data analyses were conducted separately for males and females.

**RESULTS:** For both males and females, the scatterplots showed that 1.5-mile run performance increased when the overall BCI decreased, indicating a linear relationship between the two variables. The regression equation for predicting the 1.5-mile run performance from the overall BCI for males was: predicted 1.5-mile run performance (in seconds) = 704.64 + 33.32 overall BCI, with the 95% confidence interval for the slope ranging from 24.84 to 41.58. The regression was significant ( $p < .001$ ) as  $F(1, 68) = 62.68$ . Prediction strength was very strong with  $r = .69$  ( $p < .001$ ) and  $r^2 = .48$ . With respect to females, predicted 1.5-mile run performance (in seconds) = 851 + 27.51 overall BCI, and the 95% confidence interval for the slope ranged from 12.91 to 42.12. The regression was significant ( $p < .001$ ) as  $F(1, 51) = 14.30$ . Prediction strength was strong with  $r = .47$  ( $p < .001$ ) and  $r^2 = .22$ .

**CONCLUSIONS:** The overall BCI can predict students' 1.5-mile run performance very well, accounting for 48% of the variance of 1.5-mile run performance for males and 22% of the variance for females. In addition, based on the regression equations, one unit increase in the overall BCI will result in 33.32 seconds slower for males or 27.51 seconds slower for females, on average, in 1.5-mile run for university students.

967 Board #146 May 31 3:30 PM - 5:00 PM

**Accuracy of Commercial Body Composition Scales Versus Clinical Dual-Energy X-ray Absorptiometry and Bioelectrical Impedance Analysis**

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(No relationships reported)

**Background.** Body composition (BC) analysis is increasingly available to consumers in the form of wifi-connected bioelectrical impedance analysis (BIA) bathroom scales. However the accuracy of current generation scales to criterion methods is not known.

**Purpose.** To determine the accuracy and precision of BC measurements using scales for men and women compared to dual-energy X-ray absorptiometry (DXA). In addition, we investigate the use of scales for quantifying resting metabolic rate (RMR).

**Methods.** We recruited a sample of convenience of healthy adults to undergo a series of BC measurements. Height and weight was assessed using a Seca 284. BC was accessed using whole-body DXA (Horizon A), a clinical tetrapolar multifrequency BIA (InBody770), and 7 bathroom scales: Tanita BF-684W, Weightwatchers WW701Y, Taylor 7226SFC, Withings Smart Body Analyzer WS-50 and Body Cardio WBS04, Fitbit Aria, and QardioBase. Duplicate measures were taken on the scales to evaluate the test-retest precision. RMR was calculated using Nelson RMR equations for DXA and BIA measures, and Harris-Benedict (HB) using weight.

**Results.** In total, 22 participants were recruited (12 male) with an average age of 29.6 (±7.3 years), weight of 70.0 (±13.4 kg) and height of 170.0 (±10.1 cm). PBF was highly correlated between the 770 and DXA for both men and women ( $r = 0.9$ ) but less correlated between the scales and DXA ( $0 < r < 0.65$ ). However, all BIA devices underestimated PBF by 2 to 11 units. There was poor obesity classification between the scales and DXA as well ( $\kappa < 0.2$ ). RMR was highly correlated between DXA and scales for both men and women ( $r = 0.50$  to  $0.99$ ). RMR was overestimated by all scales compared to DXA from 21 to 184 kcal but in all cases were improvements over the HB RMR estimate (HB-DXA 260 kcal). The test-retest precisions (% coef of var, standard deviation) for PBF and RMR varied by model for men and women (0.2 to 0.5 %, NA) and (0.2 to 0.6 %, 2 to 9 kcal) respectively. Overall, we found the Tanita to have the best correlation to DXA measures, Taylor and Weight Watchers to have the best precision.

**Conclusions.** We conclude that the use of bathroom scales may provide a more accurate assessment of RMR than the HB equation, and that the precision is comparable to previously-reported DXA values. However, our results varied substantially by make.

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**Relationships Between Bodpod And Field Assessments Of Body Composition In NAIA Athletes**

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**PURPOSE:** The purpose of this study was to examine the relationships between body composition measures derived from air displacement plethysmography (BodPod) and several field methods of body composition in a population of National Association of Intercollegiate Athletics (NAIA) athletes. **METHODS:** Twenty-three NAIA athletes visited the lab for a single visit. Percent body fat and lean mass were assessed in all subjects using the BodPod (BP), handheld bioelectrical impedance analysis (HBIA), standing bioelectrical impedance analysis (SBIA), and skinfolds using the 3-site Jackson and Pollack equation. Body mass index (BMI), upper arm circumference (AC), waist circumference (WC), and hip circumference (HC) were also assessed. Relationships between percent body fat as assessed by BP and all field non-lean mass assessments as well as relationships between BP lean mass and all field non-percent body fat assessments were examined using Spearman's correlation coefficients.

**RESULTS:** Percent body fat (19.1 + 8.4 %) as assessed by BP was significantly related to BMI (29 + 8 kg/m<sup>2</sup>;  $r = 0.515$ ;  $p = 0.012$ ), percent body fat calculated from skinfolds (14 + 7 %;  $r = 0.855$ ;  $p < 0.001$ ), percent body fat from HBIA (17.9 + 6.2 %;  $r = 0.855$ ;  $p < 0.001$ ), percent body fat from SBIA (14.1 + 3.7 %;  $r = 0.748$ ;  $p < 0.001$ ), AC (33 + 4 cm;  $r = 0.563$ ;  $p = 0.005$ ), WC (90 + 10 cm;  $r = 0.720$ ;  $p < 0.001$ ), and HC (102 + 18 cm;  $r = 0.788$ ;  $p < 0.001$ ). Lean mass as assessed by BP (73.3 + 8.7 kg) was significantly related to BMI (29 + 8 kg/m<sup>2</sup>;  $r = 0.483$ ;  $p = 0.020$ ), lean mass calculated from skinfolds (76 + 10 kg;  $r = 0.817$ ;  $p < 0.001$ ), lean mass from HBIA (72.7 + 8.6 kg;  $r = 0.851$ ;  $p < 0.001$ ), lean mass from SBIA (76.5 + 11.7 kg;  $r = 0.802$ ;  $p < 0.001$ ), AC (33 + 4 kg;  $r = 0.596$ ;  $p = 0.003$ ), WC (90 + 10 kg;  $r = 0.496$ ;  $p = 0.016$ ), and HC (102 + 18 kg;  $r = 0.570$ ;  $p = 0.005$ ). **CONCLUSION:** Skinfolds, HBIA, and SBIA appear to be most related to both percent body fat and lean mass in this population of NAIA athletes. Thus, when testing these athletes in a field setting, these tests could be performed to provide useful body composition information. If it were not possible to perform these tests, BMI, UAC, WC, and HC could also be used although these tests did not correlate as strongly as did skinfolds, HBIA, and SBIA with BP assessments.

969 Board #148 May 31 3:30 PM - 5:00 PM  
**The Effects of a Periodized Resistance Training Program on Body Composition of ROTC Cadets**  
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**BACKGROUND:** Similar to the general US population, the rate of cardiovascular disease, sedentary lifestyle, and obesity in military populations is growing. Android obesity, a type of obesity where excess fat accumulates around the thoracic and abdominal cavities, is associated with an increased risk of cardiovascular and metabolic deficiencies. Military populations are confronted with high physiological demands therefore it is crucial for them to be in good physical condition and minimize excess body fat in the thoracic and abdominal areas. **PURPOSE:** This research investigated the effects of a 7-week periodized training program on body composition of ROTC cadets. **METHODS:** Subjects consisted of 23 Army and Air Force ROTC cadets (male=18, female=6), Age (yrs)= 2.26±5.96, Height (cm)=172±8.68, Weight (kg)=72.98±12.91. The intervention group (IG n=14) trained for 1 hour/day, 4 days/week and the control group (CG n=9) participated in traditional military training protocol for 1 hour/day, 3 days/week. **RESULTS:** Findings revealed that both groups demonstrated a significant decrease in overall body fat percentage ( $p=0.005$ ) pre to post training, but only the IG demonstrated a significant training effect evidenced by decreases in the abdominal area ( $p=0.009$ ) and mid-axillary ( $p=0.025$ ). **CONCLUSION:** Although this research demonstrated that periodized resistance training reduces abdominal body fat among ROTC cadets, it is important that future studies address certain limitations (small sample size and length of training period) this study encountered. Due to the health risks associated with android obesity, including increased cardiovascular and metabolic disease risk factors, implementing a periodized training program may be beneficial in diverse military populations.

970 Board #149 May 31 3:30 PM - 5:00 PM  
**Validation of a Three-Dimensional Body Scanner for Body Composition Measures**  
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**PURPOSE:** The accuracy of a three-dimensional (3D) body scanner in determining body composition was compared against other laboratory methods (i.e., hydrostatic weighing, bioelectrical impedance analysis (BIA)). **METHODS:** A total of 176 (males/females= 83/93) young adults [mean±SD: age= 22.2±2.9 years, body mass index (BMI) =24.5±3.8 kg/m<sup>2</sup>] were recruited. Subjects had muscle mass estimated from the 3D body scanner, hydrostatic weighing, skinfolds, circumference measurements and BIA. The Jackson and Pollock equation was used to estimate body fat percent (BF%) from the sum of three skinfolds (males: chest, abdomen and thigh; females: triceps, suprailium, and thigh). The Navy circumference-based equation was used to estimate BF% (males: waist, neck, height; females: waist, hip, neck, and height). **RESULTS:** Males and females were not significantly different in age ( $p=0.192$ ). As expected, females had lower body mass ( $p<0.001$ ), BMI ( $p=0.016$ ) and height ( $p<0.001$ ). A repeated measures ANOVA indicated significant ( $p<0.001$ ) differences among the methods. Bonferonni post-hoc indicated that BF% from the 3D body scanner (17.6±7.7%) was significantly less than BF% from hydrostatic weighing (22.1±8.7%,  $p<0.001$ ), skinfolds (19.8±9.6%,  $p<0.001$ ), BIA (19.0±8.6%,  $p<0.001$ ), and circumferences (21.3±9.5%,  $p<0.001$ ). The main effects of sex and method were significant ( $p<0.001$ ) with a non-significant interaction ( $p=0.060$ ). Among males, BF% from the 3D scanner (10.6±4.0%) was significantly less than BF% from hydrostatic weight (16.0±6.0%,  $p<0.001$ ), BIA (11.9±3.9%,  $p=0.002$ ), skinfolds (11.8±5.1%,  $p=0.03$ ), and circumferences (13.8±4.4%,  $p<0.001$ ). Among females, BF% from the 3D scanner (23.9±4.0%) was significantly less than BF% from hydrostatic weight (27.6±6.9%,  $p<0.001$ ), BIA (25.2±6.5%,  $p=0.003$ ), skinfolds (26.8±6.6%,  $p<0.001$ ), and circumference measures (28.4±9.3%,  $p<0.001$ ). BF% from the 3D scanner was highly correlated with BF% from hydrostatic weight ( $r=0.82$ ,  $p<0.001$ ), BIA ( $r=0.89$ ,  $p<0.001$ ), skinfolds ( $r=0.85$ ,  $p<0.001$ ), and circumferences ( $r=0.85$ ,  $p<0.001$ ). **CONCLUSIONS:** The 3D body scanner consistently underestimated BF% despite being highly correlated with other established methods. Further research is needed to validate 3D scanning as a reliable method for measuring body composition.

971 Board #150 May 31 3:30 PM - 5:00 PM  
**A Comparison Of DXA And A Joint Diameter-based System For The Measurement Of Body Composition**  
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**PURPOSE:** Body composition (BC) is a frequently assessed component of health-related fitness. Recently, a portable joint diameter-based body composition assessment system, sold by Integrative Body Composition Assessment (IBC) has become commercially available for estimating BC. This method involves measuring both right and left wrist diameters using calipers, waist circumference, height and weight. These measurements are entered into the IBC software together with age and gender and the average amount of both cardiorespiratory and resistance training exercise the subject has done on average per week for the past six months. However, little is known how IBC BC estimates compare to the dual-energy X-ray absorptiometry (DXA) estimate of body composition in college aged students. The purpose of this study was to determine the accuracy of the IBC as a way to estimate BC.

**METHODS:** Participants percent body fat (%fat) was estimated using IBC and dual-energy X-ray absorptiometry (DXA), which served as the criterion estimate. Subjects were 162 (75 males, 87 females) physically active college students [age 21 (3) yrs. height 1.73 (0.1) m, body mass 76.09 (15.74) kg. and BMI 25.4 (4.1) kg/m<sup>2</sup>]. **RESULTS:** The validity of the IBC %fat estimate was based on a comparison to the criterion value from the DXA by calculating the mean, SD, coefficient of determination (r<sup>2</sup>), and standard error of estimate (SEE) from linear regression analysis. To assess the average deviation of individual scores from the line of identity, total error (TE) was calculated for each IBC estimate. Paired t-tests determined paired-wise differences between measurements with significance set at  $p<0.05$ . The mean %fat was significantly lower for the IBC [23.0 (9.3) %] estimate than the DXA [25.9 (11.5) %] estimate ( $p<0.001$ ). The r<sup>2</sup> value was 0.669; SEE was 6.6 %fat; and total error (TE) was 7.2 %fat. When separated by sex, the IBC %fat estimate was still significantly lower for both male [-1.6 (5.9) %fat,  $r^2$  0.456, SEE=5.8 %fat, TE=6.16 %fat] and female [-4.0 (6.9) %fat,  $r^2$  0.462, SEE=6.9 %fat, TE=7.9 %fat] participants. **CONCLUSIONS:** In this study the IBC did not provide a valid estimate of body composition and underestimated %fat compared to the DXA estimate. Based on this preliminary analysis, this method cannot be recommended for estimating BC in college aged students.

972 Board #151 May 31 3:30 PM - 5:00 PM  
**Changes in Anthropometric and Physiological Characteristics of Male Collegiate Rugby Union Players throughout a Season**  
 Edward K. Smith, David Q. Thomas, FACSM, Daniel J. Dodd, Dale D. Brown, FACSM, Kelly R. Laurson, Tyler R. Langosch, Jonathan C. Grimwood, Nathan P. Fillers. Illinois State University, Normal, IL.  
 (No relationships reported)

Rugby Union is a physically demanding sport requiring a variety of anthropometric and physiological characteristics to maximize performance. Factors such as muscular power, speed, agility, maximal aerobic power, mobility, and body composition all factor into player performance. **PURPOSE:** To determine changes in body composition, height, speed, muscular power, maximal aerobic power, mobility, and agility of collegiate rugby union players throughout a competitive season. **METHODS:** Participants included 29 (20.32 ± 1.49yrs) men from a collegiate rugby club. Muscular power (vertical jump), speed (10m and 20m sprint), agility (L-drill), mobility (FMS active straight leg raise and shoulder mobility) maximal aerobic power (VO<sub>2 peak</sub> via 20m multi-stage shuttle run SR), height, body mass, fat mass (ADP), fat-free mass (ADP), and body fat levels (ADP and sum of 7 skinfolds (SKBF%)) were assessed during the pre-season (PRE) and mid-season (MID). Training and match loads were estimated for each player by multiplying each player's rating of perceived exertion (RPE: 6-20) by the amount of training/playing time. **RESULTS:** PRE and MID variables were compared using a Paired-Samples T-Test with an alpha level of  $p < .05$ . The mean PRE SKBF% of 16.57 ± 6.29 was significantly higher than the mean MID SKBF% of 13.77 ± 7.61 ( $t(28) = 2.472$ ,  $p = .02$ ). The mean PRE 10m sprint time was 1.81 ± .12s and was significantly faster than the MID mean 10m sprint time 1.94 ± .11s ( $t(19) = -4.782$ ,  $p < .001$ ). The mean PRE 20m sprint time 3.15 ± .16s was significantly faster than the mean MID 20m sprint time of 3.3 ± 1.8s ( $t(20) = -4.155$ ,  $p < .001$ ). The mean PRE VO<sub>2 peak</sub> was 44.65 ± 5.43ml.kg<sup>-1</sup>.min<sup>-1</sup> and was significantly lower than the mean MID VO<sub>2 peak</sub> of 46.97 ± 6.43ml.kg<sup>-1</sup>.min<sup>-1</sup> ( $t(19) = -2.26$ ,  $p = .036$ ). **CONCLUSION:** Maximal aerobic power increased from PRE to MID while the estimated body fat levels decreased from PRE to MID. Improvements in both

variables are likely due to conditioning during training and increased activity levels of participating in sport. Speed may have decreased from PRE to MID due to fatigue from the first-half of the season with accumulating training and match loads.

in FP across ranked BC groups. Furthermore, these differences were not consistent across BC method and not consistent across sex groups. Practitioners using BC data to predict FP should be aware of these inconsistencies.

973 Board #152 May 31 3:30 PM - 5:00 PM  
**Effect Of Hydration Status On Body Composition Assessment Using Dual Energy X-ray Absorptiometry And Ultrasound**

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 (No relationships reported)

The accurate measurement of percent body fat (%BF) is very important in the determination of a wrestler's minimum wrestling weight under the National Collegiate Athletic Association Wrestling Weight Management Program. Skinfold measurements (SF), air displacement plethysmography (ADP), and hydrostatic weighting remain as the only three approved methods. Dual energy x-ray absorptiometry (DXA) is considered a criterion method while type-A ultrasound (US) serves as a less expensive, field alternative; however, a dearth of literature has examined the influence of hydration status on DXA and US determined %BF. **PURPOSE:** To determine the effect of hydration status on fat mass, lean body mass, and %BF using SF, ADP, US, and DXA. **METHODS:** Sixteen college-aged men (20.8 ± 1.6 yrs) participated in this study. Participants reported to the lab on two separate occasions in either a euhydrated state (Usg < 1.020) or a hypohydrated state (Usg > 1.020) using a randomized crossover design. Usg was assessed in order to verify hydration status and %BF was determined using SF, ADP, DXA, and US methods. **RESULTS:** Usg and body mass (BM) measurements were significantly different between the euhydrated (Usg=1.014 ± 0.006; BM=79.1 ± 14.3kg) and hypohydrated (Usg=1.026 ± 0.004; BM=78.4±14.2) assessments (Usg: p<0.001; BM: p=0.006). However, hydration status had no significant effect on %BF observed in the euhydrated or hypohydrated states (p=0.730) although significant differences were observed between the different assessment methods (SF=10.3±1.3%; ADP=13.0±1.9%; US=13.2±1.3%; DXA=19.5±1.8%; p<0.001). Pairwise comparisons identified significant differences between all methods (p<0.001-p=0.018) except for the comparison between ADP and US (p=1.000). %BF measured by DXA was significantly greater than all of the other methods (2.8-9.2%; p<0.004). **CONCLUSION:** Hydration status did not have an effect on %BF measurements when using SF, ADP, US, or DXA. The significant differences among these four methods remain a concern. The difference between two approved methods (SF and ADP) suggests that a wrestler may lose additional weight when using ADP, thus potentially allowing for certification at a lower weight class.

975 Board #154 May 31 3:30 PM - 5:00 PM  
**Skinfolds Thickness And Body Surface Area Evaluated With Anthropometry And Its Relationship With Body Fat**

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In 1921 Matiegka proposed a strategy for estimating adipose tissue mass by calculating the half of average of some skinfolds thickness and multiplying it by body surface area (BSA), but this strategy has not been evaluated with modern body composition methods.

**PURPOSE:** To describe the utility of the product of skinfold thickness measured by anthropometry and BSA in relation with body fat (% and mass) in varsity athletes. **METHODS:** 10 skinfold thicknesses were assessed in 97 varsity athletes (50 males [age 21.5 ± 2.0 y, weight 72.0 ± 10.9 kg, height 175.7 ± 6.7 cm, BMI 23.3 ± 3.0 kg/m<sup>2</sup>], 47 females [20.8 ± 1.9 y, 60.1 ± 10.2 kg, 164.7 ± 7.3 cm, 22.1 ± 2.9 kg/m<sup>2</sup>]). Body fat mass and percentage was assessed by DXA whole body scanning. Body surface area was calculated with two anthropometric equations (DuBois, Biering), additionally Behnke's body building factor was calculated. We performed the Pearson correlation test for body fat mass and body fat percentage with each skinfold thickness, the sum of 10 skinfolds (10SKF), the sum of 8 skinfolds (8SKF) and the product of multiplying 10SKF or 8SKF with either a) DuBois BSA, b) Biering BSA, c) Behnke's factor. **RESULTS:** There was a higher correlation with body fat mass than with body fat percentage when the skinfolds were multiplied by BSA, this correlation was higher in males than females. In males, triceps skinfold thickness had a high correlation with body fat percentage and axilla with body mass. **CONCLUSIONS:** The product of 10SKF (or 8SKF) multiplied by BSA had high correlation coefficients with body fat mass. We propose using the sum of skinfolds (both 10 and 8) and multiplying it by BSA as an adiposity indicator in varsity athletes. There is still need to test if this strategy is useful for monitoring changes in body fat.

Table 1. Correlation coefficients between skinfold thickness and body fat.

	Females				Males			
	Variable	Fat (kg)	Variable	Fat (%)	Variable	Fat (kg)	Variable	Fat (%)
SKF	SKF10	0.840	SKF10	0.826	SKF10	0.913	SKF10	0.897
	SKF8	0.851	SKF8	0.838	SKF Axilla	0.914	SKF8	0.902
SKF * Behnke	SKF10	0.881	SKF10	0.826	SKF10	0.919	SKF8	0.895
	SKF8	0.895	SKF8	0.837	SKF Axilla	0.925	SKF Triceps	0.899
SKF * Biering	SKF10	0.903	SKF10	0.818	SKF8	0.921	SKF8	0.887
	SKF8	0.916	SKF8	0.825	SKF Axilla	0.925	SKF Triceps	0.896
SKF * DuBois	SKF10	0.898	SKF10	0.813	SKF10	0.919	SKF8	0.887
	SKF8	0.911	SKF8	0.821	SKF8	0.921	SKF Triceps	0.895

SKF: Skinfold

974 Board #153 May 31 3:30 PM - 5:00 PM  
**Fitness Performance Across Ranked Body Composition Groups Assessed by Different Methods**

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**PURPOSE:** Body composition (BC) is a valuable indicator of performance both across and within certain sporting events. However, the specific relationship between BC and fitness performance (FP) is less understood. Therefore, the purpose of this study was to examine the relationship between BC and FP in a population of college students. An additional purpose was to determine if identified relationships were consistent across different BC methods. **METHODS:** A total of N=131 college students were used in this study. After signing IRB approved consent forms, subjects participated in a series of fitness tests conducted by trained research assistants. BC was assessed using five different methods: 1) body mass index (BMI), 2) percent body fat (PBF) by skinfold technique (SF), 3) PBF by circumference method (CM), 4) PBF by handheld bioelectric impedance (HH), and 5) waist circumference (WC). Fitness test outcome measures included 1) maximal oxygen consumption (VO2max) from the Queens College Step Test, 2) 1-repetition maximum bench press (BP) scores, 3) maximum repetition push-up (PU) scores, and 4) sit-and-reach (SR) flexibility scores. Subjects were categorized into one of three tertile groups where larger tertiles represented greater BC values. Analysis of variance (ANOVA) was used to examine mean FP differences across BC tertiles. Follow-up contrasts were performed to test for linear and quadratic trends. Significance was set to p<.05 for all tests. **RESULTS:** Male VO2max scores showed a significant indirect linear trend in all five BC methods. Male BP scores showed a significant direct linear trend in BMI and WC only. Male PU scores showed a significant indirect linear trend in all BC methods except BMI. And male SR scores showed no significant differences or trends in any BC method. Female VO2max scores showed a significant indirect linear trend in all BC methods except WC. Female PU scores showed only a significant negative quadratic trend in SF, CM, and HH. Finally, female BP and SR scores showed no significant differences or trends in any BC method. **CONCLUSIONS:** Results from this study show clear differences

976 Board #155 May 31 3:30 PM - 5:00 PM  
**Association Between Physical Activity, Total Cholesterol, Fasting Blood Glucose, And Body Fat Among Hispanic Males**

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**PURPOSE:** To examine the correlation between physical activity (PA) level, total cholesterol (TC), high-density lipoprotein (HDL), and fasted blood glucose (FBG) among college-aged Hispanic males.

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**METHODS:** Thirty-five (35) Hispanic males (age= 23.2 ± 2.8) volunteered to participate in the study. Each subject read and signed the consent form prior to any measurement to take place. PA level objectively measured via Actigraph accelerometers. Each subject wore an accelerometer for 7 consecutive days - 5 weekdays and 2 weekend days. At the end of 7 days, the subjects returned to the lab fasted for at least eight hours and gave blood sample to measure TC, HDL, and BG. The ratio of TC to HDL and non-HDL were also calculated. Air-displacement plethysmography was used to determine percent body fat (BF)  
**RESULTS:** Very vigorous PA was positively correlated with levels of HDL (r=0.557, p<0.01) and negatively correlated with TC-HDL Ratio (r=0.453, p<0.01). A positive correlation was found between minute length of sedentary bouts and levels of glucose (r=0.459, p<0.01). There was also a strong negative correlation occurred between max length of breaks in sedentary time with non-HDL (r=-0.439, p<0.01).  
**CONCLUSIONS:** The results indicate that the intensity of exercise matters for obtaining higher levels of HDL cholesterol and a lower TC-HDL ratio. The findings also suggest that longer durations of sedentary state correlated with an increased FBG and breaks from prolonged sedentary bouts may decrease the risk of developing non-HDL cholesterol related health problems in college-aged Hispanic males. Future studies should be performed to determine the minimum amount of vigorous exercise and length of breaks in sedentary time to improve variables tested in this study.

977 Board #156 May 31 3:30 PM - 5:00 PM  
**Validity and Reliability of a Consumer Bioelectrical Impedance Analysis Scale**  
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*(No relationships reported)*

**PURPOSE:** Bioelectrical impedance analysis (BIA) scales have gained popularity in monitoring fitness progress at home, yet their accuracy is unknown. We assessed the validity and reliability of body fat percentage (BF%) measurements from a consumer bioelectrical analysis (cBIA) scale compared to the “gold standard” of hydrostatic weighing (HW). **METHODS:** Forty-three [male (n=22); female (n=21)] healthy volunteers [age: 27.9±5.6y; height: 170.0±8.6cm; mass: 69.0±13.7kg; body mass index (BMI) range: 16.8-33.1] arrived at the laboratory 3h fasted after 12h without exercise and underwent measures of residual lung volume (for HW calculations), hydration status, and BF% via cBIA scale (‘Lean’ and ‘Regular’ modes) and HW. We assessed cBIA scale validity using Bland-Altman Plots (identifying Mean Biases±Limits of Agreement) and reliability using intraclass correlation coefficients (ICC). **RESULTS:** With HW as the validity criterion, mean BF% was 22.3±6.1% for all participants (range: 5.3-35.8%; male mean: 20.8±6.4%; female mean: 23.9±5.5%). Compared to HW, the cBIA scale in ‘Lean’ mode underestimated BF% by -5.3±9.1% for all participants (males: -7.9±6.9%; females: -2.6±8.0%) (p≤0.05). In ‘Regular’ mode, the cBIA scale agreed with HW for all participants (BF% -0.8±9.3%; p=0.27) and females (BF% 0.4±10.8%; p=0.73); however, there was a significant difference for males (BF% -2.0±7.1%; p≤0.05). The cBIA was reliable when comparing day-to-day (‘Lean’ mode: 0.5±1.0%, ICC:0.99; ‘Regular’ mode: 0.4±1.0%, ICC:0.99) and week-to-week (‘Lean’ mode: -0.4±1.4%, ICC:0.98; ‘Regular’ mode: -0.2±1.5%, ICC:0.97) BF% for all participants. **CONCLUSIONS:** Compared to HW, the cBIA underestimated BF% in ‘Lean’ mode, and this discrepancy was more pronounced in males. However, the cBIA scale agreed with HW when analyzing BF% in ‘Regular’ mode for all participants and females, signifying the “mode” chosen on consumer BIA devices greatly impacts validity. The cBIA was reliable when comparing day-to-day and week-to-week BF% measures for all participants, suggesting this can be a reliable at-home BF% analysis scale.

978 Board #157 May 31 3:30 PM - 5:00 PM  
**Interrater Reliability For Dxa And Bia Analysis For Measuring Total And Regional Lean Mass**  
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*(No relationships reported)*

Dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are capable of assessing total and regional body composition using different technologies. DXA is considered more reliable than BIA to evaluate body composition, while BIA is a more cost-efficient and portable option. The agreement between these measures has not been determined in Rugby athletes. **PURPOSE:** To assess the interrater reliability between two devices that are capable of assessing total and regional lean mass in rugby athletes. **METHODS:** Body composition was measured in sixteen male rugby players (21.1 ± 1.6 years; 88.3 ± 14.2 kg; 1.78 ± 0.06 m) prior to the onset of their competitive season. Total body estimates of percent fat (%FAT),

fat mass (FM), and lean mass (LM) were determined by DXA (Lunar iDXA) and BIA (InBody 770). Regional LM estimates were also determined for the arms and legs from both devices. To assess the agreement between DXA and BIA on these measures, intraclass correlation coefficients (ICC), 95% limits of agreement (95% LOA), and coefficients of variation (CV%) were calculated. **RESULTS:** The agreement between DXA and BIA for total body estimates of %FAT (ICC<sub>2,1</sub> = 0.81, 95% LOA = 0.91 - 1.34%, CV% = 10.5%), FM (ICC<sub>2,1</sub> = 0.48, LOA = 0.63 - 0.92 kg, CV% = 10.1%) and LM (ICC<sub>2,1</sub> = 0.67, LOA = 0.92 - 1.00, CV% = 2.3%) was variable, while regional values for lean arm mass (ICC<sub>3,1</sub> = 0.91, 95% LOA = 0.93 - 1.06%, CV% = 3.3%) and lean leg mass (ICC<sub>3,1</sub> = 0.89, 95% LOA = 1.05 - 1.15%, CV% = 2.4%) agreement was consistent. **CONCLUSION:** These data suggest that the interrater reliability between DXA and BIA is high when estimating total and regional lean mass, but not for estimating fat mass or body fat percentage. Although limited by the cross-sectional nature of the study design, our findings suggest it may be possible to use these devices interchangeably for tracking total and regional lean mass.

979 Board #158 May 31 3:30 PM - 5:00 PM  
**Effects Of Undulating Periodization On Physical Fitness And Body Composition In Women Practitioners Of Hydrogymnastics**  
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*(No relationships reported)*

Recently, new ways of manipulating the different training variables have been discussed in the aquatic environment. However, little attention has been considered in use of periodization theory training. **PURPOSE:** To compare the effect of two types of [daily (DUP) versus weekly (WUP)] undulating periodization on body composition, functional strength and flexibility in women practitioners of hydrogymnastics. **METHODS:** 24 women practitioners of hydrogymnastics (age: 56.8 ± 2.4 years) were allocated in DUP (n=12) and WUP (n=12) groups. Both training protocols were periodized integrating a hydrogymnastics program composed by 39 sessions, 3 times per week, alternating in low or high intensity [Borg Rating of Perceived Exertion (RPE)], or per daily (DUP) or per week (WUP). Before and after the experimental protocol the individuals completed four items from the Senior Fitness Test (SFT) and body composition analysis. The SFT task were: Chair Stand test, which assessed lower body muscle strength and endurance; Arm Curl, which assessed arm muscle strength endurance, specifically of the biceps; Chair Sit-and-Reach a test of lower body flexibility; and the Back Scratch Test, which assessed upper body flexibility, particularly of the shoulders. Body composition was performed using the In-Body (720) equipment. Data were analyzed using two-way ANOVA (group and time with a significance level of 5%). **RESULTS:** DUP and WUP treatment produced similar increase (p<0.05) of scores related to Arm Curl (~18%) and Chair Stand (~17%) tests; maintenance of Chair Sit-and-Reach scores. Differences between the groups (p<0.05; ~25%) were showed only in Back Scratch test with a higher score in DUP group. **CONCLUSION:** Both daily and weekly undulating periodization were able to increase or maintain the physical fitness status and reduce fat mass in women practitioners of hydrogymnastics. Also, it seems that upper body flexibility may be influenced more by DUP than WUP.

980 Board #159 May 31 3:30 PM - 5:00 PM  
**Relationship of Fat-Free Mass and Fat Mass to Body Weight in College Male Athletes Players**  
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*(No relationships reported)*

Body mass differs widely across the sports spectrum. While some sports are dominated by large athletes, other sports participants benefit from a small size or weight class restrictions. Perhaps the most frequent measurement of body composition has been %fat with less frequent emphasis on the major components of body composition, fat-free mass (FFM) and fat mass (FM). FFM is the functional component as it is closely associated with maximal voluntary strength, while FM plays an important role in energy balance. With the ever increasing emphasis on control and manipulation of these components in modern sports, perhaps there should be greater focus on the relationship between FFM and FM. **PURPOSE:** To determine the relationship of FFM and FM to height and body mass across the wide range of size typically observed in college athletes. **METHODS:** Two hundred and sixty-seven NCAA D-II male athletes (age = 20.2 ± 1.2 y, height = 180.6 ± 7.9 cm, body mass = 87.3 ± 16.9 kg) volunteered to serve as subjects. Body composition was assessed using dual-energy x-ray absorptiometry (DEXA). This allowed compartmentalization and regional estimates of lean (bone, muscle, etc.) and fat tissue from which FFM and FM are determined. **RESULTS:** The relationship between height and body mass are curvilinear and moderately correlated (r=0.61). FFM and FM were significantly related to height

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( $r = 0.69$  and  $0.35$ , respectively) and body mass ( $r = 0.92$  and  $0.91$ , respectively), with the relationships being more curvilinear in the latter. FM accounted for 60% of the variance in body mass, while FFM accounted for only 40%. The relationship between FFM and FM was significant ( $r = 0.62$ ) and curvilinear, showing a greater accumulation of FM at higher body masses. **CONCLUSIONS:** FFM and FM increase linearly with height, but showed a curvilinear relationship with body mass suggesting that this population of male athletes may be approaching a theoretical limit of FFM accumulation. In contrast, the accumulation of FM follows a linear pattern with height but increases exponentially with body mass. The curvilinear relationship between body weight and height is not typical and appears to be related to a relative increase in body weight with fat accumulation beyond 180 cm height and 110 kg body weight. Depending on the sport, accumulation of FM may become a hindrance to performance.

981 Board #160 May 31 3:30 PM - 5:00 PM  
**Relationship Of Fat-free Mass And Fat Mass To Body Weight In College Female Athletes**

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Body mass differs widely across the sports spectrum in female athletes. While some sports are dominated by large athletes, other sports participants benefit from a smaller size and/or are limited by weight class. The most traditional measure of body composition has been %fat with less frequent emphasis on the major components of body composition: fat-free mass (FFM) and fat mass (FM). FFM is the functional component since as it is closely associated with maximal voluntary strength, while FM plays an important role in energy balance. With the ever increasing emphasis on control and manipulation of these components in modern sports, closer observation should be given to the relationship between FFM and FM accumulation. **PURPOSE:** To determine the relationship of FFM and FM to height and body mass across a wide-range of size typically observed in college female athletes. **METHODS:** One hundred and thirty-two NCAA Division-II female athletes (age =  $19.9 \pm 1.2$  y, height =  $169.1 \pm 7.9$  cm, body mass =  $67.8 \pm 12.2$  kg) volunteered to participate. Body composition was assessed using dual-energy x-ray absorptiometry (DEXA) to assess regional estimates of lean (bone, muscle, etc.) and fat tissue which allowed determination FFM and FM. **RESULTS:** Height was linearly correlated with body mass ( $r=0.58$ ). FFM and FM were significantly related to height ( $r = 0.63$  and  $0.40$ , respectively) and body mass ( $r = 0.91$  and  $0.93$ , respectively), with the relationships being linear in all four cases. FFM accumulated at approximately 0.35 kg/cm height and 0.50 kg/kg body mass; accounting for 91% of the variance in body mass, while FM accounted for only 9%. The greatest accumulation of FFM was at a height of 169 cm (0.402 kg/cm height) and body mass of 105 kg (0.663 kg/kg). The relationship between FFM and FM was significant ( $r = 0.71$ ) and curvilinear. Accumulation of FM per kg of FFM increased at FFM > 55 kg. **CONCLUSIONS:** In female athletes, body mass appears to be the significant determinant of FM accumulation. The accumulation of FM is determined by FFM, while the rate of accumulation of FM increases significantly at a threshold of 55 kg FFM.

982 Board #161 May 31 3:30 PM - 5:00 PM  
**The Importance Of Body Composition In The National Hockey League Testing Combine**

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The National Hockey League (NHL) combine was designed to assess draft-eligible players based on speed, power, strength, and physical size. Body composition (anthropometric measures and skin fold values) are recorded for all players, with the belief that it may play a role in physical performance. **PURPOSE:** To examine the role of body composition in the battery of physical tests and to compare differences in combine results based on position.

**METHODS:** Over two seasons, thirty-seven elite male Canadian university hockey players (age =  $22.86 \pm 1.55$  years, weight =  $87.21 \pm 6.52$  kg, height =  $181.69 \pm 6.19$  cm, body fat percentage =  $16.06 \pm 3.93\%$ ) participated in the study at the beginning of their hockey seasons. All participants underwent physical testing (as outlined in the 2016 NHL combine) and a day after testing, one total body dual energy x-ray absorptiometry (iDXA) scan to measure body composition.

**RESULTS:** Pearson product correlations were used to explore the relationship among anthropometric measures (body fat percentage, visceral fat (kg), height, weight, leg lean mass per kg, upper lean mass per kg, and wingspan) with NHL fitness tests (bench press, maximum pull ups, grip strength, long jump, and Wingate anaerobic test). Multiple linear regression was used to explore the association among regional body

composition and NHL combine tests. Upper body lean mass/kg ( $R^2 = .417$ ) explained the most variance in the bench press while height ( $R^2 = .566$ ) explained the most variance in the long jump. Between positions, defensemen displayed greater right grip strength compared to forwards ( $p < 0.05$ ). All other comparisons were non-significant. **CONCLUSIONS:** There are numerous factors that may influence performance on combine-specific physical tests. Body composition and anthropometric measures both seem to influence combine-specific tests, which may help sport scientists better tailor training programs to optimize performance in elite hockey players.

983 Board #162 May 31 3:30 PM - 5:00 PM  
**Reference Standards for Lean Mass Measures using GE Dual Energy Xray Absorptiometry**

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Body composition (BC) assessments focus predominantly on fat mass, however lean mass (LM) measurements also provide useful information on clinical and nutritional status. LM measurements have been shown to be predictive of health outcomes, including sarcopenia, which has been associated with frailty and reduced quality of life. Dual energy x-ray absorptiometry (DXA) is an established technique used to assess BC, including total and regional LM. Reference values for LM derived from DXA are necessary for interpretation and detection of LM deficits and its associated health issues. Recently reference values for LM measures specific to Hologic DXA systems were developed, however it is known that BC, including LM measures differ by DXA manufacturer. There currently are no LM reference values available for GE-Healthcare DXA systems. **PURPOSE:** To develop reference values by age and sex for LM measures using with GE-Healthcare DXA systems.

**METHODS:** A de-identified sample, considered exempt from IRB review, was obtained from Ball State University's Clinical Exercise Physiology Laboratory and University of Wisconsin-Milwaukee's Physical Activity & Health Research Laboratory. DXA scans of 2,076 women and 1,251 men were completed using a GE Lunar Prodigy or iDXA. Variables of interest included total LM and appendicular lean mass index (ALMI; leg lean mass + arm lean mass (kg) / height (m<sup>2</sup>)). Percentiles (%ile) were calculated and a factorial ANOVA was used to assess differences for each variable between age groups and sex, as well as the interaction between age and sex. **RESULTS:** Men had higher mean total LM and ALMI than women ( $p < 0.01$ ), across all age groups. Total LM and ALMI decreased over the 5 decades in men and women ( $p < 0.01$ ). The 50<sup>th</sup> %ile for total LM of men and women aged 20-29 years decreased from 63.9 and 42.5 kg to 54.2 and 39.1 kg for ages 70-79 years, respectively. The rate of decline in total LM during a 5 decade period was approximately 3% and 2% for men and women per decade, respectively.

**CONCLUSIONS:** These age and sex-specific LM reference values are the first developed specifically for use with GE-Healthcare DXA systems. These reference values provide for a more accurate interpretation of DXA-derived LM measurements providing an initial resource to aid in the early detection and assessment of LM deficits.

984 Board #163 May 31 3:30 PM - 5:00 PM  
**How Much Weight Have Senior Kinesiology Students Gained?**

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Several research studies have examined the belief of freshman 15 myth as it is well known that an amount of weight gained during a student's first year at college in the United States and Canada. However, mixed results have been found that freshmen gain as much as 15 pounds, whereas other suggests minimal weight gain. There is still limited information available to systematically examine the weight gained in Kinesiology/Exercise Science major senior college students. **PURPOSE:** The present study was to examine the senior college student's body weight compared to the ideal body weight. **METHODS:** Two hundred and thirty-two exercise science major students were participated in the study (age =  $21.6 \pm 0.72$  yrs; Height =  $170.8 \pm 12.2$  cm; weight =  $77.8 \pm 14.8$  kg; Body mass index =  $26.8 \pm 5.0$  kg-m<sup>2</sup>; Body Fat% =  $19.2 \pm 8.2\%$ ; ideal body weight =  $69.8 \pm 14.2$  kg) and the ideal body weight was calculated based on using the body fat % obtained by the bio-electrical impedance device.

Descriptive for all variables were calculated and Pearson product-moment correlations were calculated to test the association between the actual weight and the ideal body weight. Dependent t-tests were performed to examine the statistically significant difference between the actual weight and the ideal body weight and also examine the ideal body weight differences between the male and female students. **RESULTS:** The difference between the actual weight and the ideal weight was 5.88 kg for male

students and 10.79 kg for female students. A strong correlation was observed between the actual weight and the ideal body weight,  $r=.832$  ( $p < 0.01$ ) and  $r=.829$  ( $p < 0.01$ ) for male and female students, respectively. The dependent t-test indicated that there are significant differences between the actual body weight and the ideal body weight for both male ( $t(133)=9.1$ ,  $p < 0.01$ ) and female ( $t(97)=14.49$ ,  $p < 0.01$ ). **CONCLUSIONS:** This finding demonstrates that even exercise science major students were heavier than their ideal body weight and female students are heavier than male students. Future researchers should focus on the mechanisms of college student's weight gain to initiate the college level interventions to prevent unhealthy weight gain.

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**Influence Of Body Fat Percentage And Sex On Mechanical Efficiency Of Rock Climbing**

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(No relationships reported)

**PURPOSE:** The purpose of this study was to determine if there is a relationship between mechanical efficiency (ME) and body fat percentage (BF%) in rock climbers. The secondary aspect was to determine if there is a difference in ME between male and female rock climbers. Years of experience and frequency of climbing was analyzed to correct for variability.

**METHODS:** 10 experienced rock climbers (7 males, 3 females) mean age of  $25 \pm 5.8$  years volunteered to participate in the study. Each participant climbed up a 30 ft. indoor vertical rock climbing wall at a self-selected pace.  $VO_2$  was analyzed at rest and during the climb using a portable COSMED device. BF% was measured using bioelectrical impedance (BIA) and years of climbing and climbing frequency was self-reported. Participants were separated in two groups based on whether they fell above or below the median BF%. Males and female participants were also analyzed by group. Correlation and independent t-tests were ran using Microsoft Excel 2016.

**RESULTS:** A negative correlation ( $r = -0.37$ ) was found between ME and body fat percentage. No significant difference in ME was seen between groups ( $p = 0.086$ ). No significance was found between ME and years or frequency of climbing. There was no significant difference in ME between males and females although the difference in BF% was significant ( $p = 0.00698$ ).

**CONCLUSIONS:** Individuals with higher BF% tend to have lower ME but this difference is not significant. Previous studies have shown that training state has the largest effects ME. Therefore, self-reported years of experience and frequency of climbing may not be an accurate estimator for training status.

986 Board #165 May 31 3:30 PM - 5:00 PM

**Validity of Whole and Regional Body Composition Testing Devices**

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(No relationships reported)

Obesity has been established as a risk factor for multiple diseases and is an increasing problem throughout the world. Advances in technology have enabled health professionals to use many devices to diagnose individuals as healthy, overweight, or obese. However, there are discrepancies between the validity of the devices.

**PURPOSE:** The purpose of this study is to validate InBody 520 and InBody S10 against the Hologic dual-energy X-ray absorptiometry (DXA) system. **METHODS:** 50 male and female subjects performed body composition testing on an InBody 520, InBody S10, and a Hologic DXA, followed by repeat measurements on the InBody 520 and S10. **RESULTS:** JMP Statistical Discovery Software Version 12.2.0 (Cary, NC) was used to run a matched pairs T-test and one-way analysis of variance (ANOVA) statistical analysis on all data collected. The significance level was set as  $p < .05$  with a confidence interval of 95%. Subjects were (31 males, 19 females) mean weight was  $87.8 \pm 19.6$ kg (male) and  $63.9 \pm 10.7$  kg (female), mean height was  $178.7 \pm 6.6$ cm (male) and  $161.9 \pm 7.1$ cm (female), mean age was  $23.1 \pm 2.7$  years (male) and  $22.9 \pm 2.0$  years (female). Body fat percentage was significantly greater for the DXA ( $28.9 \pm 8.2$ ) when compared to the InBody 520 ( $20.4 \pm 9.6$ ),  $p < .001$ , and significantly greater when compared to the the InBody S10 ( $21.8 \pm 9.8$ ),  $p = .001$ . Lean body mass was significantly less for the DXA ( $54.7 \pm 14.4$ ) when compared to InBody 520 ( $62.2 \pm 15.1$ ),  $p = .036$ , but not significant when compared to the InBody S10 ( $61.0 \pm 15.6$ ),  $p = .096$ . Body fat mass was significantly greater for the DXA ( $22.3 \pm 9.4$ ) compared to the InBody 520 ( $16.5 \pm 10.6$ ),  $p = .0156$ , but not significant when compared to the InBody S10 ( $17.9 \pm 10.9$ ),  $p = .091$ . **CONCLUSION:** The overall conclusion of this project is significant differences existed when measuring body composition variables between the DXA and the InBody devices. The InBody devices however, were not significantly different to each other when measuring body fat mass, lean body mass, and percent body fat, but again, they were significantly different when compared to the DXA.

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**Changes in Body Composition among Female College Basketball Players Pre and Post-Preseason Training**

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(No relationships reported)

**PURPOSE:** To examine changes in area-specific lean mass and body fat among female, division I college basketball players before and after preseason training. **METHODS:** Body composition was measured before and after preseason training using a dual-energy x-ray absorptiometry (iDXA) scan. Total and area-specific (arms, trunk, legs, android, and gynoid) lean mass and body fat were analyzed. Preseason training lasted 1 month and consisted of 8 hours per week of a combination of weight training, high-intensity interval sprint training, and skill workouts. Paired-sample t-tests were used to examine change pre- and post-intervention. Pearson correlations were conducted to examine potential associations among variables.

**RESULTS:** Female athletes (N=11) completed this study. Total body mass significantly increased ( $p = .001$ ) after preseason training from 152.8 to 155.6 lbs. Total and area-specific fat mass did not significantly change after preseason training. Total lean mass significantly increased ( $p = .004$ ) from 109.6 to 112.0 lbs. However, for area-specific lean mass, only lean mass in the trunk ( $p = .01$ ) and in the android region ( $p = .013$ ) significantly increased from 51.2 to 52.3 lbs. and from 6.8 to 6.9 lbs., respectively. Individual lean mass responses to training varied widely. Specifically, changes in total lean mass ranged from  $+0.2$  to  $+7.9$  lbs. Changes in total fat mass also varied widely between individuals, ranging from a loss of 2.2 lbs. to a gain of 3.5 lbs. Change in total lean mass was not significantly correlated with baseline total lean mass, age, year in school, or position played. Change in total body fat was negatively correlated ( $r = -.82$ ,  $p = .001$ ) but not significantly correlated with age, year in school, or position played. One athlete experienced an ACL tear midway through the season. Although her data was not included in pre-post analysis, her iDXA scan indicated a loss of 11.3 lbs. in lean mass, with the majority of this reduction seen in the legs (-6.4 lbs.).

**CONCLUSIONS:** Because there were significant increases in total body mass and lean mass but not body fat, it is important to directly measure body composition to examine effects of training. In addition, these data demonstrate that athletes' responses to training can vary widely thus highlighting the potential use of individualized training programs.

988 Board #167 May 31 3:30 PM - 5:00 PM  
**Relationships Between Body Composition And Sports Performance In Collegiate Baseball**

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**Purpose:** Baseball requires a multifaceted list of skills and athletic abilities in order to be successful. This varies even further depending on the player's role within the team, such as pitchers and hitters. There is currently little data seen within the realm of baseball depicting the relationships between athlete body composition and their performance.

**Methods:** Athletes from a NCAA division I collegiate baseball team were recruited for this study ( $n=28$ ). The athletes were measured for height, weight, and body composition. Body composition was measured utilizing air displacement (Cosmed, USA). The players were broken into two categories; allocated by their role as a pitcher in the team or as a batter. Pitchers were noted for their earned run average (ERA) and batters for their batting average (BA). Statistics were accessed from season performance data.

**Results:** The pitchers within this squad had a mean body weight of  $186 \pm 12.3$  lbs., (Mean $\pm$ STD) a mean BF% of  $17.3 \pm 4.6$ , and a mean ERA of  $7.31 \pm 4.9$ . The batters had a mean body weight of  $194 \pm 23.7$  lbs., a mean BF% of  $16.4 \pm 8.2$ , and a mean BA of  $.270 \pm 0.1$ . Correlations between body fat percentages and BA were non-significant, and so were correlations between body fat percentages and ERA.

**Conclusions:** From these results, no significant difference appeared to show how body fat percentage along with total body weight would play a major role in determining the overall ability of the pitchers or the batters. This research shows that variety of body weight and body compositions can be successful when playing baseball since no clear trend was identified. Further research should be conducted with baseball with comparisons at the professional level.

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**Comparing Body Composition Changes Between Skinfold and Air Plethysmography in Division II Men's Basketball Players**

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 (No relationships reported)

Body composition can be used as an indicator of health in the general population and athletes alike. Men's college basketball players are encouraged to make healthy (body composition, aerobic and anaerobic markers, etc.) changes between Post-season and Pre-season, often overseen with a strength and conditioning staff intervention. The ability to measure percent fat, and track those changes during an athlete's career, including the off-season, is a vital measurement for strength and conditioning coaches.

**PURPOSE:** To compare changes in body density (BD), body fat percentage (BF%) and fat-free mass (FFM) obtained from skinfolds (SKF) using calipers and BodPod values in men's basketball players from Post-season to Pre-season during an off-season college-level strength and conditioning intervention.

**METHODS:** Certified Strength and Conditioning (CSCS) staff supervised the off-season (April to October) training intervention. SKF were performed by a single, experienced technician on 7 Division II men's basketball players (21.0 ± 0.6 yrs, 1.91 ± 0.11 m, 94.9 ± 17.2 kg) following ACSM Guidelines. BD via SKF was calculated via Jackson-Pollock seven-site formula. For SKF, the BD to BF% conversion utilized either BF% = (4.86/Db) - 4.39 or BF% = (4.95/Db) - 4.50, based on age, sex, and ethnicity. BodPod was performed in accordance with manufacturer's directions. A dependent, t-test was used to determine differences in BD, BF%, and FFM obtained from SKF and BodPod.

**RESULTS:** Changes in BD did not differ between the two groups (SKF 0.002 ± 0.002 kg/L, BodPod 0.004 ± 0.007 kg/L). The change in BF% did not differ significantly between skinfold and BodPod (SKF 1.2 ± 1.2%, BodPod 2.4 ± 2.2%). Changes in FFM did not differ significantly between the two assessment methods (SKF 1.1 ± 0.9 kg, BodPod 1.4 ± 0.6 kg). Body weight did not change significantly in the off-season (April 94.9 ± 17.1 kg, Oct 94.2 ± 14.5 kg).

**CONCLUSION:** The changes in body composition were accounted for equally by SKF and BodPod. While SKF and BodPod values may vary in the actual measurement of BD, BF% and FFM, the absolute change in BD, BF%, and FFM from Post-season to Pre-season was assessed equally by both modes of testing. Regardless of the body composition assessment tool, its variation can be presumed accurate as long as the same mode of testing was used at both time points.

990 Board #169 May 31 3:30 PM - 5:00 PM  
**Differences in Total Body Fat and Body Fat Percentage Between Performance and Aesthetic Collegiate Athletes**

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Aesthetic sport athletes may believe that they can achieve a higher score if their body conforms to an ideally perceived body image. These athletes may follow extreme diets that can lead to a low body fat percentage, fluctuations in weight, and eating disorders in order to achieve their desirable body image. Although, performance sports do not score points from judges, these athletes may be very lean in response to their training demands. **Purpose:** To compare absolute and relative total fat, android fat, gynoid fat, between synchronized swimming (aesthetic sport) to hockey (performance sport) in female collegiate athletes. **Methods:** 41 female collegiate athletes ( $n=22$  hockey players,  $n=19$  synchronized swimmers) completed a total body iDXA scan to evaluate total and regional body fat percentage. The average age of the athletes was 20.30 ± 1.77 yrs. The average weight of the athletes was 65.36 ± 8.37 kg where synchronized swimmers weighed 62.62 ± 8.45 kg and hockey players weighed 67.73 ± 7.73kg, ( $F(1,40)=4.09, p<0.05$ ). ANOVA was used to compare between sport differences in total body fat and body fat percentage as well as in the android and gynoid regions. **Results:** Synchronized swimmers had higher total body fat percentages (30.64 ± 6.76% vs 26.74 ± 4.63%,  $F(1, 39) = 4.756, p=0.035$ ), higher android percent fat (27.83 ± 9.91% vs 22.4 ± 7.09%  $F(1,39) = 4.156 p=0.048$ ) and gynoid percent fat (35.18 ± 6.96% vs 30.50 ± 4.86%  $F(1,39) = 6.372 p=0.016$ ) than hockey players. Moreover, there was no significant differences in total body fat (18.79 ± 5.87kg vs 17.57 ± 4.64kg)  $F(1,39) = 0.550 p=0.463$ , android fat (1.14 ± 0.53kg vs 0.97 ± 0.46kg  $F(1,39) = 1.280 p=0.265$ ) and gynoid fat (3.68 ± 1.18kg vs 3.51 ± 0.82kg  $F(1,39) = 0.301 p=0.586$ ) between the two groups. **Conclusion:** Previous literature suggests that synchronized swimmers (aesthetic sports) have lower body fat percentage in order to achieve a higher score from judges. However, our results indicate that collegiate hockey players (performance sports) have lower body fat in all the tested regions.

Factors such as body image perception, training, and diet during the competitive season should be further investigated in order to better tailor health and training programs for female student athletes.

991 Board #170 May 31 3:30 PM - 5:00 PM  
**Effect of Body Composition and Mass Adjustments on Workload Estimation in NCAA Division I Football Players**

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**PURPOSE:** Global Positioning Systems (GPS) and accelerometer integrated wearable technology (IWT) is often used to quantify an athlete's work output. Differences in body composition may impact an athlete's workload. This study examined the relationship between IWT determined total workload (TWL) and body composition measurements between 9 football positions. **METHODS:** TWL was measured in 78 NCAA Division I football athletes [9 Safeties (S), 6 Cornerbacks (CB), 12 Wide Receivers (WR), 5 Running Backs (RB), 5 Quarterbacks (QB), 6 Tight Ends (TE), 13 Linebackers (LB), 13 Defensive Linemen (DL), and 9 Offensive Linemen (OL)] using IWT during summer training sessions (June-July). Body fat percentage (BF%) and total upper body – lean lower mass ratio (TULLR) were determined using dual X-ray absorptiometry. Average TWL for the measured period was multiplied by BF%, BMI, and TULLR to obtain relative values for each player. An ANOVA was used to test the effect of position on each workload variable. When position had a significant effect, a Tukey test determined positional differences. **RESULTS:** Position had an effect on TWL ( $p<0.001$ ) with S having a higher TWL than OL. When TWL was adjusted for BF% OL had significantly ( $p<0.025$ ) higher TWL than all positions. There were no differences in TWL by position when adjusted for BMI ( $p=0.174$ ) or TULLR ( $p=0.107$ ). Table 1 presents the positional comparisons for each measure of TWL. **CONCLUSION:** Data from this study suggests that adjustments of TWL influences the interpretation of positional differences. Given that TWL is estimated based on changes in acceleration, the amount, and composition, of the athlete's mass is critical to understanding the actual work being performed. Based on the observed variance in physiological response to similar TWL, future studies should examine relative player loads based on body mass and composition.

Table 1: Total Workload and Relative Adjustments mean (±SD)

	S n = 9	CB n = 6	WR n = 12	RB n = 5	QB n = 5	TE n = 6	LB n = 13	DL n = 13	OL n = 9
<b>Total (AU) Workload</b>	242.9 <sup>a</sup> (41.0)	230.5 <sup>ab</sup> (29.7)	234.4 <sup>ab</sup> (28.1)	239.6 <sup>ab</sup> (11.1)	225.7 <sup>ab</sup> (33.3)	208.1 <sup>ab</sup> (22.8)	224.3 <sup>ab</sup> (47.4)	209.3 <sup>ab</sup> (32.0)	187.4 <sup>b</sup> (27.6)
<b>BF% (AU)</b>	3392.5 <sup>b</sup> (760.0)	3177.9 <sup>b</sup> (739.2)	3628.4 <sup>b</sup> (482.8)	3453.4 <sup>b</sup> (676.2)	3475.0 <sup>b</sup> (332.7)	3762.8 <sup>b</sup> (861.7)	4016.8 <sup>b</sup> (997.4)	4637.9 <sup>b</sup> (1255.4)	5941.7 <sup>a</sup> (1241.3)
<b>BMI (AU)</b>	6818.1 <sup>a</sup> (1222.7)	6114.9 <sup>a</sup> (1064.9)	6217.6 <sup>a</sup> (763.8)	7252.3 <sup>a</sup> (400.2)	5933.0 <sup>a</sup> (521.8)	5980.0 <sup>a</sup> (632.3)	6725.4 <sup>a</sup> (1360.1)	6977.2 <sup>a</sup> (1206.5)	7065.9 <sup>a</sup> (1347.8)
<b>TULLR (AU)</b>	398.8 <sup>a</sup> (61.8)	363.0 <sup>a</sup> (64.6)	386.7 <sup>a</sup> (49.4)	382.0 <sup>a</sup> (33.1)	365.6 <sup>a</sup> (46.7)	351.3 <sup>a</sup> (47.0)	360.5 <sup>a</sup> (82.7)	331.8 <sup>a</sup> (53.7)	325.2 <sup>a</sup> (38.0)

\*If values do not share a letter in each row they are significantly different from one another

992 Board #171 May 31 3:30 PM - 5:00 PM  
**Changes in Division I Collegiate Ice Hockey Player Anthropometrics and Fitness Over 36 Years**

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Over the past several decades, fitness training has become integral to collegiate ice hockey, with the objective being to improve on-ice performance. However, the change in anthropometric and fitness profiles of collegiate ice hockey players has not been addressed. In addition, it is unknown whether these characteristics differ in athletes who later play in the National Hockey League (NHL) compared to those who do not. **PURPOSE:** The purposes of this study were to describe anthropometric (height, weight, %fat) and aerobic fitness ( $VO_{2max}$ ) characteristics of collegiate ice hockey players over 36 years, and to evaluate whether these characteristics differ from those athletes who later play professionally in the NHL. **METHODS:** Physiologic and anthropometric profiles were obtained through preseason fitness testing of all players from a NCAA Division I men's ice hockey team from 1980 through 2015. Athletes (N=56) who later played at least one year in the NHL were also compared to non-NHL

athletes (N=220). Descriptive statistics (means, standard deviations) were calculated for non-NHL team players, as well as NHL players. Changes over time in variables of interest for each year's team were evaluated via regression analysis using linear and polynomial models. Characteristics of average non-NHL characteristics and future NHL players were compared via analysis of variance. **RESULTS:** Regression analysis revealed that a cubic model best predicted changes in mean height ( $R^2=0.65$ ) and weight ( $R^2=0.77$ ), while a quadratic model best fit change in %fat by year ( $R^2=0.30$ ). Non-NHL averages were slightly, yet significantly ( $P<0.01$ ) greater for %fat (12.4±3.5 % vs. 11.2±3.3 %), but there was no difference in height (181.8±6.2 cm vs 182.5±4.8 cm), weight (84.6±7.7 kg vs 85.0±5.7 kg), and  $VO_{2max}$  (58.0±4.6 ml·kg<sup>-1</sup>·min<sup>-1</sup> vs 58.6±5.0 ml·kg<sup>-1</sup>·min<sup>-1</sup>) between non-NHL and future NHL players, respectively. **CONCLUSION:** While average player heights and weights fluctuated over time, increased emphasis on fitness training did not appear to affect athletes' relative aerobic fitness levels.

993 Board #172 May 31 3:30 PM - 5:00 PM  
**Anthropometric Evolution Of Professional Basketball Positions: A 20-year Retrospective View Of NBA Players**  
 Christopher W. Bach, Jack W. Ransone, FACSM. *University of Nebraska - Lincoln, Lincoln, NE.*  
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 (No relationships reported)

Coaches and management should constantly monitor long-term development of both current and prospective athletes in order to ensure proper fit into their system. Longitudinal analysis of player development and changing physical requirements of specific player positions can help to further evaluate player characteristics and allow for more effective comparison within their organization. **PURPOSE:** To identify whether the anthropometric characteristics of professional basketball positions have changed over the past 20 years (1997-2016). **METHODS:** Anthropometric assessments (height, weight, body fat, wingspan, and wingspan:height ratio) were taken by staff from multiple NBA settings (combines, individual team tryouts, etc.) over the course of 20 NBA seasons (1997-2016) and pooled together in order to evaluate changes in anthropometric characteristics of each the following positions: point guard (PG), shooting guard (SG), small forward (SF), power forward (PF), and center (C). All players included in the analysis were either current NBA players or prospective NBA players selectively chosen by the NBA and its respective organizations. Multilevel modelling was used to explore trends in anthropometric variation over time using linear regression analysis. **RESULTS:** With the exception of PG (2.626 cm), average height decreased for all positions over the course of 20 years (SG: -1.072 cm; SF: -0.335 cm; PF: -0.625 cm; C: -1.646 cm). Weight decreased for the PF position over time (-2.549kg), while all other positions reported increases in average weight (PG: 1.085 kg, SG: 1.301 kg, SF: 0.368 kg; C: 0.017 kg). Wingspan increased for all positions (PG: 2.306 cm; SG: 2.322 cm; SF: 2.581 cm; PF: 1.991 cm) with the exception of C (-0.655 cm). Improved body composition was observed with body fat percentage decreasing for all positions (PF: -2.55%; SG: -1.45%; SF: -1.45%; PG: -2.48%; C: -0.72%). PG showed minimal change in wingspan:height ratio (-0.02%), while all other positions reported a slight increase in this ratio (SG: 1.80%; SF: 1.40%; PF: 1.20%; C: 0.60%). **CONCLUSION:** Findings demonstrate the long-term evolution of professional basketball players has resulted in minimal changes in height and weight, while all positions appear to have become longer and leaner over the past 20 years.

994 Board #173 May 31 3:30 PM - 5:00 PM  
**Validation Of Air-displacement Plethysmography And Bioimpedance With Dxa In Measuring Body Fat Among Chinese Athletes**  
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 (No relationships reported)

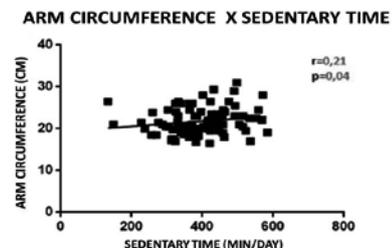
Estimates of body composition are used to assess nutritional status and training effect in athletes. However, most equations that predict relative body fat were derived from predominantly white samples, and ethnic difference may cause discrepancies in body composition assessment. Moreover, musculoskeletal development in athletes may affect the density of the fat-free mass, which is the primary factor limiting the accuracy of body composition estimates from body density. **PURPOSE:** To validate air-displacement plethysmography and bioelectrical impedance in body fat estimates in Chinese professional athletes. **METHODS:** Body composition was measured by BOD POD and by Inbody 720 (BIA). Dual-energy X-ray absorptiometry (DXA) was used as the criterion measurement. Comparisons were made among three different BMI groups, LOW (BMI<18.5), NOR (BMI 18.5-24.99), and HIGH (BMI 25+). **RESULTS:** A heterogeneous group of 111 professional athletes were randomly recruited from Shanghai, including 63 males and 48 females. An almost perfect

correlation of body fat percentage (%BF) estimated from BOD POD and DXA was found in all three BMI groups (ICC=0.841 for LOW, 0.909 for NOR, and 0.937 for HIGH, respectively), and the same happened for BIA and DXA (ICC=0.818 for LOW, 0.900 for NOR, and 0.909 for HIGH, respectively). The paired-samples t tests also showed significant correlation between BOD POD, BIA and DXA estimates in all three BMI groups ( $p<0.001$ ). Estimated %BF from BOD POD was significantly lower than that from DXA in all three groups ( $p<0.001$ ). Estimated %BF from BIA was significantly lower than that from DXA ( $p<0.001$ ) in HIGH but not significantly different in LOW ( $p=0.946$ ) and NOR ( $p=0.681$ ) groups. Bland-Altman plots showed that BIA tends to overestimate %BF in thinner subjects and underestimated %BF in heavier participants. **CONCLUSION:** Both BOD POD and BIA appear to measure %BF in Chinese athletes reliably; however, findings suggest that BOD POD seems to underestimate %BF compared to DXA, and BIA estimates is valid in low to normal BMI subjects but it may deviate from DXA estimates in high BMI group. Consequently, modifications should be given to the embedded equations in BOD POD and BIA devices when measuring %BF in Chinese athletes.

995 Board #174 May 31 3:30 PM - 5:00 PM  
**Association Among Arm Circumference, Anthropometric Variables And Sedentary Time In Children**  
 Sergio R. Vieira, João Pedro da Silva Junior, Luis Carlos de Oliveira, Rafael Benito Mancini, Timoteo Leandro de Araujo, Victor Matsudo. *CELAFISCS, SÃO CAETANO DO SUL, Brazil.*  
 (No relationships reported)

**PURPOSE:** to verify the association of arm circumference and anthropometric variables. **METHODS:** this study is part of the Mixed-Longitudinal Project of Growth, Development, and Physical Fitness from Ilhabela. A convenient sample of 89 children of both sexes, aged 9-11 years-old, was taken from two public schools of Ilhabela. Anthropometric variables included body weight (kg), body height (cm), body mass index (BMI; kg/m<sup>2</sup>), arm (AC) and waist (AW) circumference (cm), and adiposity (AT; mm), measured by the mean of seven skinfolds (biceps, triceps, subscapular, supra-iliac, medial axillar, abdominal, an calf. Sedentary time was determined objectively by Actigraph GT3X+ accelerometer (ActiGraph, Pensacola, USA). Children wore the accelerometers for seven consecutive days. The cut-off criteria for sedentary time in the accelerometer was ≤25 counts/15 seconds, according to Evenson, et al., 2008. A Spearman-rho correlation was determine, and a significant level of  $p\leq.05$  was taken. **RESULTS:** **CONCLUSIONS:** A significant but weak association was found between arm circumference and sedentary time. However, arm circumference was strongly associated to all anthropometric variables. Then, it seems that arm circumference may be an important obesity predictor in children from 9 to 11 years-old.

Variables	r	IC95%	p
Body Weight (kg)	0.83	0.75-0.88	<0.0001
Body Height (cm)	0.54	0.37-0.67	<0.0001
BMI (kg/m <sup>2</sup> )	0.93	0.90-0.96	<0.0001
Waist Circumf (cm)	0.83	0.75-0.88	<0.0001



**B-66 Free Communication/Poster - Cancer**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

- 996 Board #175 May 31 2:00 PM - 3:30 PM  
**Effect of Periodized Training on Sarcopenic Obesity and Physical Function in Prostate Cancer Survivors**  
Jacqueline L. Kiwata, Tanya B. Dorff, E. Todd Schroeder, FACSM, Christina M. Dieli-Conwright. *University of Southern California, Los Angeles, CA.*  
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(No relationships reported)

For prostate cancer survivors (PCS) on androgen deprivation therapy (ADT), the loss of skeletal muscle and increase in adiposity, together called sarcopenic obesity, is a common adverse effect. Sarcopenia is also associated with decreases in strength and mobility. No studies to date have concomitantly improved sarcopenic obesity and physical function in PCS on ADT. This study attempts to improve on existing interventions by employing periodization to optimize physiological and performance adaptations. **PURPOSE:** This ongoing pilot trial investigates the effects of 12 weeks of periodized resistance training on sarcopenic obesity and physical function in PCS on ADT. **METHODS:** Eighteen PCS (65.6 ± 8.8 yr) on current or previous ADT were recruited from the USC Norris Comprehensive Cancer Center and randomized to periodized resistance training (PRT; n=9) or an attention control stretching program (CS; n=9). Outcomes were assessed at baseline and after the 12-wk intervention. Body composition was measured through dual-x-ray absorptiometry, estimated 1 RM strength was tested on leg press and seated row, and mobility was assessed through timed up and go. Appendicular skeletal muscle index (ASMI), a common index of sarcopenia, was calculated from body composition. PRT performed a supervised total-body resistance exercise and stretching program 3 times a week. CS performed home-based stretching 3 times a week. Baseline group differences were tested with univariate ANOVA, while differences in all outcomes were tested with 2 (group) x 2 (time) ANOVA.

**RESULTS:** No significant differences in characteristics or outcomes were found between groups at baseline ( $P > 0.05$ ). Post-intervention, significant increases were observed in PRT compared to CS for appendicular skeletal mass ( $0.8 \pm 4$  kg;  $P = 0.04$ ), ASMI ( $0.3 \pm .1$  kg/m<sup>2</sup>;  $P = 0.041$ ), leg press ( $126.6 \pm 31.7$  kg;  $P = .004$ ) and seated row ( $23.0 \pm 3.5$  kg;  $P < .001$ ). A nonsignificant decrease in body fat (%) was observed in PRT compared to CS ( $1.3 \pm .7$  %;  $P = .067$ ;  $d = 0.89$ ). No differences were found in mobility. **CONCLUSIONS:**

In PCS on ADT, a 12-wk periodized resistance training program improved skeletal muscle mass and strength. Future work is warranted to determine if adiposity can be attenuated and improvements sustained beyond the 12-wk intervention. Supported by an NSCAF doctoral grant.

- 997 Board #176 May 31 2:00 PM - 3:30 PM  
**Efficacy Of An Adaptive Clinical Exercise Program For Cancer Survivors During And After Treatment**  
Ryan J. Marker, Catherine M. Jankowski, FACSM, W. Thomas Purcell, John C. Peters. *University of Colorado Anschutz Medical Campus, Aurora, CO.* (Sponsor: Catherine M. Jankowski, FACSM)  
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(No relationships reported)

Exercise programs for cancer survivors improve endurance, strength, and quality of life. Survivors exercising during cancer treatment tend to show smaller improvements, or performance maintenance, compared to those who have completed treatment.

Adapting exercise to the day-to-day status of survivors during and after treatment is recommended and may improve program efficacy. **PURPOSE:** To investigate a three month adaptive clinical exercise program for cancer survivors during and after treatment. **METHODS:** Cancer survivors undergoing treatment (chemotherapy and/or radiation) at enrollment or within six months of completing treatment were included. No cancer types were excluded. Estimated VO<sub>2</sub>peak, grip strength, the Piper Fatigue Scale (PFS), and the Beck Depression Inventory (BDI) were assessed at baseline and program completion. The number of exercise sessions completed was recorded. Age, sex, and body mass index (BMI) at baseline were compared between treatment groups (undergoing treatment and completed treatment). ANOVAs (Exercise [within-participant] x Treatment [between-participant]) were performed for each performance measure in all participants and separately for breast cancer survivors. **RESULTS:** Participants undergoing treatment (N=58) did not significantly differ from those who had completed treatment (N=61) in age (57±12 years; Mean±SD), sex (71% women), or BMI (26.4±5.6 kg/m<sup>2</sup>). The number of exercise sessions completed was not different between groups (18±5 out of a possible 24,  $p > 0.05$ ). The main effect of Exercise was significant for all measures ( $p < 0.01$ ), with improvements seen from

baseline to program completion (estimated VO<sub>2</sub>peak:  $3.1 \pm 4$  ml/min/kg, grip strength:  $1 \pm 3$  kg, PFS:  $-1 \pm 2$ , BDI:  $-3 \pm 6$ ), while the main effect of Treatment and Treatment-Exercise interactions were not significant ( $p > 0.05$ ). These results were replicated when only breast cancer survivors were analyzed (N=48, 24 undergoing treatment). **CONCLUSIONS:** Cardiorespiratory fitness, strength, fatigue, and depressive symptoms improved significantly with exercise, regardless of treatment status. These results suggest that cancer survivors currently undergoing treatment can experience benefits equal to those of survivors who have completed treatment through an adaptive exercise program.

- 998 Board #177 May 31 2:00 PM - 3:30 PM  
**Randomized Controlled Trial of Peer Led Intervention for Prostate Cancer Patients to Increase Exercise Participation**  
Daniel A. Galvão<sup>1</sup>, Robert U. Newton<sup>1</sup>, Afaf Girgis<sup>2</sup>, Stephen J. Lepore<sup>3</sup>, Anna Stiller<sup>4</sup>, Catherine Mihalopoulos<sup>5</sup>, Robert A. Gardiner<sup>6</sup>, Dennis R. Taaffe, FACSM<sup>1</sup>, Stefano Occhipinti<sup>7</sup>, Suzanne K. Chambers<sup>7</sup>. <sup>1</sup>Edith Cowan University, Joondalup, Australia. <sup>2</sup>University of NSW, Sydney, Australia. <sup>3</sup>Temple University, Philadelphia, PA. <sup>4</sup>Cancer Council Queensland, Brisbane, Australia. <sup>5</sup>Deakin University, Melbourne, Australia. <sup>6</sup>Royal Brisbane and Women's Hospital, Brisbane, Australia. <sup>7</sup>Griffith University, Brisbane, Australia. (Sponsor: Dennis R Taaffe, FACSM)  
Email: d.galvao@ecu.edu.au  
(No relationships reported)

**PURPOSE:** To evaluate the effectiveness of a peer-led multimodal intervention for increasing exercise participation in patients with localized prostate cancer.

**METHODS:** A randomized controlled trial with 463 prostate cancer patients 10.8 months post-curative therapy, enrolled from September 2011 until November 2012, from Queensland, Australia were randomized into a peer-led multimodal intervention (INT) (n=232) targeting exercise and unmet supportive care needs or usual care (UC) (n=231). The intervention included self-management materials, exercise equipment, and monthly telephone-based group peer-support for 6 months. Patients were assessed for compliance with exercise guidelines for cancer survivors, psychological distress, and quality of life (QoL) at baseline, 3, 6 and 12 months. **RESULTS:** 81.6% completed the final assessment at 12 months. Patients in INT engaged in significantly more resistance exercise than UC at 3 months (19.4 [95% CI 6.52 to 32.28] min/wk,  $p = 0.003$ ) and 6 months (14.6 [95% CI 1.69 to 27.58] min/wk,  $p = 0.027$ ). There was no difference between groups for aerobic-based activity at any time point nor for resistance exercise time at 12-month follow-up. At 3 months 40.3% of UC were inactive compared to 29.3% of INT ( $X^2 = 6.12$ ,  $p = .013$ ), while 7.8% of UC were sufficiently active compared to 18.0% for INT ( $X^2 = 8.89$ ,  $p = .003$ ). INT had significantly higher Assessment of Quality of Life (AQoL)-8D Relationships subscale scores at 3-month follow-up (.03 [95% CI .00 to .06],  $p = .038$ ) compared with UC, with no change in psychological distress. **CONCLUSION:** The intervention was effective in increasing patients' resistance exercise participation in the short- to medium-term, however, this behaviour change was not accompanied by overall improvements in QoL or psychological distress. Further investigation is required to increase effectiveness and maintain long-term adherence.

- 999 Board #178 May 31 2:00 PM - 3:30 PM  
**Effects of Exercise Program on Prostate Cancer Patients with Androgen Deprivation Therapy**  
Jung Jun Lim<sup>1</sup>, Yeon Soo Kim<sup>1</sup>, Hong Sang Moon<sup>2</sup>, Gyu Sik Kim<sup>2</sup>, Hong Yong Choi<sup>2</sup>, Duck chul Lee, FACSM<sup>3</sup>, Sang hwa Lee<sup>1</sup>, Jung Woon Kim<sup>1</sup>, Joon sik Kim<sup>1</sup>. <sup>1</sup>Seoul National University, Seoul, Korea, Republic of. <sup>2</sup>Hanyang University, Seoul, Korea, Republic of. <sup>3</sup>Iowa state university, Iowa, Ames, IA. (Sponsor: Duck Chul Lee, FACSM)  
Email: imjung87@naver.com  
(No relationships reported)

**PURPOSE:** The purpose of this study is to identify the effects of 12-week exercise program on physical and psychological health outcome in older prostate cancer patients with androgen deprivation therapy (ADT). **METHODS:** Nineteen prostate cancer patients (mean age 75.26 ± 6.9) receiving ADT at least 3 months were randomized into an exercise program comprising supervised (once a week) and home-based (more than 3 days/week) exercise session ( $n = 11$ ) or usual care ( $n = 8$ ) for 12 weeks. The exercise program was composed of stretching, resistance, and walking based aerobic training. Thigh circumference, level of physical activity, muscle strength, functional fitness, quality of life, and fatigue were assessed at baseline and after 12-week intervention. Data were analyzed using repeated measures ANOVA. **RESULTS:** The exercise group showed improvements in thigh circumference (exercise group (EG) 1.2 vs. usual care group (UCG) -0.5 cm,  $p = .013$ ), level of physical activity using

accelerometer (daily steps: EG 2,247.1 vs. UCG -1,204.3 steps/day,  $p=.027$ ; moderate to vigorous physical activity: EG 85.6 vs. UCG -12 min/day,  $p=.008$ ), muscle strength using hand grip dynamometer (grip strength: EG 2.1 vs. UCG -0.3 kg,  $p=.034$ ; knee extensor: EG 44.2 vs. UCG 6.1 Nm/kg,  $p=.004$ ; knee flexor: EG 18.8 vs. UCG -21.3 Nm/kg,  $p<.001$ ), and functional fitness (chair stand: EG 9.2 vs. UCG 5.1 count/sec,  $p<.001$ ; up and go: EG -1.5 vs. UCG 0.3sec,  $p=.003$ ; 2-min step: EG 67.7 vs. UCG -14.2count/sec,  $p<.001$ ) compared with usual care group. Exercise group also improved quality of life using Functional Assessment of Cancer Therapy-Prostate (EG 21.2 vs. UCG -22.1 points,  $p<.001$ ) and reduced fatigue using Functional Assessment of Chronic Illness Therapy-Fatigue (EG 18.6 vs. UCG 1.9 points,  $p=.004$ ). There were no adverse events during the testing or exercise intervention period. **Conclusion:** Twelve-week exercise program not only significantly improved physical and psychological health but also increased level of physical activity in older prostate cancer patients with ADT. Supported by the Korean society of sports medicine.

1000 Board #179 May 31 2:00 PM - 3:30 PM  
**Functional Capacity Of Gastrointestinal Cancer Patients - A Pre-therapy Comparison To Breast Cancer Patients And Healthy Women**

Lutz Vogt<sup>1</sup>, Katrin Stücher<sup>1</sup>, Claus Bolling<sup>2</sup>, Axel Dignass<sup>2</sup>, Winfried Banzer, FACS<sup>1</sup>. <sup>1</sup>J.W.Goethe-University, Frankfurt/Main, Germany. <sup>2</sup>Agaplesion Markus Hospital, Frankfurt/Main, Germany. (Sponsor: Winfried Banzer, FACS) (No relationships reported)

**PURPOSE:** Many studies of cancer patients report that frailty, cachexia and decreased physical function during chemotherapy (CT) predict a higher mortality risk. Although a high prevalence of these symptoms in gastrointestinal (GI) cancer patients is known, there is almost no data on functional status and body composition in this population. The aim of the study is to assess and compare the pre-therapy motor performance of advanced GI cancer patients in contrast to breast cancer patients and healthy controls. **METHODS:** In a 3-arm cross-sectional study female patients with advanced cancer (UICC ≥ III) (GI: n=17; 70.1±3.1 yrs; BMI 23.6±5.3 kg/m<sup>2</sup>; breast: n=17; 66.9±2.3 yrs; BMI 23.6±3.8 kg/m<sup>2</sup>) before first-line CT and 17 healthy age-matched women (69.4±1.4 yrs; BMI 24.2±3.3 kg/m<sup>2</sup>) are examined. Body composition was obtained from bioelectrical impedance analysis. The amount of daily physical activity (steps; MVPA/min-wk<sup>-1</sup>) was calculated from accelerometer (Actigraph) readings. A capacitive force platform (Zebris) was used for gait speed recordings during free level walking. Maximal isometric voluntary contraction force (MIVF) of the quadriceps muscle was assessed by a strain gauge force transducer (ASYS). **RESULTS:** ANOVA with post-hoc test and Bonferroni correction show significant differences in outcome measures of GI cancer patients compared to breast cancer patients and healthy women. GI cancer patients show lower values in phase angle (4.5±0.8°; 5.3±0.5°;  $p<.01$ ) and isometric strength (5.5±2.2; 9.1±3.3; 8.4±1.8 N/kg;  $p<.01$ ). Steps per day (3125±2396; 8703±4104 stp,  $p<.001$ ), moderate to vigorous activity (7.3±11.9; 36.9±28.5 MVPA/min-wk<sup>-1</sup>;  $p=.001$ ) and gait speed (3.5±1.1; 4.9±0.6 km/h;  $p<.001$ ) are decreased compared to healthy women. **CONCLUSIONS:** Patients with advanced GI cancers demonstrate sufficient deficits in functional status and motor performance before CT compared to advanced breast cancer patients and healthy women. Gait speed, phase angle and force are below cut-off values for low prognosis of survival and may reflect a diminished tolerance of CT. Measures to improve muscle status, physical function and its effects on treatment is warranted in patients with advanced GI cancers.

1001 Board #180 May 31 2:00 PM - 3:30 PM  
**Feasibility of Exercise for Improving Inflammation in Advance Stage Prostate Cancer Patients**

Calvin Lloyd Cole, PhD., Ian Kleckner, PhD., Sarah Kerns, PhD., MPH, Matthew Asare, PhD., Po-Ju Lin, PhD., Charles Kamen, PhD., Michelle Janelsins, PhD., MPH, Karen Mustian, PhD., University of Rochester, Rochester, NY. (Sponsor: Leslie J. Brandon, PhD, FACS) Email: Calvin\_Cole@urmc.rochester.edu (No relationships reported)

**BACKGROUND:** Cancer cachexia is a burdensome side effect in prostate cancer patients, with advanced stage (ADV) patients having the highest risk. Chronic activation of immune response as a result of cancer and its treatments is a key stimulator of the chronic pro-inflammatory response hypothesized to result in cachexia in prostate cancer patients. Exercise reduces inflammation in cancer patients; however, it is unclear if exercise is feasible and effective at reducing inflammation among ADV prostate cancer patients with a high risk of cachexia. **PURPOSE:** This study aimed to assess the feasibility of ADV prostate cancer patients completing an exercise intervention and the efficacy of the intervention for reducing inflammation in these men compared to early stage (ERL) patients. **METHODS:** A secondary data analysis was performed on a two-arm randomized clinical trial examining the influence of a 6-week home-based aerobic and resistance exercise program. Participants included 57 sedentary prostate cancer patients aged

67 ± 8.1 years, who were receiving hormone therapy and/or radiation therapy. Each participant was randomly assigned to usual care (UC) or usual care plus exercise (UCE). ERL and ADV cancer was defined based on NCCN guidelines. Mean steps/day, minutes of resistance training/day and serum protein levels of IL-6, IL-1b, IFN $\gamma$ , IL-10, IL-8, and TNFR1 were measured at baseline and post-intervention. **RESULTS:** Attrition was minimal, with no significant difference between ERL and ADV patients (5 total withdrawals). No adverse events (AEs) were attributed to exercise and there were no significant differences between ERL and ADV patients in number of AEs. Results also showed no significant difference in the number of steps walked or minutes of resistance exercise between ERL and ADV patients in the exercise arm. (Steps Walked: ERL = 6859 ± 899; ADV = 8939 ± 1359;  $p>0.05$ ); Minutes of Resistance Training per Session ERL = 13 ± 4 (3 days/week); ADV = 19 ± 13 (3 days/week);  $p>0.05$ ). Changes in levels of IL-1b, IFN $\gamma$ , IL-10, IL-8, and TNFR1 were similar among ERL and ADV (all  $p>0.05$ ), however changes in IL-6 did significantly differ between groups ( $p<0.05$ ). **CONCLUSIONS:** Findings suggest exercise is feasible and safe, and may have positive effects on chronic inflammation in ADV prostate cancer patients. R25 CA102618, DOD PC061518

1002 Board #181 May 31 2:00 PM - 3:30 PM  
**Effects Of Exercise Training On Physiological And Psychological Measurements Of Cancer-related Fatigue**

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While there is extensive evidence connecting exercise to a reduction in psychological fatigue, the effect of exercise on objectively measured muscular fatigue has yet to be studied in cancer patients. Evaluating how exercise modulates physiological and psychological fatigue dimensions either similarly, or independently, could aid in our understanding of how exercise reduces cancer-related fatigue. **PURPOSE:** To evaluate the effect of exercise on self-reported psychological fatigue measures and objectively measured muscular fatigue in cancer survivors. **METHODS:** A total of 21 cancer survivors (62 ± 14 years of age) were asked to complete both physiological and psychological measures of fatigue prior to, at midpoint, and following a 24-week exercise intervention. Participants completed the revised Piper Fatigue Scale (PFS), a subjective and psychological measure of fatigue. The PFS produces a total score (PFST) and four subscale scores: behavioral/severity (PFSB), affective (PFSA), sensory (PFSS), and cognitive/mood (PFSC). For the measurement of objective, physical fatigue, a handgrip fatigue index (HFI) was determined for each participant by repetitively squeezing a handgrip dynamometer 15 times with maximal force for each repetition. Participants also completed 15 maximal force knee extensions at a joint angular velocity of 60 deg·s<sup>-1</sup> and a quadriceps fatigue index (QFI) was computed. Following testing, participants completed 24 weeks of supervised exercise training. **RESULTS:** Significant main effects were found for PFST and all four subscales ( $p<.05$ ). Results indicate significant decreases in PFST (-30%;  $p=.001$ ), PFSB (-32%;  $p=.015$ ), PFSA (-33%;  $p=.001$ ), PFSS (-32%;  $p=.001$ ), and PFSC (-25%;  $p=.004$ ) following 12 weeks of the exercise intervention. Testing following 24 weeks of the intervention resulted in significant decreases in PFST (-30%;  $p=.031$ ), PFSA (-32%;  $p=.023$ ), and PFSS (-31%;  $p=.016$ ). **CONCLUSION:** Improvements in psychological fatigue did not mirror the changes in physiological fatigue, indicating that exercise may be a more powerful modulator of emotional fatigue as opposed to muscular fatigue. Clinicians may find utilizing subjective evaluations of cancer-related fatigue more assistive and informative when prescribing exercise interventions in the cancer population.

1003 Board #182 May 31 2:00 PM - 3:30 PM  
**Validity of The Six-Minute Walk Test For Predicting VO<sub>2peak</sub> in Cancer Survivors**

Alexandra Schumacher, Daniel Shackelford, Deandra Elcock, Jessica Brown, Reid Hayward. University of Northern Colorado, Greeley, CO. (No relationships reported)

Exercise improves cardiovascular function in cancer survivors (CS) suffering from treatment-related toxicities, such as decreased peak oxygen consumption (VO<sub>2peak</sub>). Establishing valid assessment protocols that determine VO<sub>2peak</sub> are essential for developing individualized exercise prescriptions for cancer rehabilitation programs. The University of Northern Colorado Cancer Rehabilitation Institute (UNCCI) has developed a valid cancer-specific VO<sub>2peak</sub> treadmill protocol to address this need. The six-minute walk test (6MWT) is an exercise assessment used in many populations with chronic disease to predict VO<sub>2peak</sub> but it is not clear whether this test accurately assesses VO<sub>2peak</sub> in CS. The 6MWT is simple, inexpensive, and representative of daily living

activities. **PURPOSE:** To assess the validity of predicted  $VO_{2peak}$  from the 6MWT compared to the UNCCRI treadmill protocol in CS. **METHODS:** 128 CS completed a UNCCRI treadmill protocol and a 6MWT one week apart in randomized order to obtain  $VO_{2peak}$  (mL/kg/min).  $VO_{2peak}$  values from the UNCCRI treadmill protocol were compared against four common 6MWT  $VO_{2peak}$  prediction equations. **RESULTS:** All four 6MWT prediction equations significantly ( $p < 0.001$ ) underestimated  $VO_{2peak}$ . Equations 1, 2, 3 and 4 yielded  $VO_{2peak}$  values of  $18.9 \pm 3.0$ ,  $14.2 \pm 4.6$ ,  $8.3 \pm 3.8$ , and  $16.4 \pm 2.3$ , respectively, while the UNCCRI treadmill yielded a much higher  $VO_{2peak}$  of  $24.7 \pm 7.4$ . A positive strong correlation occurred between the UNCCRI treadmill protocol and 6MWT prediction equation 1 ( $r = 0.83$ ). A moderately strong correlation occurred between the UNCCRI treadmill protocol and 6MWT equation 3 ( $r = 0.70$ ). Maximum heart rates were significantly higher ( $p < 0.001$ ) during the UNCCRI treadmill protocol compared to the 6MWT ( $150 \pm 21$  bpm vs.  $109 \pm 21$  bpm), respectively. **CONCLUSION:** These findings suggest that the 6MWT is not a valid test for predicting  $VO_{2peak}$  in CS due to its underestimation of all four equations. The UNCCRI treadmill protocol is much more accurate for assessing  $VO_{2peak}$  in CS in order to correctly prescribe an individualized exercise rehabilitation program.

1004 Board #183 May 31 2:00 PM - 3:30 PM  
**Relationship between Survivorship Time and Physical Activity Level in Puerto Rican Breast Cancer Survivors**  
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Cancer is one of the major public health problems in Puerto Rico, especially breast cancer. There is evidence that suggests that engaging in physical activity (PA) during and after cancer treatment improved fatigue, body composition, cardiorespiratory fitness, psychological state, and quality of life. Thus, it is important to assess PA level in breast cancer survivors.

**PURPOSE:** To assess: 1) the level of PA in a group of breast cancer survivors women; and 2) the relationship of survivorship time and PA level. **METHODS:** 21 breast cancer survivors participated. PA was assessed: 1) using the International Physical Activity Questionnaire - Long Version (IPAQ-L), and 2) pedometer that the participants wore for a week (OMRON-HJ320).

**RESULTS:** The participants average age was 54 years, height  $62.2 \pm 2.5$  inches, weight  $148.1 \pm 22.6$  pounds, estimated basal metabolic rate  $1607.2 \pm 132.9$  calories. The average survivorship time was  $4.24 \pm 3.9$  years, distributed as follows: 0-11 months,  $n = 4$ ; 1-2 years,  $n = 5$ ; 3-5 years,  $n = 4$  and  $> 5$  years,  $n = 8$ . The average scores of the IPAQ-L were: Work  $393.9 \pm 927.4$  METS-mins/week, Transportation  $976.6 \pm 1068.1$  METS-mins/week, Home Chores  $2,369.7 \pm 3,111.2$  METS-mins/week, Recreational activities  $752.6 \pm 1,184.4$  METS-mins/week, Sitting time Week  $201.4 \pm 176.8$  minutes, Sitting time Week End  $157.1 \pm 151.6$  minutes. The average daily steps was  $4,870.8 \pm 2,612.5$ . A Spearman Correlation analysis did not showed significant relationship between survivorship time and physical activity level.

**CONCLUSIONS:** There were no significant relationship between survivorship time and physical activity. The participants did not meet the recommendation of 10,000 steps/day. The results from the IPAQ-L showed that the participants engaged in moderate physical activity in some of the domains of the questionnaire such as transportation, home chores and recreational activities.

1005 Board #184 May 31 2:00 PM - 3:30 PM  
**Feasibility Of Supervised Aerobic Interval Exercise Training Following Treatment For Breast Cancer**  
 Savanna Rowe<sup>1</sup>, Amy A. Kirkham<sup>2</sup>, Kelcey A. Bland<sup>1</sup>, Cheri L. Van Patten<sup>3</sup>, Alis Bonsignore<sup>4</sup>, Don C. McKenzie<sup>1</sup>, Karen A. Gelmon<sup>3</sup>, Kristin L. Campbell<sup>1</sup>. <sup>1</sup>University of British Columbia, Vancouver, BC, Canada. <sup>2</sup>University of Alberta, Edmonton, AB, Canada. <sup>3</sup>British Columbia Cancer Agency, Vancouver, BC, Canada. <sup>4</sup>University of Toronto, Toronto, ON, Canada.  
 (No relationships reported)

Aerobic interval training (AIT) can be more effective in improving cardiorespiratory fitness, and muscle oxidative capacity than moderate continuous training (MCT) in a variety of healthy and clinical populations. Due to physical deconditioning associated with breast cancer treatment, AIT is of interest in this population. However, the feasibility and safety of AIT among breast cancer patients is unknown.

**PURPOSE:** To assess the feasibility and occurrence of major adverse events (MAE) with AIT among breast cancer patients immediately post completion of adjuvant chemotherapy and radiation.

**METHODS:** Women with early stage breast cancer were enrolled in the Nutrition and Exercise During Adjuvant Treatment trial within the first half of chemotherapy. MCT aerobic exercise was prescribed 3x/week during chemotherapy and radiation (20-30 min at 50-75% Heart Rate Reserve (HRR)). Upon treatment completion, eligible participants were prescribed AIT (4 sets of 4 min at 75-85%  $VO_{2R}/HRR$  and 4 min at 40-65%  $VO_{2R}/HRR$ ) at least 1x/week, with the choice of either MCT or

AIT for remaining sessions. AIT eligibility included an absence of angina, dyspnea, uncontrolled hypertension, asthma or current prescription for heart medications. The ACSM's metabolic equation for treadmill walking was used to prescribe interval speed/grade, while HRR was used for intervals performed on a cycle ergometer or elliptical trainer.

**RESULTS:** 57 women (age  $51 \pm 11$ ) entered the post-treatment phase of the study, of which 44 (75%) were eligible for AIT. 36 (82%) participants performed at least one AIT session. 66% of the total sessions performed were AIT workouts, indicating a potential preference for AIT vs. MCT. Those performing AIT attended significantly more sessions overall relative to those who were not performing AIT ( $18 \pm 6$  vs  $13 \pm 8$ ,  $p = 0.01$ ). Adherence to AIT intensity was achieved in 68% of all sessions, with no difference between those performed on the treadmill, bike/elliptical, nor relative to MCT sessions. The most common barrier to AIT intensity adherence was the prescription being too difficult (75%). No MAE occurred.

**CONCLUSIONS:** AIT after treatment completion for breast cancer appears to be feasible, potentially preferable to MCT, and may result in greater attendance than MCT alone.

1006 Board #185 May 31 2:00 PM - 3:30 PM  
**Effect of Combined Aerobic and Resistance Exercise on Remnant Cholesterol in Breast Cancer Survivors**  
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**PURPOSE:** An increased risk of cardiovascular disease (CVD) and mortality is apparent in breast cancer survivors (BCS). Remnant cholesterol, defined as a product of partially catabolized chylomicrons and very-low-density lipoprotein, is a recently identified novel blood marker for increased CVD risk. In fact, the risk for CVD is two-fold greater in patients with high remnant cholesterol possibly due to higher density of remnant cholesterol per particle than LDL-C. The combination of aerobic and resistance exercise has been recommended to reduce cholesterol levels and risk of CVD in BCS, but it is unclear as to whether combined exercise improves remnant cholesterol level. This study sought to examine the effects of a 16-week progressive aerobic and resistance exercise intervention on remnant cholesterol in BCS.

**METHODS:** Thirty sedentary BCS diagnosed with Stage I-III breast cancer who completed cancer-related treatment within 6 months prior to enrollment were randomized to the Control (CON;  $n = 15$ ) or the Exercise (EX;  $n = 15$ ) group. The EX group underwent supervised aerobic and resistance exercise sessions 3 times a week for 16 weeks set at a moderate-vigorous intensity. The CON group was asked to maintain their current level of activity. Remnant cholesterol was calculated as total cholesterol-HDL-LDL. Paired t-test and two-way repeated measures ANOVA were used to examine the effects of exercise training on remnant cholesterol.

**RESULTS:** Prior to the intervention, the EX and CON did not differ by age ( $52.7 \pm 7.9$  yr), body mass index ( $33.9 \pm 6.4$  kg/m<sup>2</sup>), waist circumference ( $99.8 \pm 4.2$  cm), total cholesterol ( $196.4 \pm 37.5$  mg/dL), LDL-C ( $101.9 \pm 31.2$  mg/dL), HDL ( $42.7 \pm 5.7$  mg/dL), and remnant cholesterol ( $51.7 \pm 28.8$  mg/dL). Following the 16-week intervention, mean remnant cholesterol levels were significantly reduced ( $45.2 \pm 13.8$  to  $9.9 \pm 2.5$  mg/dL; 78% mean decrease) in the EX group compared to CON group ( $P = 0.02$ ; group x time interaction). There were no significant changes in remnant cholesterol levels in the CON group ( $P > 0.05$ ).

**CONCLUSIONS:** A 16-week supervised progressive aerobic and resistance exercise intervention is an effective approach to reduce remnant cholesterol in BCS. Participation in combined exercise during cancer survivorship should be considered to reduce the risk for CVD mortality in BCS.

1007 Board #186 May 31 2:00 PM - 3:30 PM  
**Breast Cancer- And Metabolic-related Predictors Of Vo2peak Amongst Active Post-menopausal Women**  
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Peak oxygen consumption ( $VO_{2peak}$ ) is reported to be lower amongst breast cancer patients both during and after adjuvant treatment relative to healthy sedentary controls. It is not known whether this is attributable to direct effects of treatment or indirect effects on whole body metabolism and exercise behaviour. **PURPOSE:** To identify metabolic and breast cancer-related predictors of relative  $VO_{2peak}$  amongst active post-menopausal women. **METHODS:** 10 subjects were selectively recruited to each of three groups: 1) breast cancer patients 3 weeks post chemotherapy (BC1); 2) breast cancer patients 1-3 years post chemotherapy and radiation (BC2); 3) healthy controls (CON). All women were 45-60 years, self-reported as post-menopausal and performing  $\geq 90$  min/week of moderate intensity aerobic exercise. Gas analysis measurements were made during rest, a maximal incremental treadmill test, and steady state exercise

(60% VO2R). Univariate linear regressions were performed with adjustment for age and BMI. RESULTS: Group was a significant predictor ( $p=0.01$ ), resulting in  $\beta$  coefficients of  $-7.5$  and  $-2.5$  mL/kg/min for BC1 and BC2 relative to CON. In BC1 and BC2 combined, receipt of non-anthracycline but not anthracycline-containing chemotherapy protocols relative to CON was predictive of a lower VO2peak ( $\beta=-8.8$ ,  $p<0.01$ ). The amount of moderate intensity exercise self-reported in the past month (hours/week) ( $\beta=1.5$ ,  $p=0.03$ ), and surrogates of cardiovascular function, including O2 pulse (ml/beat) during steady state exercise ( $\beta=1.7$ ,  $p<0.01$ ), and five-minute heart rate recovery (bpm) ( $\beta=0.3$ ,  $p=0.03$ ) were also significant predictors. Receipt of fluorouracil chemotherapy or trastuzumab treatments, resting heart rate, resting VO2, substrate utilization (RER) at rest and for moderate intensity exercise, time since last menstruation, and occurrence of chemotherapy-induced menopause were not significant predictors. CONCLUSION: Among post-menopausal women, receipt of chemotherapy for breast cancer, in particular non-anthracycline-containing protocols and more recent completion, are associated with lower VO2peak, but resting and exercise metabolic parameters are not. Better recent exercise behaviour and cardiovascular function are associated with higher VO2peak.

1008 Board #187 May 31 2:00 PM - 3:30 PM  
**The Effects of Exercise Program on Quality Of Life and Fatigue Level During Autologous Hematopoietic Stem Cell Transplantation**  
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 (No relationships reported)

**PURPOSE:** The purpose of the study was to investigate the effects of exercise program on quality of life (qoL) and fatigue among the patients who undergo autologous hematopoietic stem cell transplantation (AHSCT).  
**METHODS:** Twenty two patients with different diagnosis (9 multiple myeloma, 10 lymphoma, 3 other cancer type) participated in this study. The mean age was  $47\pm 13$  years. All patients underwent AHSCT. The exercise program started before this procedure and continued until discharge day (mean 15 days). The program included breathing, range of motion, and resistive exercises focusing large muscle groups and brisk walking duration 5-10 minutes in corridor. The Borg Rating of Perceived Exertion was used to estimate the intensity of the program to light to moderate intensity exercise prescription was based on a rating of "somewhat hard" (10-13). The fatigue was evaluated with Fatigue Impact Scale. The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) was used to assess qol.  
**RESULTS:** The mean score of Fatigue Impact Scale was  $32\pm 32$  points before the procedure and  $23\pm 17$  points at discharge day, but there was not statistical significant difference. Global health status, functional scale and symptom scale scores which are the sub-tests of the EORTC QLQ-C30 were  $47\pm 31$ ,  $65\pm 18$ ,  $31\pm 18$  points before the treatment and  $41\pm 25$ ,  $69\pm 18$ ,  $31\pm 17$  points at the discharge day. There were not statistical significant differences between two time points in qoL scores.  
**CONCLUSIONS:** As a result of our study exercise program was effective in reducing fatigue levels and raising qol in AHSCT patients, however the results were not statistically significant. It was thought because of the clinical status of the patients is not recover completely at the discharge day and two week is not enough to show the effects of the exercise program, we could not demonstrate effectiveness of the exercise program statistically.

**B-67 Free Communication/Poster - Carbohydrate Metabolism and Exercise**  
 Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
 Room: Hall F

1009 Board #188 May 31 2:00 PM - 3:30 PM  
**Metabolic Differences Between A Bout Of Eccentric, Concentric And Traditional Resistance Exercise**  
 Stephen M. Fischer, Jon Stavres, John McDaniel. *Kent State University, Kent, OH.*  
 (No relationships reported)

Eccentric, concentric and traditional resistance exercises that incorporate both eccentric and concentric phases are often used to improve musculoskeletal fitness. Although there is evidence that indicates concentric contractions are metabolically more costly than eccentric contractions, the extent to which this translates to whole body metabolism during an entire resistance workout is less clear. **PURPOSE:** To determine the extent to which metabolic variables such as VO2(ml/kg/min), RER, and HR as well as blood glucose and lactate vary between resistance workouts comprised of only eccentric, concentric or traditional bouts. **METHODS:** N=12 men and women

completed a traditional (TRAD), concentric (CONC), and eccentric (ECC) full-body resistance workout at 65% of a pre-determined 1 repetition max with each condition matched for work. The traditional condition required 3 sets of 10 repetitions on each exercise (6 total). 3 sets of 20 repetitions were required for the eccentric and concentric conditions. During each condition, the subject was fitted to a metabolic cart and the aforementioned metabolic variables were recorded through indirect calorimetry and heart rate monitor. Blood glucose and blood lactate were taken using the ACCU-CHEK glucose monitor and Lactate Plus at five different stages (Pre, Post Leg Curl, Post Ex., 30 min Post, and 60 min Post). **RESULTS:** Both the TRAD ( $9.26 \pm 1.83$  ml/kg/min) and CONC ( $10.03 \pm 1.63$  ml/kg/min) conditions resulted in significantly ( $p < 0.001$ , and  $p < 0.001$  respectively) greater VO2 values when compared to the ECC condition ( $6.67 \pm 1.25$  ml/kg/min). TRAD ( $1.03 \pm .04$ ) and CONC ( $1.00 \pm .03$ ) conditions also resulted in significantly (both  $p < 0.001$ ) greater RER compared to the ECC ( $0.88 \pm .09$ ) with the TRAD condition being significantly ( $p = 0.045$ ) greater than the CONC condition. Accumulation of lactate from Pre to Post Exercise was also significantly (both  $p < 0.001$ ) greater in the TRAD ( $6.17 \pm 2.68$ mmol) and CONC ( $5.73 \pm 3.29$ mmol) compared to the ECC ( $1.10 \pm 1.60$ mmol). **CONCLUSIONS:** Results indicate a much greater metabolic demand from concentric and traditional contractions compared to eccentric contractions on a whole body level.

1010 Board #189 May 31 2:00 PM - 3:30 PM  
**The Influence of a Single Bout of High-Intensity Interval Exercise on Postprandial Lipemia and Glycemia**  
 James Rowe, Stephen Decker. *Stephen F. Austin State University, Nacogdoches, TX.*  
 (No relationships reported)

**PURPOSE:** Examine the effects of high-intensity interval exercise (HIIE) on postprandial (PP) triglyceride (TG), glucose, and insulin concentrations following a mixed meal (MM). **METHODS:** Physically active men ( $n=10$ ; age= $22.2\pm 2.1$  yrs; body mass =  $82.7\pm 13.2$ kg; body fat% =  $13.3\pm 3.1$ ) completed two trials in random order: 1) Rest and 2) A single bout of high-intensity interval exercise (HIIE). Both trials were performed at 0800 hours. HIIE consisted of performing eight (15-second) maximal effort sprints on a stationary bicycle. Each sprint was followed with approximately 3 minutes of passive cycling with no resistance. Rest consisted of sitting quietly for 30 minutes. Approximately 30 minutes following the completion of each trial, a fasting (12hr) blood sample was collected followed by the consumption of the MM providing  $7.5\pm 1.2$  kcal/kgBM (body mass) with a macronutrient composition of 35% carbohydrate (CHO), 5% protein, and 60% fat. The MM was blended with whole milk, ice cream, and whipping cream. Blood was collected again at 0.5, 1, 2, and 3 hours post-MM and analyzed for TG, insulin, and glucose concentration. Postprandial responses were quantified via the incremental area under the curve (AUC) using the trapezoidal method. Significant differences ( $p < .05$ ) between trials were determined using a one-way, repeated measures ANOVA and Bonferroni post hoc test. **RESULTS:** The duration of the HIIE was 24 minutes (not including a 5-minute warm up). HIIE expended  $90.1\pm 11.8$  kcal. HIIE significantly reduced the glucose AUC<sub>1</sub> (Rest:  $9.9\pm 43.1$ mg·dl<sup>-1</sup>·3hr<sup>-1</sup>; HIIE:  $-39.9\pm 37.0$ mg·dl<sup>-1</sup>·3hr<sup>-1</sup>;  $p=.010$ ) and insulin AUC<sub>1</sub> (Rest:  $36.2\pm 25.4$ μIU·ml<sup>-1</sup>·3hr<sup>-1</sup>; HIIE:  $5.9\pm 30.7$ μIU·ml<sup>-1</sup>·3hr<sup>-1</sup>;  $p=.035$ ) with no significant effect on TG AUC, (Rest:  $57.2\pm 52.8$ mg·dl<sup>-1</sup>·3hr<sup>-1</sup>; HIIE:  $78.7\pm 46.5$ mg·dl<sup>-1</sup>·3hr<sup>-1</sup>;  $p=.20$ ). **CONCLUSION:** HIIE blunted the postprandial glucose and insulin response to high-fat mixed meal in young physically active men. The lack of change in the TG concentration might be explained by the lower energy expenditure of the HIIE due to its short duration. Future investigations should evaluate the applicability of HIIE within an at-risk populations (i.e. obesity, diabetes). This study was supported by the Stephen F. Austin State University Research Pilot Study Grant and the Texas ACSM Student Research Development Grant.

1011 Board #190 May 31 2:00 PM - 3:30 PM  
**Effects of Acclimatization to High Altitude on Exogenous Carbohydrate Oxidation During Steady-State Exercise**  
 Andrew J. Young, FACSM, Claire E. Berryman, Allyson N. Derosier, Robert W. Kenefick, FACSM, Marques A. Wilson, Stefan M. Pasiakos, FACSM. *US Army Research Institute of Environmental Medicine, Natick, MA.*  
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 (No relationships reported)

In a previously reported study, oxidation of exogenous glucose consumed before and during exercise was the same in acute hypoxia as normoxia, despite higher endogenous carbohydrate (CHO) oxidation. However, how altitude acclimatization affects exogenous carbohydrate oxidation is unknown. **PURPOSE:** To determine how altitude acclimatization affects exogenous CHO oxidation during exercise. **METHODS:** Male sea level (SL) residents ( $n = 17$ , mean  $\pm$  SD, age,  $23.4 \pm 5.6$  y; body mass,  $81.9 \pm 13.9$

kg;  $VO_{2peak}$   $4.17 \pm 0.65$  L/min at SL and  $2.77 \pm 0.46$  at HA) performed metabolically-matched 80-min exercise bouts ( $\sim 1.7$  L/min,  $\sim 55\%$  of HA  $VO_{2peak}$ ) at SL, within 6 h of arrival at 4,300 m (acute HA) and after 21-day residence at 4300 m. Immediately before and every 20 min during exercise, volunteers consumed either a CHO beverage ( $n = 9$ , 45 g fructose/L + 55 g glucose/L; 0.8 fructose/glucose ratio, CHO ingestion rate = 1.8 g/min) or a flavor-matched, non-nutritive placebo beverage (PLA,  $n = 8$ ). Total, endogenous and exogenous CHO oxidation rates were determined during the last 40 min of exercise by indirect calorimetry and U- $^{13}C$ -glucose. Exogenous CHO oxidation efficiency was the ratio (expressed as %) of exogenous CHO oxidation rate to the CHO ingestion rate. **RESULTS:** Exogenous CHO oxidation rate of volunteers consuming PLA was zero during all trials. For volunteers consuming CHO, exogenous CHO oxidation rate (g/min) during exercise was lower ( $P < 0.05$ ) at acute HA ( $0.39 \pm 0.22$ ) than at SL ( $0.75 \pm 0.16$ ). After altitude acclimatization, oxidation rate ( $0.62 \pm 0.18$ ) was higher ( $P < 0.05$ ) than with acute HA, and not different from SL. Efficiency of CHO oxidation (%) followed the same pattern (SL = 41 > acute HA = 22 < chronic HA = 34), but efficiency did not reach SL values after acclimatization. For those consuming CHO, endogenous CHO oxidation rate at acute HA ( $1.35 \pm 0.48$ ) tended to be but was not significantly higher than at SL ( $1.05 \pm 0.53$ ). After altitude acclimatization, endogenous CHO oxidation rate ( $0.67 \pm 0.45$ ) was lower ( $P < .05$ ) than either SL or acute HA. **CONCLUSION:** Acute hypoxia impairs exogenous CHO oxidation, but adaptations with altitude acclimatization alleviate that impairment, and contribute to a reduction in endogenous CHO oxidation. Supported by U.S. Army Medical Research and Materiel Command; authors' views not official U.S. Army or DoD policy.

1012 Board #191 May 31 2:00 PM - 3:30 PM  
**Pre-exercise Carbohydrate Ingestion and Transient Hypoglycemia During Exercise: Effects of Fasting vs. Feeding**

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Previous studies demonstrated that carbohydrate feeding 30-45 min before exercise results in transient hypoglycemia shortly after onset of exercise in some but not all subjects. However, it remains unclear whether the transient hypoglycemia after pre-exercise carbohydrate intake is more likely to occur under fed or fasted condition. **PURPOSE:** The purpose of this study was thus to directly compare the effects of fasting vs. feeding on plasma glucose kinetics following pre-exercise carbohydrate ingestion and to elucidate the contributing factors of the transient hypoglycemia in each condition. **METHODS:** Sixteen subjects performed 60-min cycle ergometer exercises at 75%  $VO_{2max}$  in overnight fasted and fed (3 h after breakfast) states in random order. In both conditions, they consumed 500 ml of a beverage containing 150 g of glucose 30 min before the start of exercise. Plasma glucose and serum insulin levels are determined before and during the exercise. **RESULTS:** In the fasted state, plasma glucose levels dropped transiently below 4.0 mmol/l in 5 subjects, who showed substantially higher serum insulin level at the onset of exercise, while plasma glucose levels remained above this level in the other subjects. On the other hands, 7 subjects developed transient hypoglycemia in the fed state and their  $VO_{2max}$  ( $3285 \pm 286.6$  L/min) was significantly higher than that in the other subjects who did not demonstrate a decline in plasma glucose ( $2915 \pm 262.7$  L/min). **CONCLUSIONS:** Subjects with higher aerobic fitness and enhanced insulin secretory capacity seem to be more prone to transient hypoglycemia following pre-exercise carbohydrate ingestion under fed and fasted conditions, respectively.

1013 Board #192 May 31 2:00 PM - 3:30 PM  
**Pentraxin 3 And Glucose Responses To Acute High-intensity Interval Exercise Vs. Continuous Moderate-intensity Exercise**

Katelyn M. Dodge<sup>1</sup>, Michael Whitehurst, FACSM<sup>1</sup>, Aaron L. Slusher<sup>2</sup>, Brandon G. Fico<sup>1</sup>, Arun Maharaj<sup>1</sup>, James T. Mock<sup>1</sup>, Chun-Jung Huang, FACSM<sup>1</sup>. <sup>1</sup>Florida Atlantic University, Boca Raton, FL. <sup>2</sup>Virginia Commonwealth University, Richmond, VA. (Sponsor: Chun-Jung Huang, FACSM)  
 (No relationships reported)

**PURPOSE:** Pentraxin 3 (PTX3) is an anti-inflammatory/cardioprotective protein and responds promptly to down-regulate pro-inflammatory mediators. It may potentially play a role in the regulation of glucose metabolism. Therefore, this study investigated the relationship between plasma PTX3 and glucose responses following both acute high intensity-interval exercise (HIIE) and continuous moderate-intensity exercise (CMIE). **METHODS:** Nine healthy males were recruited to participate in HIIE and CMIE on a cycle ergometer. HIIE consisted of 10 repeated 60 second of cycling at 90% max watts ( $W_{max}$ ) separated by 2 minutes of cycling without resistance, while CMIE was 28 minutes of cycling at 60%  $W_{max}$ . Blood samples were collected prior to, during (4 min, 10 min, 16 min, 22 min), immediately post, and 30 and 60 minutes

into recovery following exercise. A linear mixed model for repeated measures was conducted to control for total work output (kilojoules). **RESULTS:** A significant increase in PTX3 across time was found in both acute HIIE and CMIE ( $p = 0.030$ ), whereas no change was observed in glucose oxidation ( $p = 0.108$ ). Although no difference was shown in carbohydrate (CHO) oxidation between both exercise protocols, fat oxidation and total energy expenditure were greater during acute CMIE ( $p = 0.001$ ,  $p < 0.001$ , respectively). Furthermore, the percent change in PTX3 from baseline to immediately following acute HIIE was negatively correlated with fat oxidation ( $r = -0.769$ ;  $p = 0.015$ ), while the relationship with CHO oxidation approached significance ( $r = 0.608$ ;  $p = 0.082$ ). **CONCLUSION:** Our results indicate that acute HIIE could be a practical model to understand the potential role of PTX3 in the regulation of energy metabolism during exercise.

1014 Board #193 May 31 2:00 PM - 3:30 PM  
**Effects of Varying Physical Activity Level on Glucose Tolerance Testing**

Gabrielle A. Volk, Michael A. Deal, Adam J. Meisler, Jenna M. Karrow, Alex P. Good, Kevin D. Ballard, Kyle L. Timmerman. Miami University, Oxford, OH. (Sponsor: Helaine Alessio, FACSM)  
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 (No relationships reported)

The oral glucose tolerance test (OGTT) is a commonly used method for the diagnosis of insulin resistance. Currently the only level of control prior to an OGTT is an 8-10 hour fast. Physical activity is known to influence glucose uptake kinetics. Thus, our **PURPOSE** was to determine if varying the level of physical activity, the day prior to an OGTT, influenced the blood glucose and insulin responses to an OGTT. We hypothesized that higher levels of physical activity the day prior to an OGTT would result in attenuated blood glucose and insulin responses to an OGTT. **METHODS:** Ten healthy adults (6 m/4 f; age =  $21.5 \pm 0.3$  y; BMI =  $24 \pm 5$  kg·m<sup>-2</sup>) participated in three OGTT trials the morning after performing 50%, 100%, or 150% of their habitual physical activity in randomized order. Habitual physical activity as average steps/day ( $12,318 \pm 1310$  steps·day<sup>-1</sup>) was determined using 7-day pedometry. Pedometers were worn for 24 hrs prior to each OGTT trial and used to confirm steps·day<sup>-1</sup> for the 50%, 100%, and 150% conditions. Trials were separated by at least one week and subjects were asked to follow a similar diet the day prior to each OGTT trial. For each OGTT trial, plasma glucose and insulin were measured after an overnight fast and at 30 min intervals for two hours following ingestion of the glucose beverage (1-gram glucose·kg<sup>-1</sup> body mass). Area under the curve (AUC) for glucose and insulin for each OGTT was calculated using the trapezoidal method. Between trial differences for these variables were analyzed using a general linear model with repeated measures. Significance was set to  $p < 0.05$ . **RESULTS:** Subjects successfully achieved the desired percentage of habitual steps prior to each trial: 52±1%, 98±2%, and 146±3%. Fasting plasma glucose (50%:  $95 \pm 2$  mg·dl<sup>-1</sup>; 100%:  $91 \pm 2$  mg·dl<sup>-1</sup>; 150%:  $91 \pm 2$  mg·dl<sup>-1</sup>), glucose AUC (50%:  $12,932 \pm 769$  mg·min·dl<sup>-1</sup>; 100%:  $13,239 \pm 1,008$  mg·min·dl<sup>-1</sup>; 150%:  $13,016 \pm 471$  mg·min·dl<sup>-1</sup>), and insulin AUC (50%:  $5,562 \pm 1810$  μU·min·ml<sup>-1</sup>; 100%:  $5181 \pm 1839$  μU·min·ml<sup>-1</sup>; 150%:  $4735 \pm 1776$  μU·min·ml<sup>-1</sup>) did not differ between trials. **CONCLUSIONS:** Our data suggests that varying the physical activity level (from 50 to 150% of habitual activity) the day prior to an oral glucose tolerance test does not influence the blood glucose or insulin responses to this commonly utilized diagnostic test.

1015 Board #194 May 31 2:00 PM - 3:30 PM  
**Prior Acute Resistance Exercise Enhances Postprandial Fat Oxidation in Response to a High-Fructose Meal**

Christopher Melby, Andrea Wysong, Jeffrey Bourquin, Jessie Wilburn. Colorado State University, Fort Collins, CO.  
 (No relationships reported)

A fructose-rich, mixed-macronutrient meal rapidly increases carbohydrate oxidation and decreases fat oxidation during the post-prandial period. An acute strenuous bout of weight-lifting exercise has been shown to elevate fat oxidation for many hours following cessation of exercise. **Purpose:** To determine whether or not a single resistance exercise bout performed approximately 15 hours before consumption of a high-fructose, mixed-meal could attenuate the meal-induced shift from fat oxidation to CHO oxidation. **Methods:** Seven apparently healthy men who were recreational weight lifters (Mean ± SEM; age =  $27 \pm 2$  years, BMI =  $24.2 \pm 0.3$  kg/m<sup>2</sup>) completed three separate two-day conditions in a random order: (1) EX-COMP: a full-body superset weightlifting workout (12 different exercises x 4 sets x 10 reps) with the provision of additional kilocalories to compensate for the energy expended during exercise on day 1, followed by the consumption of a high-fructose, mixed-macronutrient test meal (kcal =  $600 \pm 8$  kcal; 0.75 g fructose/kg body weight) the next morning (day 2) and the determination  $VO_2$ ,  $VCO_2$ , and respiratory exchange ratio (RER) for determination of fat and carbohydrate oxidation during a six-hour post-prandial period; (2) EX-NoCOMP: same as EX-COMP condition but without energy

intake compensation for the exercise on day 1; and (3) CON: no exercise control. **Results:** Post-prandial RER was significantly lower in the EX-NoCOMP (0.789±0.01) condition compared to CON (0.809±0.01) ( $p=0.005$ ). Fat oxidation was significantly higher in EX-NoCOMP (0.094±0.009 g/min) compared to CON (0.084±0.009 g/min) ( $p=0.001$ ). CHO oxidation was significantly lower in the EX-NoCOMP (0.09±0.012 g/min) compared to CON (0.108±0.011 g/min) ( $p=0.037$ ). For the EX-COMP condition, postprandial RER (0.787±0.009), fat oxidation (0.095±0.008 g/min) and CHO oxidation (0.091±0.011 g/min) were almost identical to EX-NoCOMP, but these values compared to CON did not quite reach statistical significance. **Conclusion:** A single acute bout of high intensity resistance exercise completed 15 hours prior to a high-fructose, mixed-macronutrient meal results in greater post-prandial fat oxidation than does lack of exercise followed by the same meal.

1016 Board #195 May 31 2:00 PM - 3:30 PM  
**Differential in Aerobic Capacity Among Collegiate Distance Runners Consuming a Low Carbohydrate Diet**

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Although current sports nutrition recommendations advocate for a high carbohydrate (CHO) intake among endurance athletes, recent research has suggested that training with low CHO availability may augment adaptations to aerobic training. When adopted during the competitive season, when training intensity and the demand for glycogen replenishment is high, low CHO diets may be detrimental to training adaptations by preventing adequate recovery between concurrent high-intensity endurance sessions. **PURPOSE:** To observe the dietary habits of collegiate distance runners and to investigate the effects of habitual CHO intake on aerobic performance (PostVO<sub>2max</sub>) during a competitive season. **METHODS:** During an 8-week trial period, 12 collegiate track athletes (males, n=8; females, n=4) recorded their self-selected dietary intake via 24-hr recall. Analysis of CHO intake was conducted by a registered dietitian using NutriCalc software. Pre (PreVO<sub>2max</sub>) and post season aerobic capacity assessments were performed. A one-way ANCOVA with two covariates controlling for PreVO<sub>2max</sub> and CHO intake compared the variance in PreVO<sub>2max</sub> and PostVO<sub>2max</sub> by sex. **RESULTS:** The average CHO intake was 4.11 ± 1.03 g/kg with only one female athlete meeting dietary recommendations, consuming > 6 g/kg. Male distance runners had a lower CHO intake than females (3.64±0.77g/kg; 5.03±0.91g/kg). After adjusting for PreVO<sub>2max</sub> and CHO, the male improvement in PostVO<sub>2max</sub> was 12.62 ml/kg/min (95% CI 2.12-23.12,  $p=0.02$ ) greater than the effect observed in females. There were no differences in weight and body composition changes by sex throughout the season ( $p=0.48$ ;  $p=0.86$ ). CHO accounted for 18% of the variance in PostVO<sub>2max</sub>. **CONCLUSIONS:** Collegiate distance runners were able to make improvements in their aerobic capacity during a competitive season while consuming a low CHO diet, with a predominant effect in male athletes. Therefore, it may not be detrimental for endurance athletes to consume low CHO diets while undergoing training at high intensities from an aerobic adaptation standpoint.

1017 Board #196 May 31 2:00 PM - 3:30 PM  
**The Physiological Effects of 12-Weeks of Ketogenic Dieting While Cross-Training**

Paul A. Roberson<sup>1</sup>, Wesley C. Kephart<sup>1</sup>, Coree Pledge<sup>1</sup>, Petey W. Mumford<sup>1</sup>, Kevin W. Huggins<sup>1</sup>, Jeffrey S. Martin<sup>1</sup>, Kaelin C. Young<sup>1</sup>, Ryan P. Lowery<sup>2</sup>, Jacob M. Wilson<sup>2</sup>, Michael D. Roberts<sup>1</sup>. <sup>1</sup>Auburn University, Auburn, AL. <sup>2</sup>Applied Sports Performance Institute, Tampa, FL.  
 (No relationships reported)

**PURPOSE:** Recent literature has suggested impaired strength and anaerobic performance outcomes with ketogenic dieting. Herein, we sought to determine the metabolic and performance effects of 12 weeks of ketogenic dieting while cross-training in cross-trained individuals. **METHODS:** Volunteers were divided into a control group (CTL; n=9) and a ketogenic group (KD; n=9). Pre and post-testing involved body composition assessment via dual x-ray absorptiometry (DEXA), vastus lateralis (VL) thickness using ultrasound, resting energy expenditure (REE), phlebotomy to determine serum health biomarkers, an aerobic capacity evaluation, one repetition maximum (1RM) testing, and 400-m sprint time assessments. All subjects were instructed to follow a cross-training routine for 12 weeks. The KD group was given dietary guidelines to follow for 12 weeks, while the CTL group continued their normal diet. Blood ketone bodies were measured weekly to ensure nutritional ketosis was reached by the KD but not CTL. **RESULTS:** KD blood ketone levels were significantly higher than the CTL at each week following intervention ( $p<0.05$ ) except week 9 ( $p=0.09$ ). DEXA fat mass declined in the KD (-3.47 ± 1.06 kg) compared to CTL (-0.06 ± 0.45 kg) ( $p<0.01$ ).

DEXA lean mass and visceral fat mass changes were not different between groups ( $p=0.99$  and  $p=0.23$ , respectively). At rest, respiratory quotient delta scores were not different between CTL (-0.012 ± 0.027) and KD (-0.067 ± 0.020) ( $p=0.19$ ). REE was not altered between groups ( $p=0.24$ ). No between-group differences in delta scores were observed for fasting glucose ( $p=0.31$ ), HDL-C ( $p=0.49$ ) or triglycerides ( $p=0.19$ ), although LDL-C trended with increases in the KD (+33.8 ± 14.3 mg/dL) but not CTL group (+0.2 ± 8.0 mg/dL) ( $p=0.052$ ). Neither VL nor total mid-thigh thickness delta scores were different between groups ( $p=0.46$  and  $p=0.14$ , respectively). There were no between-group differences in delta scores for 1RM Squat ( $p=0.15$ ), 1RM overhead press ( $p=0.37$ ), 400-m sprint times ( $p=0.90$ ) or VO<sub>2max</sub> ( $p=0.57$ ). **CONCLUSIONS:** Ketogenic dieting improves body composition without negatively impacting muscle mass and/or aerobic, anaerobic or strength performance in recreational cross-trained subjects.

1018 Board #197 May 31 2:00 PM - 3:30 PM  
**7,12-dimethylbenz(a)-anthracene (DMBA) & High Fat High Sugar Diet Decrease Physical Activity in Female Mice**

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 (No relationships reported)

**BACKGROUND:** Regular exercise has been shown to diminish the risk of certain cancers. DMBA, (7, 12-dimethylbenz(a)-anthracene) is a complete carcinogen that is used to induce tumors in mice. It has yet to be established whether DMBA has an effect on voluntary wheel running (WR) in mice, and whether these effects may be exacerbated via consumption of a high fat high sugar (HFHS) diet. **PURPOSE:** Determine if DMBA treatment altered voluntary WR in female SENCAR mice, and whether a HFHS diet exacerbated treatment effects on voluntary WR. **METHODS:** Offspring of SENCAR breeder pairs were weaned at 3 weeks (wks) of age onto either an ad lib fed HFHS (20% protein, 45% fat/24% sucrose + 10% fructose water) or a diet restricted (DR) (12% kcal restriction, 20% protein, 10% fat, 57% cornstarch) diet. Animals were double-housed and randomly assigned to either a DMBA (n=40) treatment with HFHS (n=20) and DR (n=20) diets; or a control (CNTL) (n=18) treatment with HFHS (n=10) and DR (n=8) diets. At 4 wks of age, two plastic running wheels were mounted inside standard rat cages, and connected to a computer to record WR duration and distance. At 7-9 wks of age, mice were gavaged with DMBA dissolved in corn oil (20 µg/mouse/day) or with corn oil vehicle only (CNTL) for 5 days/wk for 6 weeks. A two-way ANOVA was employed to determine the effect of DMBA on activity with factors of treatment and diet for wks 9-20. **RESULTS:** Compared to CNTL, DMBA significantly decreased distance (7.41 ± 0.45 vs. 11.08 ± 0.68 km/day;  $p=0.0002$ ), and duration (175.19 ± 8.24 vs. 261.23 ± 12.36 min;  $p<0.0001$ ). No significant difference in speed was noted (40.31 ± 1.37 vs. 40.34 ± 2.05 m/min;  $p=0.77$ ). HFHS diet compared to DR diet significantly decreased distance (5.84 ± 0.60 vs. 11.08 ± 0.55 km/day;  $p<0.0001$ ), duration (168.41 ± 10.9 vs. 233.14 ± 10.1 min;  $p<0.0001$ ), and speed (33.04 ± 1.81 vs. 47.12 ± 1.67 m/min;  $p<0.0001$ ). No significant interactions were observed between treatment and diet groups. **CONCLUSIONS:** DMBA and HFHS diet decrease WR distance and duration, while only the HFHS diet decreased WR speed. Although DMBA and HFHS independently decreased WR, a lack of interaction suggest that they are not additive or synergistic. **ACKNOWLEDGMENTS:** Project was funded by the US Army through the Department of Defense projects W81XWH-13-1-0278 (Fuchs-Young) and W81XWH-13-1-0279 (Lightfoot).

**B-68 Free Communication/Poster - Cardiovascular**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

1019 Board #198 May 31 2:00 PM - 3:30 PM

**Lower-body Compression On Leg Vessel Morphology And Systemic Hemodynamic Responses In Healthy Participants**

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(No relationships reported)

The efficacy of compression garment (CG) application in exercise performance and recovery remains controversial, as limited information exists on the physiological mechanisms of CG action, specifically its effect on vessel morphological and systemic hemodynamic responses.

**PURPOSE:** To investigate the effect of thigh-length compression tights (CG) on leg vessel morphological and systemic hemodynamic responses in healthy participants.

**METHODS:** Leg vessel caliber in thirty-two participants (16 males and 16 females) was measured, using 0.25T MRI, at four leg positions; calf, knee, lower-thigh and mid-thigh, in both a supine and upright position. Exerted pressure (EP) from three CGs (Low: G1; Medium: G2; High: G3) were measured at the four leg positions on the right leg during standing. Systemic hemodynamic variables including cardiac output (CO), stroke volume (SV), heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DPB) and systemic vascular resistance (SVR) were monitored using non-invasive Doppler ultrasound, in a supine and upright position.

**RESULTS:** The average EP from G1, G2 and G3 were  $2.2 \pm 1.3$ ,  $12.2 \pm 3.7$  and  $26.7 \pm 8.1$  mmHg, respectively. The EP at the calf was higher than in the other leg positions ( $P < 0.001$ ). CO, SV, HR, DBP and SVR were lower in the upright than supine position ( $P < 0.001$ ). Wearing G3 elicited higher CO than wearing G2 ( $P < 0.005$ ) but not G1 ( $P > 0.05$ ). SV was higher in G3 compared to G1 and G2 ( $P < 0.05$ ). Deep vein and great saphenous vein (GSV) calibers were larger at all leg positions in the upright than supine position ( $P < 0.001$ ). Furthermore, G3 elicited smaller superficial vessels caliber than G1 and G2, but the largest deep vessels caliber at calf level ( $P < 0.001$ ) only. The G3 also elicited the smallest GSV caliber followed by G2 and G1 respectively, at knee level ( $P < 0.001$ ). The G1 elicited the largest but similar GSV caliber, among G2 and G3, at lower-thigh and mid-thigh level ( $P < 0.005$ ).

**CONCLUSIONS:** Leg vessel morphological and systemic hemodynamic responses to compression garment application were greatest in compression garments with a higher exerted pressure and were most pronounced at the calf level.

1020 Board #199 May 31 2:00 PM - 3:30 PM

**Cardiovascular Strain Associated With Spinning Practice In Women**

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(No relationships reported)

Spinning (SP) is a very popular indoor stationary cycling advertised as an efficient exercise to foster cardiovascular fitness and weight loss. However, its absolute and relative cardiovascular intensity has been poorly described.

**PURPOSE:** To evaluate the cardiovascular strain during regular SP classes performed by women.

**METHODS:** We evaluated 23 women ( $36.9 \pm 11.3$  yrs; BMI  $24.0 \pm 4.1$  kg/m<sup>2</sup>), from 5 fitness centers randomly selected in Brasilia-Brazil. Cardiovascular strain was evaluated by the absolute and relative time spent in different effort intensities and by the heart rate (HR) in different moments during SP classes. HR was registered with a RS800 Polar monitor. Each volunteer was monitored in 3 classes to obtain the mean HR of each moment. Effort intensity was classified in 4 HR zones based on percentage of predicted Maximal HR (MHR=220-age): very heavy ( $\geq 94\%$ ); heavy (77-93%); moderate (64-76%) and light ( $< 64\%$ ). HR was analyzed in 4 moments: initial (in) (5min average-HRin), highest HR (HRpk), class ending (5min average-HRe1) and after cool down (HRe2). Data was non-normal (Shapiro-Wilk) and presented as median (min-max) values. HR comparisons used Friedman/Dunns post-hoc test at 5% level of significance.

**RESULTS:** HRpk 167 (127-186)bpm was greater than HRin: 90 (60-122)bpm, HRe1: 135 (111-150)bpm and HRe2: 113 (89-137)bpm ( $p < 0.05$ ). The HRe1 was greater than HRin ( $p < 0.05$ ), but similar to HRe2, which was similar to HRin ( $p > 0.05$ ). Absolute

and relative increase of HR to HRpk was 74 (34-111)bpm, 80.9 (36.6-185.0)%, respectively. The HRe1 reduced 26 (13-57)bpm or 19 (11.4 - 44.2)% from HRpk. HRe2 was similar to HRin ( $p > 0.05$ ). Absolute and relative time in each HR zone are shown in Table\_1.

HR Zone	Absolute (min:sec)		Relative (%)	
	Median	Extremes	Median	Extremes
Light	7:06	2:05 - 19:07	15.3	5.0 - 43.1
Moderate	11:00	3:08 - 37:36	23.6	6.4 - 64.2
Heavy	25:00	8:00 - 35:00	50.2	1.5 - 79.3
Very heavy	0:02	0:00 - 13:08	0.1	0.0 - 27.5

**CONCLUSIONS:** We observed high cardiovascular strain. SP classes were performed usually on heavy or very heavy intensity (50.3%), which deserves safety considerations. The cool down period was effective in reestablishing HR to its initial pattern since HRin and HRe2 were similar.

1021 Board #200 May 31 2:00 PM - 3:30 PM

**Cardiorespiratory Responses to a 20-minute Shallow Water Tabata Style Workout: A Gender Comparison**

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(No relationships reported)

**PURPOSE:** To compare physiological responses to a 20-min high intensity, Tabata-style shallow water exercise workout (TS-SWE) between healthy males (M, n=9, 24±1 y) and females (F, n=9, 26±6 y). **METHODS:** Participants first performed an incremental SWE test to exhaustion while metabolic (indirect calorimetry), heart rate (HR, telemetry) and blood lactate (Bla) responses were monitored. On a second visit, metabolic, HR, rating of perceived exertion (RPE, Borg scale 6-20), and Bla were measured while participants performed TS-SWE. TS-SWE consisted of 4, 4-min bouts with each bout alternating between 20s "all-out" exercise followed by 10s rest. Each bout was separated by 1 min rest (total of 32 "all-out" 20s efforts). For both visits, participants were immersed to axillary level at a water temp. of 83 F. **RESULTS:** M had a greater peak VO<sub>2</sub> and Bla ( $3.6 \pm 0.4$  vs  $2.7 \pm 0.3$  l·min<sup>-1</sup>;  $10.9 \pm 1.3$  vs  $8.1 \pm 1.7$  millimolar (mM);  $p < 0.05$ ) while peak HR was similar ( $185 \pm 7$  (M) vs  $181 \pm 7$  bpm (F) ( $p > 0.05$ )). For the overall TS-SWE workout, %VO<sub>2</sub> peak for M and F was  $72.9 \pm 4.7$  and  $72.4 \pm 6.5$ , respectively, while %HR peak was  $83.9 \pm 4.9$  (M) and  $86.3 \pm 2.2$  (F), ( $P > 0.05$ ). RPE for the overall workout was ~18-19 (very, very hard) for both M and F. %VO<sub>2</sub> peak for M and F was similar for each bout and increased from ~70% (Bout 1), 74% (Bout 2), to 77% (Bout 3) with the greatest metabolic load achieved during Bout 4 (~85%) ( $P < 0.05$ , main effect bout). %HR peak was also similar between M and F for each bout: ~82% (Bout 1), 85% (Bout 2), 88% (Bout 3) and ~94% for Bout 4 ( $P < 0.05$ , main effect bout). Bla (mM) was similar between M and F for bout 1 ( $6.3 \pm 1.8$  vs  $5.2 \pm 1.6$ , respectively ( $p > 0.05$ )), however, males accumulated a greater Bla in bouts 2 ( $9.0 \pm 2.0$  vs  $6.0 \pm 1.0$ ), 3 ( $9.3 \pm 2.3$  vs  $5.9 \pm 0.9$ ) and 4 ( $11.1 \pm 2.2$  vs  $9.2 \pm 1.7$ ) ( $P < 0.05$ ). **CONCLUSION:** TS-SWE elicited cardiometabolic and psychophysical responses for both males and females that are classified as vigorous to near-maximal to maximal intensity according to the American College of Sports Medicine. Furthermore, the presence of a cardiometabolic "end-spurt", as reflected in a substantially greater %VO<sub>2</sub>, %HR peak, and blood lactate response during bout 4, suggests that a pacing strategy may have been employed despite a-priori instructions to exercise "all-out" throughout the workout.

1022 Board #201 May 31 2:00 PM - 3:30 PM

**Long-term Effects Of Exercise On Cardiovascular Disease Risk Profile Following Weight Loss In Overweight Women**

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(No relationships reported)

Despite the widely recognized benefits of weight loss, minimal research has examined the longitudinal effects of exercise training on cardiovascular disease (CVD) risk factors after weight loss. **PURPOSE:** To evaluate the long-term influence of exercise training on CVD risk factors after weight loss in previously overweight women.

**METHODS:** A randomized weight loss trial was conducted in 64 premenopausal women (BMI  $28.3 \pm 1.2$  kg/m<sup>2</sup>; age  $33.7 \pm 6.4$  yrs). Participants were assigned to either aerobic training (AT: continuous treadmill exercise at 67-80% of maximum heart rate), resistance training (RT: 10 total body exercises at 65-80% of 1-RM), or control (C: no exercise). All groups consumed a standardized diet until achieving

BMI <25kg/m<sup>2</sup>. Exercise groups trained 3x/wk during the weight loss period and were encouraged to exercise 2x/wk for one yr following the initial weight loss. Body weight, % body fat, abdominal fat, resting blood pressure (BP), insulin sensitivity, total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, and triglycerides (TG) were measured. Two-way repeated measures ANOVA was used to analyze dependent variables at baseline, post-intervention, 1 yr post intervention, and 3 yrs post intervention. Post hoc paired sample t-tests were used to examine changes from baseline to 3 yrs post intervention. Significance was accepted at  $p \leq 0.05$ . **RESULTS:** Mean weight loss for all subjects was 11.92 kg. Significant group x time interactions were found for body weight, % body fat, systolic BP, TG, HDL, and TC:HDL ratio, with no significant interactions for any other variable. Three yrs after weight loss, body weight (74.9.4±5.7 to 71.1±9.6 kg), body fat (39.7±3.9 to 35.9±6.2%), systolic BP (120.0±13.0 to 111.4±8.0 mmHg), HDL (42.0±13.4 to 55.1±11.9 mg/dL), and TC:HDL ratio (4.2±1.6 to 3.3±1.2 mg/dL) were significantly improved from baseline in AT. TG (87.5±32.2 to 74.3±27.0 mg/dL), HDL (41.2±8.9 to 49.4±13.4 mg/dL), and TC:HDL ratio (3.9±0.8 to 3.5±0.8 mg/dL) significantly improved from baseline in RT. C had no differences. **CONCLUSIONS:** Three yrs after initial weight loss, several CVD risk factors were more favorable in women who exercise trained compared to non-exercisers. Further longitudinal research examining the effects of exercise on the maintenance of improved CVD risk factors is warranted.

1023 Board #202 May 31 2:00 PM - 3:30 PM  
**Cardiovascular Risk Profiles Of World Masters Games Participants**

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 (No relationships reported)

Increasing evidence indicates adherence to exercise throughout life is concurrent with improved health. World masters games (WMG) have more participants than any other international sporting competition and is under investigated, particularly with regard to indices of cardiovascular disease (CVD) risk. **Purpose:** This study investigated selected CVD risk factors in WMG participants. **Methods:** This was a cross-sectional, observational study which utilized a web-based questionnaire to survey cardiovascular risk factors of WMG participants. The survey consisted of three sections: basic demographics, medical history and physiological parameters which included body mass index (BMI), waist circumference (WC), resting blood pressure (BP) and lipids (total cholesterol (TC), high density lipoprotein (HDL) and low density lipoprotein (LDL)). **Results:** A total of 1,435 participants (567 female & 868 male), aged 27-91 years participated in the study. Key findings included significant differences between genders where females were significantly lower in BMI (5.3%,  $p < 0.001$ ), WC (10.6%,  $p < 0.01$ ), resting SBP (5.8%,  $p < 0.01$ ), resting DBP (8.4%,  $p < 0.01$ ), significantly higher in HDLs (15.2%,  $p < 0.001$ ) and significantly lower in both the TC:HDL ratio (12.6%,  $p < 0.001$ ) and LDL:HDL ratio (19.0%,  $p < 0.001$ ). Significant differences ( $p < 0.001$ ) were also identified when comparing WMG lipid results to the Australian general population (AGP). WMG demonstrated healthier TC (4.47±1.11 mmol/L), HDLs (1.75±0.79 mmol/L), and LDLs (2.92±0.96 mmol/L) when compared to AGP parameters (TC: 5.07 mmol/L, HDL: 1.34 mmol/L, LDL: 3.13 mmol/L). **Conclusions:** WMG participants demonstrated improved values in a number of CVD risk factors when compared to the general population with female WMG participants presenting healthier CVD risk factors when compared to males. Hence, within the parameters of this study, masters athletes exhibit evidence of superior health when compared to the general population within Australia.

1024 Board #203 May 31 2:00 PM - 3:30 PM  
**Progressive, High Intensity Endurance Exercise Training Significantly Increases Maximal Cardiac Power Output In Middle Aged, Previously Sedentary Adults**

Dean Palmer, Sheryl Livingston, Erin Howden, Mitchel Samels, FACSM, Braden Everding, FACSM, Tom Sarma. IEEM, Dallas, TX. (Sponsor: Dr. Benjamin Levine, FACSM)  
 (No relationships reported)

High intensity, endurance exercise increases maximal cardiac power output (CPO) in young, healthy adults. It is less clear whether such gains are realized among sedentary adults who begin such a program during middle-age. **PURPOSE:** To determine whether a progressive, high-intensity endurance exercise program will increase CPO in healthy, middle-aged adults. **METHODS:** We studied 51 middle-aged adults (22 males; 52.7 ± 5.1 yrs). 23 (10 males) were randomized to a non-aerobic exercise group (Control). The remaining 28 (12 males) were assigned to an endurance training group (Exercise), all of whom completed a 24 month exercise training program. This progressive regimen was gradually expanded from 3\*30min moderate intensity

sess./wk to 1-2\*30 min and 1\*60 min moderate intensity (55-70% of VO<sub>2max</sub>) sess./wk + 2 high intensity aerobic interval (>95%peakHR) sess./wk; and 1 low intensity recovery sess./wk. After nine months, the exercise participants plateaued their training to one high intensity interval sess./wk. Endurance training sessions were monitored via both Polar heart rate monitoring and manual data logs. VO<sub>2max</sub> was measured using the Douglas Bag method via an incremental treadmill protocol. Cardiac output (Qc) was measured by a non-invasive acetylene rebreathing method. Blood pressure was measured by SunTech Tango+ electrophygmomanometry. Mean arterial pressure (MAP) was calculated by MAP=(SBP-DBP)/3+DBP, where DBP is diastolic blood pressure and SBP the systolic blood pressure. CPO was calculated as follows: CPO(W)=MAP·Qc·K, where K is the conversion factor (2.22·10<sup>-3</sup>) to watts. **RESULTS:** Endurance training increased VO<sub>2max</sub> 19.5% (28.8 to 34.4ml/kg/min) and maximal Qc 14.2% (14.5 to 16.6L/min) among the Exercising group, while MAP remained constant (114 to 114mmHg), resulting in a 18.1% increase in CPO<sub>max</sub> (3.68 to 4.28W,  $p < 0.01$ ). VO<sub>2max</sub> (29.5 to 28.7ml/kg/min), Qc<sub>max</sub> (14.8 to 15.2L/min), MAP (114 to 113mmHg) and CPO<sub>max</sub> (3.80 to 3.84W) were all unchanged in the control group. **CONCLUSION:** Healthy, previously sedentary middle-aged adults who complete a progressive endurance exercise training program realize a significant increase in CPO during maximal exercise.

1025 Board #204 May 31 2:00 PM - 3:30 PM  
**Head-down Tilt High Aerobic Intensity Training Effect On Vo2max And Stroke Volume Adaptations**

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The majority of evidence points to the stroke volume (SV) of the heart being the major limiting factor for maximal oxygen uptake (VO<sub>2max</sub>) in healthy humans. High-intensity aerobic interval training has previously been found to improve VO<sub>2max</sub> more than low and moderate intensity aerobic training when matched for total work. Haemodynamics are affected by venous return and positioning of the working muscles in relation to the heart. **PURPOSE:** It is the aim of the present study to investigate the effects of interval training with the legs placed above the heart. **METHODS:** A total of 28 young, healthy, untrained males were randomly assigned cycle training of 4x4 min intervals at 90 - 95% of HR<sub>max</sub> with their legs higher than the level of the heart (STG) or on a conventional upright cycle (UTG) for 24 sessions over 6 weeks. VO<sub>2max</sub>, maximal SV (SV<sub>max</sub>), submaximal heart rate (HR<sub>100w</sub>), and maximal power output (MPO) were examined before and after the training period. **RESULTS:** No significant difference was apparent between the groups in VO<sub>2max</sub> improvement for from pre- to posttest when tested in either postural position. Both groups increased absolute VO<sub>2max</sub> (L·min<sup>-1</sup>) significantly, by 15.3% in UTG and 16.5% in STG ( $P < 0.01$ ) in upright cycling, and 9.4% (UTG) and 15.9% (STG) in supine cycling ( $P < 0.01$ ). These adaptations were accompanied by increased SV of 8.9% and 10.6% for UTG and STG, respectively ( $P < 0.05$ ), and reduced submaximal HR ( $P < 0.01$ ). **CONCLUSIONS:** High-intensity aerobic interval training performed in a 4x4 min fashion in either the upright or supine position does not lead to different adaptations in VO<sub>2max</sub>. However, high-intensity interval training four times per week is an effective means to improve VO<sub>2max</sub> in young, untrained males. Also, since the improvement in SV did not differ between groups this is further testament to the heart being an important modulating factor for VO<sub>2max</sub> improvements.

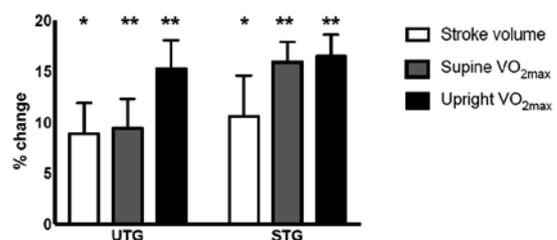


Figure 1. Percentage change in VO<sub>2max</sub> (L·min<sup>-1</sup>) and stroke volume (mL·beat<sup>-1</sup>) from pre- to posttest for upright (UTG) and supine training group (STG). Values presented are means ± SE. Significantly different from pre- to posttraining within groups: \*  $P < 0.05$ , \*\*  $P < 0.01$ .

1026 Board #205 May 31 2:00 PM - 3:30 PM  
**Relationship Between Maximal Oxygen Uptake And Field Endurance Tests By Aerobic Fitness Level In Korean**

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 (No relationships reported)

**PURPOSE:** To determine the relationships between maximal oxygen uptake ( $VO_{2max}$ ), 1,500 meter run (1500-R), and the 20-m multistage shuttle run (MS-R) according to aerobic fitness level in Korean young men.

**METHODS:** Ninety nine young men (19.5±0.9 yrs; 175.6±5.6 cm; 67.8±8.8 kg; 22.0±2.4 kg/m<sup>2</sup>; 16±4.9 %fat) participated in three randomly ordered testings. In one occasion, they ran on a treadmill with an incremental work load to determine their  $VO_{2max}$ . In other occasions, they ran on a track for 1500-R time trial and performed MS-R, twice for each test. They were categorized according to ACSM guidelines based on the  $VO_{2max}$  (in ml·kg<sup>-1</sup>·min<sup>-1</sup>), into four fitness groups; average (A; 41.5-44.9, n=18), good (G; 45.0-49.9, n=21), very good (VG; 50.0-54.9, n=30), and excellent (E; 54.9<, n=30). The better score of two trials of 1500-R and MS-R was taken for the analyses.

**RESULTS:** The average  $VO_{2max}$  was 42.8±1.6, 47.2±1.5, 51.9±1.3, and 59.4±3.1 ml·kg<sup>-1</sup>·min<sup>-1</sup> in A, G, VG, and E, respectively. The best record of 1500-R was 429±44, 416±66, 387±45, and 380±31 sec and that of MS-R was 65±16, 71±18, 76±21, and 82±19 repetitions in A, G, AG, and E, respectively. When the record were compared by groups, it was only different between A and E in both 1500-R (ANOVA, p<0.005) and MS-R (ANOVA, p<0.05). The Pearson Correlation Coefficients were only significant between 1500-R and MS-R in all groups (-0.676 in A, -0.779 in G, -0.671 in VG, and -0.461 in E; p<0.01) while no significance was noticed between  $VO_{2max}$  and two field tests.

**CONCLUSION:** Records of both 1500-R and MS-R appear to increase progressively by fitness level, but the outcome of field endurance tests only differentiate the maximal aerobic capacity between the average and the excellent aerobic capacity groups. Two field tests were highly correlated with each other, but not with  $VO_{2max}$  in all fitness levels.

1027 Board #206 May 31 2:00 PM - 3:30 PM  
**Association of Cardiovascular Fitness and Metabolic Syndrome in Male First Responders**

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 (No relationships reported)

Recent studies have concluded that the incidence of Metabolic Syndrome may be greater in male firefighters than in the US male population. However, research exploring this relationship is still lacking in male first responders (firefighters and police officers). Previous research has suggested that the prevalence of coronary artery disease (CAD) in police officers may be higher than in the general population.

**Purpose:** To determine the association of metabolic syndrome and cardiovascular fitness in male first responders. **Methods:** As part of an annual physical exam, 405 male first responders (average age 36 ± 9 yr) underwent evaluation of risk factors associated with metabolic syndrome as defined by NCEP III. These include the presence of three or more of the following: Waist Circumference > 40", HDL Cholesterol < 40 mg/dL, Triglycerides > 150 mg/dL, Blood Glucose > 110 mg/dL, and Resting Blood Pressure > 130/85 mm Hg. Cardiovascular fitness was determined by estimating  $VO_{2max}$  from time on treadmill during a Bruce protocol. **Results:** The subjects were ranked and divided into quartiles based on  $VO_{2max}$ . All data were analyzed using a Chi Square test (p < 0.05). Prevalence of metabolic syndrome increased across quartiles as cardiovascular fitness declined. **Conclusion:** These data suggest that as cardiovascular fitness improves, the likelihood of male first responders having metabolic syndrome decreases.

1028 Board #207 May 31 2:00 PM - 3:30 PM  
**Relationships Among Aerobic Capacity, Cardiovascular Fatigue Thresholds, And 1.5 Mile Run Times In ROTC Cadets**

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 (No relationships reported)

**PURPOSE:** To examine relationships among peak oxygen uptake ( $VO_{2peak}$ ), the gas exchange threshold (GET), respiratory compensation point (RCP), and 1.5 mile run times during the Air Force physical fitness test (PFT) in Air Force ROTC cadets.

**METHODS:** Twelve male Air Force ROTC cadets (mean ± SD: age = 20 ± 1 yr; height = 178 ± 5 cm; mass 78 ± 9 kg) performed an incremental treadmill test to exhaustion to determine GET (ml/kg/min), RCP (ml/kg/min), and  $VO_{2peak}$  (ml/kg/min). The GET was determined as the  $VO_2$  value corresponding to the intersection of two linear regression lines using the data points below and above the breakpoint in the carbon dioxide produced ( $VCO_2$ ) vs  $VO_2$  relationship. The RCP was determined as the  $VO_2$  corresponding to the point of departure from linearity of the VE vs  $VCO_2$  relationship. The 1.5 mile run times were collected during participants' ROTC physical fitness test. Relationships among the dependent variables were analyzed with Pearson correlation coefficients. Stepwise, multiple regression was used to determine the relative contributions of  $VO_{2peak}$ , GET, RCP, age, and BMI to 1.5 mile run time.

**RESULTS:** The means ± SDs for each variable, as well as the results of the Pearson correlation coefficients are shown in Table 1. The multiple regression analysis indicated that GET, RCP, and age contributed significantly to the prediction of 1.5 mile run time (Standardized regression coefficients = GET [-0.86], RCP = [-0.60], and age [-0.43]). **CONCLUSION:** There were significant relationships among peak aerobic capacity, cardiovascular fatigue thresholds, and 1.5 mile run time. However, these data suggest that improving cardiovascular fatigue thresholds may be especially important for improving 1.5 mile run performance. In addition, the contribution of age to the prediction of 1.5 mile run time may suggest that an increased exposure to ROTC training programs (i.e., older participants have a higher class standing) is beneficial to 1.5 mile run time performance.

Table 1. The means ± SDs for physical fitness test (PFT) 1.5 mile run time, peak oxygen uptake ( $VO_{2peak}$ ), gas exchange threshold (GET), respiratory compensation point (RCP), & BMI. Pearson's r value reported from each variable to PFT 1.5 mile run time.

	Mean ± SD	Correlations				
		PFD Run Time	$VO_{2peak}$	GET (ml/kg/min)	RCP (ml/kg/min)	BMI
PFD Run Time	10:49 ± 0.056	1				
$VO_{2peak}$	59.60 ± 8.03	-0.699*	1			
GET (ml/kg/min)	47.80 ± 9.44	-0.769*	0.876*	1		
RCP (ml/kg/min)	63.30 ± 14.89	-0.626*	0.735*	0.506	1	
BMI	24.76 ± 2.33	0.154	-0.980	-0.164	-0.060	1

\* = significant relationship (p < 0.05)

1029 Board #208 May 31 2:00 PM - 3:30 PM  
**Heart Rate Variability of College-level Athletes Exposed to Different Fatigue Protocols**

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 (No relationships reported)

Nowadays, sports scientists have explored various methods to predict and to assess physiological performance to pursue better athletic outcomes. The use of Heart Rate Variability (HRV) to evaluate the Autonomic Nervous System (ANS) seems to be a reliable indicator to measure athletes' physical adaptation to conditioning programs. The understanding of the behavior of the ANS plays a major role in identifying interaction between the parasympathetic and sympathetic activities during physiological stress and exercise adaptation. However, it is unknown whether or not HRV can assess the response of the ANS to different fatigue protocols. In this study, the non-linear Poincaré method was used to measure the self-similarity of consecutive R-R intervals to quantify the HRV at fatigue exposure.

**PURPOSE:** To examine the effects of four exercise-based fatigue protocols on the HRV.

**METHODS:** Ten healthy college-level handball athletes volunteered in this study (mean ± SD age: 21.10 ± 1.72 y/o, body mass: 81.10 ± 16.75 kg, body height: 173 ± 4.76 cm, and  $VO_{2max}$ : 47.80 ± 6.42 mL/kg/min). Participants completed a consent form approved by an Institutional Research Board. A cross-over design was followed to expose athletes to four fatigue protocols based on isotonic and sustained maximal isometric contractions, maximal anaerobic and incremental aerobic protocols in a cycloergometer. The SD1 Poincaré index was assessed immediately before fatigue (BF), after fatigue (AF), and during a 5-min recovery period (R). Differences were evaluated by a one-way ANOVA. The significance level was set at 5%.

**RESULTS:** The isotonic and isometric fatigue protocols showed similar results, significant differences were found between the SD1 values of BF and AF ( $p < 0.01$ ). Also, the difference between SD1 values of AF and R was significant for both fatigue protocols ( $p < 0.05$ ). Anaerobic and aerobic fatigue protocols depicted a significant difference between the SD1 mean values of BF and AF, and BF and R ( $p < 0.05$ ). **CONCLUSIONS:** Findings demonstrated that the effects of fatigue on the HRV could be assessed by the non-linear Pointcaré SD1 feature. Additionally, it seems that the behavior of HRV depends on the fatigue protocol used. Therefore, the non-linear HRV analysis could be a promising method to assess different types of fatigues present in sports.

1030 Board #209 May 31 2:00 PM - 3:30 PM  
**Cardiovascular and Metabolic Responses of High Intensity Sprint Protocols on an Elliptical Cross Trainer**  
 Terence A. Moriarty, Kurt A. Escobar, Tony P. Nunez, Len Kravitz, Ann L. Gibson, FACSM. *University of New Mexico, Albuquerque, NM.* (Sponsor: Ann L. Gibson, FACSM)  
 Email: moria1ta@unm.edu  
 (No relationships reported)

Sprint interval training protocols have been shown to significantly improve aerobic capacity and select markers of health in both healthy individuals and in diseased patients, and in some cases, have been shown to be superior to traditional aerobic training. **PURPOSE:** The purpose of the current study was to investigate the metabolic and cardiovascular effect of 3 sprint interval training protocols using an elliptical cross trainer. **METHODS:** Twelve healthy (Male = 6, Female = 6; Weight = 70.52 ± 13.47kg; Height = 1.71 ± 0.11m) college-aged participants (ages 19 - 28 years) volunteered. After giving written consent, each participant performed an individualized maximal aerobic capacity test on a cycle ergometer for the determination of  $VO_2$  max (40.53 ± 5.94 ml/kg/min). Each participant then performed 3 different high-intensity interval protocols in a randomized fashion: ten 30/30 sec, 30/60 sec or 30/90 sec work-to-rest ratio bouts for a total of 10, 15 or 20 min. Oxygen consumption and heart rate were continuously collected and monitored during each training protocol. A one way repeated measures ANOVA (SPSS v22;  $p < 0.05$ ) with post-hoc Bonferroni adjustment was used to examine differences between protocols. **RESULTS:**  $VO_2$  (mean of 15-sec averages) (30.1 ± 4.6, 29.5 ± 4.0, 28.2 ± 2.6 ml/kg/min), RER (1.0 ± 0.06, 0.95 ± 0.09, 0.98 ± 0.05) and average peak heart rate (177 ± 13, 176 ± 11, 171 ± 16) illustrated no statistical significance across the 30/30 sec, 30/60 sec and 30/90 sec protocols, respectively ( $p > 0.05$ ). Total caloric expenditure was, however, significantly higher in the 30/60 (240.44 ± 34.30 kcal) and 30/90 (277.22 ± 57.78 kcal) protocols as compared to the 30/30 (182.64 ± 25.35 kcal) protocol ( $F = 13.97, p < 0.01$ ). **CONCLUSION:** Under such work-to-rest ratios, varying rest duration between 30 and 90 seconds had limited impact on metabolic responses during repeated 30-sec high-intensity exercise bouts. These data suggest that a 30/60 sec or 30/90 sec approach may be advocated as a preferred strategy for producing higher caloric expenditure in a college-aged population. Future studies examining the minimum duration and frequency of HIIT bouts are warranted if HIIT is to be used as an alternative to current physical activity recommendations.

1031 Board #210 May 31 2:00 PM - 3:30 PM  
**The Effect Of Temperature And Experience On Acute Musculoskeletal And Cardiovascular Responses During Yoga.**  
 Elizabeth Norris, Donald Hoover, Kayla Alvey, Ashley Bowers, Jennifer Grothe, Vincent Erica. *Western Kentucky University, Bowling Green, KY.*  
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 (No relationships reported)

**Purpose:** The aim of this study was to compare the acute musculoskeletal and cardiovascular responses to a series of Hatha yoga postures performed at room temperature and in a hot environment by novice (N) and experienced (E) yoga practitioners. **Methods:** 20 N (35.2±9.1 years, 65% female) and 21 E (39.9±8.2 years, 81% female) yoga subjects were recruited. Subjects completed 2- 60 minute yoga sessions within 7-10 days. One session was RT (78°F 44% humidity) and one session was HY (99°F 55% humidity). Each session consisted of 23 yoga postures and 2 breathing exercises divided into a standing series and a floor series. Pre and post musculoskeletal (low back flexibility, shoulder mobility) and cardiovascular (heart rate, blood pressure) measures were conducted at each session. Rating of perceived exertion (RPE) was assessed during the standing and floor series. A two-way mixed methods ANOVA was used to examine the effect of temperature and experience level. Planned comparisons were conducted for significant main effects of temperature and experience. **Results:** The interaction between temperature and experience was non-significant for all measures ( $p > 0.150$ ). There was a significant main effect of temperature for all variables ( $p \leq 0.008$ ) except systolic BP. The main effect of experience was significant only for diastolic blood pressure (DBP) ( $p < 0.037$ ). Regardless of experience level,

hot yoga resulted in higher RPE during both the standing (HY =13.5; RT=12.2) and floor series (HY=12.9; RT=11.6) ( $p=0.001$ ). HR was significantly greater during the hot yoga class (max HR=145.6, average HR= 107.3) as compared to room temperature (max HR =134.4, average HR=97.7) ( $p \leq 0.005$ ). There was a significantly greater decrease in DBP during hot yoga (9.9mmHg) as compared to RT (4.9mmHg) ( $p=0.019$ ) and in N (9.9 mmHg) as compared to E (5.2 mm Hg) subjects ( $p=0.037$ ). Musculoskeletal parameters showed significantly greater improvements in left shoulder mobility ( $p=0.002$ ) and low back flexibility ( $p=0.008$ ) after HY (4.3 cm; 2.2 cm, respectively) as compared to RT yoga (2.9 cm; 0.03 cm, respectively). **Conclusion:** The findings of this study demonstrate acute effects of yoga are greater when yoga is performed in a hot environment as compared to room temperature. Furthermore, these benefits are not dependent upon the experience level with yoga.

1032 Board #211 May 31 2:00 PM - 3:30 PM  
**Improved Muscular Strength Did Not Improve Resting Cardiac Vagal Activity In Young Healthy Men**  
 Piia Kaikkonen<sup>1</sup>, Juha Ahtaiainen<sup>2</sup>. <sup>1</sup>Tampere Research Center of Sports Medicine, Tampere, Finland. <sup>2</sup>University of Jyväskylä, Jyväskylä, Finland.  
 (No relationships reported)

**Purpose:** The benefits of resistance training (RT) on cardiac function are well acknowledged but usually no effects of moderate load of RT on resting cardiac vagal modulation have been found in healthy subjects. Therefore, the aim of this study was to investigate the effects of more intensive RT period and consequent tapering period on nocturnal heart rate variability (HRV). **Methods:** Young, recreationally trained, healthy men (n = 15, age 24 ± 2 yrs, height 176 ± 6 cm, body mass 81 ± 15 kg, body fat 18 ± 5 %) performed a two-week intensive RT period (ITP) with five hypertrophic whole-body exercise sessions per week and a two-week tapering period (TAP) with two exercise sessions per week. Lower-body strength tests were performed before and after ITP and after TAP. Nocturnal RR-intervals were measured during three consequent nights before and at the end of both training periods. A mean of all three nights were used in the analysis. **Results:** Subjects were retrospectively divided to responders (Resp) and non-responders (Nonresp) according to the responses in strength tests in ITP. 1RM leg press (90°) in Resp improved 16,9 % ( $P < 0.01$ ) after ITP when compared to baseline (296 ± 59 kg) with no further change after TAP. 1RM in Nonresp did not change after ITP (-5,3 %, ns.) or TAP when compared to the baseline (361 ± 90 kg). The root mean square of successive differences (RMSSD) in Resp decreased 14,1 % ( $p < 0.05$ ) after ITP when compared to baseline (52 ± 21 ms<sup>2</sup>) with no further change after TAP. RMSSD in Nonresp did not change significantly either after ITP or TAP when compared to baseline (43 ± 7 ms<sup>2</sup>). **Conclusion:** An intensive two-week RT period improved performance and decreased nocturnal HRV in Resp but not in Nonresp. As previously reported in intensive endurance training, also the present increased RT load could be detected in resting HRV. It is presumable that a very high RT load is needed to achieve changes in HRV, as earlier studies with moderate load have not found changes in HRV. In contrast to the usual findings in endurance training, improved strength performance was not related to improved cardiac vagal modulation in the present study. It may be speculated that changes in the neuromuscular system may explain the improved performance despite the disturbed autonomic modulation, i.e. increased stress, detected as decreased resting HRV.

1033 Board #212 May 31 2:00 PM - 3:30 PM  
**Risk Factors for Cardiovascular Disease Among University Employees**  
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 (No relationships reported)

**PURPOSE:** The purpose of this study was to examine cardiovascular disease risk factors among university employees, and to compare these results with standardized norms based on age and gender from the National Health and Nutrition Examination Survey (NHANES) data and the American College of Sports Medicine (ACSM) recommendations. **METHODS:** Health and wellness assessments were performed on N = 47 public university employees aged 26 to 65 years. The assessments included body compositional analysis, blood lipid and glucose panels, dietary recalls, and blood pressure and then compared with the results of current NHANES data and ACSM recommendations using a multiple independent t-tests ( $p < 0.05$ ) and descriptive analysis. **RESULTS:** Descriptive results indicated that the sample's means were above recommended values for male age, body fat percentage, low density lipoprotein cholesterol, and a diet too high in sodium and too low in calcium, fiber, and vitamin D. Results indicated that the sample also had significantly higher diastolic blood pressure ( $p = .0008$ ) and High Density Lipoprotein ( $p = .0005$ ) and significantly lower blood glucose ( $p = .00001$ ) than the national average. **CONCLUSION:** These results

indicate that the university employees were at significant risk for some cardiovascular disease risk factors and dietary choices, which indicates that they would benefit from health promotion programs that target those specific risk factors. :

## B-69 Free Communication/Poster - Cellular/Molecular

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

### 1034 Board #213 May 31 3:30 PM - 5:00 PM High-Intensity Interval Training Does Not Promote Fibrinolytic Adaptations in Healthy Men

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(No relationships reported)

Blood clots cause the majority of adverse cardiovascular events, such as heart attack and stroke, and fibrinolysis, the capacity to dissolve blood clots, is recognized as an independent predictor of cardiovascular morbidity and mortality. Aerobic exercise training is theorized to enhance fibrinolytic potential, but studies have yielded inconclusive results. High intensity interval training (HIIT) is a novel exercise training strategy that has been shown to improve several components of health in various populations, but the effect of a HIIT regimen on fibrinolytic potential is unknown. **Purpose:** The purpose of this study was to examine potential fibrinolytic adaptations in healthy men following four and eight weeks of HIIT. **Methods:** Healthy, sedentary men participated in a HIIT program three days/week for eight weeks. Training bouts were modeled after the traditional Wingate test, consisting of repeated, 30-second bouts of maximal intensity cycling separated by 4.5 minute rest intervals. Training began with three bouts per day and an additional bout/day was added to the regimen every two weeks, progressing up to six bouts per day in the final two weeks. Plasma concentrations of total tissue plasminogen activator (tPA) and plasminogen activator inhibitor-1 (PAI-1) were assessed at baseline, after four weeks (4w), and after eight weeks (8w). Statistical comparisons across the three time points were done using repeated measures ANOVA. Significance was set to  $p < 0.05$ . **Results:** 21 men (age:  $25 \pm 5$  yrs, BMI:  $26.7 \pm 6.2$  kg/m<sup>2</sup>) completed the study. No significant changes were observed for tPA during training (baseline:  $9.8 \pm 3.1$ , 4w:  $9.7 \pm 2.9$ , 8w:  $8.9 \pm 2.7$  ng/ml,  $p > 0.05$ ). Likewise, PAI-1 did not change with training (baseline:  $17.7 \pm 16.8$ , 4w:  $18.8 \pm 16.1$ , 8w:  $18.0 \pm 16.8$  ng/ml,  $p > 0.05$ ). **Conclusion:** Though it has been suggested that HIIT may be superior to traditional, aerobic training for the purpose of enhancing one's cardiovascular health, results of the present study do not indicate HIIT influences fibrinolytic potential in healthy young men. Future research should explore the benefits of HIIT in populations that may be characterized by diminished fibrinolytic potential.

### 1035 Board #214 May 31 3:30 PM - 5:00 PM Acute Exercise-induced Angiogenic T Cell Redistribution Is Attenuated in Older Men

Mark Ross<sup>1</sup>, Lesley Ingram<sup>1</sup>, Islay Cranston<sup>1</sup>, Guy Taylor<sup>2</sup>, Daniel West<sup>2</sup>, Graham Wright<sup>1</sup>, George Chambers<sup>1</sup>, Richard Simpson, FACSM<sup>3</sup>, Geraint Florida-James<sup>1</sup>. <sup>1</sup>Edinburgh Napier University, Edinburgh, United Kingdom. <sup>2</sup>Newcastle University, Newcastle, United Kingdom. <sup>3</sup>University of Houston, Houston, TX. (Sponsor: Richard Simpson, FACSM)  
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(No relationships reported)

Circulating CD31<sup>+</sup> T cells (T<sub>ANG</sub>) possess significant pro-angiogenic capabilities, contribute to maintenance of endothelial function, and are reduced in those with vascular-related diseases. Therefore, maintaining high levels of these cells may be important for vascular health benefits. Acute bouts of exercise stimulate an increase in circulating T-cells, including T<sub>ANG</sub> cells. Ageing is associated with a chronic reduction in T<sub>ANG</sub> cells. **PURPOSE:** To determine the influence of age on the exercise-induced increases in circulating T<sub>ANG</sub> cells. **METHODS:** Eight young (18-25yrs) and eight older (60-75yrs) men underwent a 30-minute cycling bout at 75% of their pre-determined maximum oxygen uptake (VO<sub>2</sub>max). Peripheral blood samples were taken pre-, immediately post-, and 1 hour post-exercise. Blood samples were used to quantify circulating T<sub>ANG</sub> cells by flow cytometry. T<sub>ANG</sub> were defined as peripheral blood mononuclear cells expressing CD3 and CD31. In addition, these cells were further characterised using antibodies against CD4 and CD8. Mixed model repeated measures analyses of variance (ANOVA) were performed to examine the effect of age, time and interactions of such (age x time) on changes in circulating T<sub>ANG</sub> cells. **RESULTS:** Acute exercise stimulated an increase in circulating T<sub>ANG</sub> cells in both groups, with a

significant time x age interaction found for total T<sub>ANG</sub> cells ( $p=0.049$ ), with older age group displaying reduced circulating cell response to the exercise bout ( $95.62 \pm 7.71\%$  vs.  $78.09 \pm 7.25\%$ , young vs. older individuals respectively). CD4<sup>+</sup> T<sub>ANG</sub> cells were also significantly affected by acute exercise, including a time x age interaction ( $p=0.0014$ ,  $107.09 \pm 10.56\%$  vs.  $79.88 \pm 10.04\%$  increase). Despite CD8<sup>+</sup> T<sub>ANG</sub> cells significantly increasing in response to exercise (time,  $p=0.002$ ,  $71.44 \pm 7.30\%$  pooled increase), no such effect of age was apparent (age x time,  $p=0.384$ ). **CONCLUSIONS:** Exercise significantly increases the number of circulating T<sub>ANG</sub> cells, however ageing attenuates the increase in total T<sub>ANG</sub> and CD4<sup>+</sup> T<sub>ANG</sub> cells, but not CD8<sup>+</sup> T<sub>ANG</sub> subsets. Acute increases in circulating T<sub>ANG</sub> cells may contribute to the improvements in vascular function observed with exercise, yet strategies to augment the T<sub>ANG</sub> cell increase to exercise in older individuals may be required to promote vascular benefits of exercise.

### 1036 Board #215 May 31 3:30 PM - 5:00 PM Serum Angiogenic Capacity and Circulating MicroRNAs in Trained and Inactive Young, Healthy Individuals

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(No relationships reported)

Angiogenesis is induced by endurance exercise training and improves cardiovascular function. Exercise training also influences blood-borne factors, such as circulating microRNAs (ci-miRNAs), which can affect endothelial cell functions. **PURPOSE:** To determine differences in the angiogenic response of human umbilical vein endothelial cells (HUVECs) to serum of young individuals with no risk factors for cardiovascular disease (CVD), who differ only by habitual aerobic exercise level. In addition, ci-miRNAs were compared as potential candidates responsible for differences in HUVEC responses. **METHODS:** Serum was isolated from fasted, peripheral blood of endurance trained ( $n=10$ ) and inactive ( $n=10$ ) men and women aged 20-39. Exercise habits and VO<sub>2</sub>max were determined, and groups were matched by age, BMI, and blood chemistry. Serum was applied to HUVECs in a radius well migration assay, fluorometric proliferation assay, and tube angiogenesis assay at concentrations of 10%, 20%, and 7.5%, respectively. Ci-miRNA was isolated from serum and reverse transcribed. Using real-time quantitative PCR (qPCR), a subset of three samples per group were first compared for an array of 84 CVD-related miRNAs. Targets showing at least a 4-fold difference, as well as a priori chosen miRNAs, were validated using qPCR and compared for all subjects. **RESULTS:** HUVECs exposed to serum from trained subjects migrated 8% more in the first 4 hours ( $p < 0.05$ ) and 13% more after 8 hours ( $p=0.058$ ) compared to those exposed to serum from inactive subjects. Following 12 and 24 hours, migration was 20% ( $p=0.055$ ) and 21% ( $p=0.08$ ) greater respectively, with serum of trained subjects. Following 36 hours, serum of trained individuals resulted in greater proliferation of HUVECs compared to serum of inactive individuals ( $P=0.04$ ). There were no differences in tube length or complexity between the groups. PCR array data indicated nine ci-miRNAs with  $\geq 4$ -fold difference. One ci-miRNA was more highly expressed in the trained sample, while eight were higher in the inactive sample. Of the ci-miRNAs chosen for validation, none exhibited different expression between groups. **CONCLUSION:** Serum of endurance trained individuals induces faster migration and greater proliferation compared to serum of inactive men and women, even in a young, healthy population.

### 1037 Board #216 May 31 3:30 PM - 5:00 PM Both Exercise And Calorie Restriction Increase Mitochondrial Membrane Potential Of Myocardium In Aging SD Rats

Mingchen Yu<sup>1</sup>, Xiang lin<sup>1</sup>, Jian Zhang<sup>1</sup>, Yang Ren<sup>1</sup>, Li Wen<sup>1</sup>, Yong Zhang<sup>1</sup>, Lili Ji, FACSM<sup>2</sup>. <sup>1</sup>Tianjin University of Sport, Tianjin, China. <sup>2</sup>University of Minnesota, Twin cities, MN.  
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(No relationships reported)

Exercise and calorie restriction have function to relieve the increase of oxidative damage in the myocardium. Mitochondria are the main cellular location to produce the reactive oxygen species (ROS). It is still unknown whether exercise or calorie restriction reduce the production of reactive oxygen in myocardial mitochondria. **Purpose:** The purpose of this study is to explore the positive effects from exercise and calorie restriction on the membrane potential of myocardial mitochondria, the ROS level in mitochondria, the relief of myocardial oxidative damage and the improvement of the myocardial function. **Method:** Twenty-one months-old male SD rats were divided into four groups: control aged group (CA), calorie aged with calorie restriction group (CRA, 60% calorie of CA group), aged exercise group (EA, running on treadmill with the speed of 15m/

min,5%,at 64% VO<sub>2</sub> max for 60 min/day, 5 days a week for 12 weeks) and exercise combined calorie restriction group (CREA). In addition, 20 of 9 months-old SD male rats were set as the young control group (YC).

**Result:** The pulse pressure(blood pressure in left ventricle) was significantly higher in CREA (12.08±2.9) than in CRA (9.39±1.0, P<0.05) and EA (9.30±1.2, P<0.05). The membrane potential(fluorescence image) was significantly higher in CREA than in CRA (P<0.01) and EA (P<0.05). The level of ROS(fluorescence image) was significant lower in CREA (28.92±2.6) than in CRA (39.54±8.7,P<0.05), EA (32.94±3.2, P<0.05) and CA (33.63±5.6,p<0.01). The level of MDA(kit) in CA (5.79±1.9) was extremely significantly higher than that in YC (2.37±0.3,p<0.01), CRA (2.37±0.3,p<0.01), CRE (3.06±0.7,p<0.01) and CREA (2.94±0.7,p<0.01).

**Conclusion:** Exercise training and calorie restriction increased the membrane potential of aged myocardium, they reduced the production of ROS and the level of oxidative damage in the mitochondria,and,improved the myocsrdisl ctrnscstle function.(This report is supported by NSFC 31271275,Corresponding author:wenli34@hotmail.com)

1038 Board #217 May 31 3:30 PM - 5:00 PM  
**Plasma Metabolomics in Response to an Acute Bout of Exercise in Adolescents Boys and Girls**

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(No relationships reported)

Technological advances now permit the simultaneous detection of previously unattainable numbers of small molecule metabolic products (the metabolome) in blood. Metabolomics facilitates analysis of dynamic, interacting physiologic systems and unravelling the role of physical activity during the process of growth in disease prevention across the lifespan. **PURPOSE:** To evaluate the effect of an acute intense bout of exercise on plasma metabolomics in a group of healthy adolescents, and explore sex-related patterns. **Methods:** 29 normal weight healthy adolescents (14-17 y/o, 16 girls) performed 10, 2-min bouts of cycle ergometer exercise interspersed with 1-min rest at a constant work equivalent to ~75% of their peak VO<sub>2</sub>. Blood was collected at baseline and immediately after the exercise. Untargeted profiling of primary metabolism was performed using automatic liner exchange / cold injection GC-TOF mass spectrometry at the UC Davis WCM Center. An acute exercise effect was assessed using paired t test (FDR ≤0.05). Two- way repeated measure ANOVA followed by paired t test was carried out to evaluate sex differences. Pathway analysis was performed using MetaboAnalyst 3 (FDR<0.05). **Results:** Exercise caused a significant shift in plasma metabolites associated with major bioenergetics, aerobic, anaerobic and amino acid metabolism. 48 annotated metabolites (36↑12↓) were classified into 11 metabolism pathways (e.g., citrate cycle, alanine, aspartate and glutamate metabolism, valine, leucine and isoleucine biosynthesis, glycine, serine and threonine metabolism, arginine and proline metabolism and aminoacyl-tRNA biosynthesis). 11 metabolites had different response to exercise in boys compared to girls. 4 of them were enriched (FDR=0.01) in the arginine and proline metabolism pathway, which plays a role in maintenance of vascular tone and hemodynamics, and acts in muscle metabolism. **CONCLUSION:** The rapidly emerging field of metabolomics enables us to identify interacting networks of cellular metabolites activated by exercise. Our exploratory data revealed that exercise induced a shift in the metabolic profile indicating global cellular metabolic/energetic stress and sex dimorphism not previously observed. Supported by NIH Grant P01HD-048721 and PERC System Biology Fund

1039 Board #218 May 31 3:30 PM - 5:00 PM  
**Microparticles Are Linked to Post-Prandial Hyperglycemia and Cardiovascular Disease Risk in Adults with Prediabetes**

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(No relationships reported)

**PURPOSE:** Microparticles (MPs) have been implicated in type 2 diabetes and cardiovascular disease (CVD). However, no study has assessed MPs from fresh samples with advanced imaging flow cytometry in order to understand the relation of MPs to CVD risk. We tested the hypothesis that MPs would correlate with hyperglycemia and CVD risk in adults with prediabetes. **METHODS:** In this cross-sectional study, 12 subjects (Age: 61.25±7.03y, BMI: 34.2±5.5kg/m<sup>2</sup>) were screened for prediabetes using American Diabetes Association criteria (75g OGTT and HbA<sub>1c</sub>). Post-prandial early (0-30min) and late phase (60-180min) glucose tolerance (75g OGTT) was calculated by incremental area under the curve (AUC). CVD risk was assessed by body composition (BIA) and waist circumference, fitness (VO<sub>2</sub>max and rate pressure product (RPP)), as well as systolic (SBP) and diastolic blood pressure (DBP). Arterial stiffness (augmentation index; AI) was calculated using total AUC.

Total MPs and endothelial MPs (EMPs; CD105, CD31<sup>+</sup>/CD41<sup>-</sup>) were analyzed from fresh plasma via imaging flow cytometry. **RESULTS:** Elevated total MPs were associated with early phase glucose intolerance (r=0.77, P=0.009) and VO<sub>2</sub>max (trend: r=0.52, P=0.08). CD31<sup>+</sup>/CD41<sup>-</sup> EMPS were correlated with higher body weight (r=0.59, P=0.04), waist circumference (r=0.66, P=0.03), RPP (r=-0.66, P=0.02) and late phase glucose intolerance (r=0.64, P=0.02). CD105 EMPS were inversely related to total AI (r=-0.61, P=0.04). **CONCLUSION:** MPs are significantly linked to post-prandial hyperglycemia and markers of increased CVD risk in adults with prediabetes.

1040 Board #219 May 31 3:30 PM - 5:00 PM  
**In Vitro Exercise, Laminar Shear Stress, Attenuates Basal Mmp-2 Dysfunction In Cultured African American Endothelial Cells**

Marc D. Cook, Adelola Adeyemo, Maitha Aldokhayyil, Michael Brown, FACSM. *University of Illinois at Chicago, Chicago, IL.*  
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Matrix metalloproteinase (MMP)-2, an enzyme that is integral in regulating vascular structure and vascular homeostasis, is constitutively expressed in endothelial cells (EC). MMP-2 has been associated with arterial stiffness and hypertension in African Americans (AA). While exercise improves biomarkers of vascular dysfunction in AA with pre-hypertension and hypertension, the mechanism(s) related to exercise-induced improvements in EC health and MMP-2 activity is unknown.

**PURPOSE:** To determine the extent of EC dysfunction of MMP-2 activity, and its responsiveness to a physiological exercise mimetic, laminar shear stress (LSS), in human umbilical vein endothelial cells (HUVEC) isolated from Caucasian (CA) and AA donors.

**METHODS:** The present work evaluated expression and activity of MMP-2 and related peptides in 4 AA and 4 CA HUVEC with gender split under basal conditions with LSS (20 dynes/cm<sup>2</sup>).

**RESULTS:** In AA HUVEC, we report that basal MMP-2 gene expression was significantly higher (2.13-fold increase, t<sub>2,8,12</sub>; p=0.01) while relative MMP-2 activity was significantly lower (CA: 0.7758 ± 0.1944; AA: 0.1324 ± 0.1135 n=4, t<sub>2,8,6</sub>; p=0.02), compared to CA HUVEC. Importantly, LSS normalized relative basal MMP-2 expression and activity (F<sub>3,15</sub> = 3.92; p=0.03) by increasing the relative expression in AA HUVEC.

**CONCLUSIONS:** These *in vitro* data highlight an inherited endothelial dysfunction in AA HUVEC and imply that MMP-2 dysfunction likely contributes to early vascular dysfunction and subsequent hypertension risk in AA. Further, exercise (e.g., LSS) normalized this dysfunction, *in vitro*, and highlights a potential mechanism by which exercise improves endothelial and vascular function in AA, *in vivo*.

1041 Board #220 May 31 3:30 PM - 5:00 PM  
**Diabetes Impairs the Ability of Skeletal Muscle Pericytes to Augment Postischemic Neovascularization in Mice**

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(No relationships reported)

Peripheral artery disease is an atherosclerotic disease that causes limb ischemia and has few effective treatments. Stem cell therapy is a promising treatment option, but concomitant diabetes may limit its effectiveness. **PURPOSE:** To evaluate the therapeutic potential of skeletal muscle pericytes to augment postischemic neovascularization following the induction of limb ischemia in wild type (WT) and type 2 diabetic (T2DM) mice. **METHODS:** Pericytes were isolated via fluorescence activated cell sorting for CD45<sup>+</sup>CD34<sup>+</sup>CD146<sup>+</sup> cells, and pericyte phenotype was confirmed via surface marker expression, gene expression, and *in vitro* differentiation potential. WT C57BL/6 (n=10) and db/db T2DM (n=8) mice underwent unilateral femoral artery ligation to induce limb ischemia. 24 hrs post-ligation, pericytes or vehicle control were transplanted into the muscles of the ischemic hindlimbs. Postischemic neovascularization was assessed via foot blood flow at pre-surgery, post-surgery, and postoperative days 3, 7, 14, 21, and 28 using laser Doppler perfusion imaging. Differences in gene expression were determined using t-tests; differences in blood flow were determined using linear mixed models. **RESULTS:** CD45<sup>+</sup>CD34<sup>+</sup>CD146<sup>+</sup> pericytes were positive for mesenchymal stem cell markers CD90 (74%) and CD105 (65%) and weakly positive for the pericyte marker PDGFRβ (42%) and the endothelial cell marker CD144 (36%). Pericytes transdifferentiated into skeletal myocytes, adipocytes, osteocytes, and endothelial cells. Pericytes had significantly (p<0.05) upregulated *Scal* (4.0-fold) gene expression, downregulated *CD31* (0.2-fold) gene expression, and no difference in *MyoD* (1.0-fold), *Pax3* (1.3-fold), or *Pax7* (1.0-fold) expression. Blood flow recovery in WT mice was significantly higher after pericyte transplantation than after vehicle control (p=0.03; 81.1±6% vs.

64.7±9% at postoperative day 28). Blood flow recovery in T2DM mice after pericyte transplantation was not different than after vehicle control ( $p=0.44$ ;  $50.1\pm4\%$  vs.  $53.5\pm4\%$  at postoperative day 28). **CONCLUSION:** T2DM negates the capacity of pericytes to augment neovascularization after limb ischemia. Further study is required to determine the mechanism by which T2DM impairs this pericyte function. Support: AAUW American Dissertation Fellowship

## B-70 Free Communication/Poster - Cold/Dive/Space Physiology

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

### 1042 Board #221 May 31 3:30 PM - 5:00 PM Differences in Energy Expenditure Between Genders in Ultra-Endurance Nordic Skiing

Michelle M. Johannsen, Kenneth Shin, Robert H. Coker, FACSM. *University of Alaska - Fairbanks, Fairbanks, AK.*  
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(No relationships reported)

**PURPOSE:** Given the new reclassification options for women serving in the, the purpose of this study was to evaluate sex differences in energy expenditure and body composition data collected during the Alaska Mountain Wilderness Ski Classic. **METHODS:** Fifteen race participants (8 males and 7 females, aged 31-54) were recruited for the study. Participants completed pre- and post-race body composition scans via dual energy x-ray absorptiometry (DEXA). Participants wore ActiGraph activity monitors around their wrists for the entire duration of their participation in the race. Pack weights were measured prior to the race. **RESULTS:** There was no difference in time to completion between men and women (ie.,  $125\pm 20.1$  hours and  $119.3\pm 18.0$  hours, respectively,  $p=0.6$ ). Pack weights relative to body mass were significantly lower in men ( $20.7\pm 2.0\%$ ) compared to women ( $25.9\pm 5.4\%$ ). Pre- and post-percent fat mass was significantly lower in men ( $14.8\pm 4.0$  and  $12.8\pm 3.5$ ) compared to women ( $19.8\pm 2.7$  and  $18.0\pm 2.5$ ), respectively. Calculated total energy expenditure for the duration of the race was higher in men ( $42,679$  and  $30,861$  kcal, men and women, respectively,  $p=0.002$ ). Energy expended in order to complete the race was proportionate to total weight (body and pack) regardless of gender ( $R^2=0.84$ ). **CONCLUSION:** Despite the challenge of carrying a heavier pack weight relative to their body mass, the women were able to complete the race in the same amount of time as the men. Previous studies suggest that at extreme distances women may possess a metabolic advantage over men. Further research is warranted to better understand the unique physiological advantages women in the military may offer under similar conditions.

### 1043 Board #222 May 31 3:30 PM - 5:00 PM A Thermochromic Leuco Dye Coated Glove for the Prevention of Frostbite in Cold Environments

Craig Verdin, Nilin Rao, Nicholas Williams, Joseph Albright, Michelle Hurlless, Michael Dzewit, Ellen Glickman, FACSM. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, PhD FACSM, FACSM)  
(No relationships reported)

**Background:** We have developed a prototype of a thermochromic leuco dye coated latex glove designed for the early prevention of frostbite in cold environments. The thermochromic leuco dye was calibrated to detect contact temperature and change color accordingly at temperatures of  $8^\circ\text{C}$  and below. **Purpose:** The purpose of this study was to evaluate the reliability and efficacy of the glove as a potential tool for the early detection of frostbite and adverse outcomes secondary to cold environments. **Methods:** Two trials were conducted in a constant environmental temperature set at  $24^\circ\text{C}$  and  $6^\circ\text{C}$  using an environmental chamber. Using a water bath, water was cooled to temperatures between  $5^\circ\text{C}$  and  $15^\circ\text{C}$  in  $1^\circ\text{C}$  increments. The thermochromic dye coated latex glove and was placed into the same temperature thermochromic dye coated latex glove five times at each temperature set point, in each trial. Visual findings were recorded and all data was analyzed using paired samples t-tests. **Results:** Color change was noted in 20/100 individual trials at all internal contact temperatures of  $8^\circ\text{C}$  and below. Mean internal contact temperature measurements were  $8.54 (\pm) 0.05^\circ\text{C}$  in Trial 1 ( $24^\circ\text{C}$  ambient) and  $8.48 (\pm) 0.04^\circ\text{C}$  in Trial 2 ( $6^\circ\text{C}$  ambient). It was concluded that there was no significant difference ( $p=0.208$ ) between threshold mean internal water temperature between the two trials at the targeted color change of red. **Conclusion:** The glove demonstrated a consistent color change at a threshold temperature of  $8^\circ\text{C}$  and below with all of the 100 individual trials at 2 different external environmental temperature set points, therefore, proving that ambient temperature has minimal influence on the necessary contact temperature required to elicit a color change. The results of this proof of concept supports the use

of a thermochromic dye coated latex glove as a visual, real time diagnostic tool for the prevention of cutaneous frostbite. Future work may therefore focus on developing this material for the military or outdoorsman for the early detection of cold injury in the field.

### 1044 Board #223 May 31 3:30 PM - 5:00 PM Evaluation of Three Rewarming Techniques Following Cold Water Immersion in Military Personnel.

Kaitlyn A. Rostomily, Douglas M. Jones, Christina K. Cooper, Dale S. Bergquist-Turori, Carina M. Pautz, Jay H. Heaney. *Naval Health Research Center, San Diego, CA.*  
(No relationships reported)

The Marine Corps Mountain Warfare Training Center (MCMWTC) conducts a Cold Weather Medicine course to educate students about first aid and treatment for cold injuries and illnesses. Students participate in a "hypothermia lab," consisting of immersion in cold water followed by rewarming. Currently, no body temperature values have been analyzed to support a rewarming technique that is most physiologically or perceptually effective. **PURPOSE:** To determine the impact of three rewarming techniques following cold water immersion, and to identify the most beneficial technique for rewarming warfighters in the field. **METHODS:** Thirty-eight military personnel participated in the MCMWTC hypothermia lab (mean  $\pm$  SD age:  $26 \pm 5$  yrs; height:  $1.8 \pm 0.09$  m; weight:  $83.2 \pm 10.9$  kg). Students fully immersed their bodies in cold water ( $0.3^\circ\text{C}$ ) and remained at neck-high level for 10 min. Post-immersion, students changed into a dry set of clothing and rewarmed for 60 min by either donning a sleeping bag ( $n = 13$ ), donning a sleeping bag while drinking 1 liter of warm liquids (SBWL,  $n = 13$ ), or completing a set exercise program ( $n = 12$ ). Core ( $T_{\text{core}}$ ) and mean skin temperature ( $T_{\text{MSK}}$ ), thermal sensation (TS,  $-4$  very cold to  $+4$  very hot), and shivering sensation (SS, 0 no shivering to 3 vigorous shivering) were recorded. **RESULTS:** No physiological or perceptual differences were seen between the three techniques.

		Sleeping bag	SBWL	Exercise	p value
Tcore	Pre	$35.8 \pm 1.4^\circ\text{C}$	$36.2 \pm 0.5^\circ\text{C}$	$36.0 \pm 1.3^\circ\text{C}$	0.666
	Post	$36.8 \pm 0.4^\circ\text{C}$	$36.7 \pm 1.0^\circ\text{C}$	$37.0 \pm 0.8^\circ\text{C}$	
TMSK	Pre	$16.7 \pm 1.7^\circ\text{C}$	$17.6 \pm 2.2^\circ\text{C}$	$17.3 \pm 1.3^\circ\text{C}$	0.111
	Post	$27.7 \pm 1.4^\circ\text{C}$	$28.5 \pm 1.4^\circ\text{C}$	$27.2 \pm 0.9^\circ\text{C}$	
TS	Pre	$-3.0 \pm -1.1$	$-3.2 \pm -1.5$	$-2.8 \pm -1.3$	0.137
	Post	$0.0 \pm 1.4$	$0.0 \pm 1.6$	$1.1 \pm 1.6$	
SS	Pre	$2.2 \pm 0.6$	$2.5 \pm 0.7$	$1.9 \pm 1.0$	0.128
	Post	$0.1 \pm 0.0$	$0.4 \pm 1.0$	$0.0 \pm 0.0$	

**CONCLUSION:** The three rewarming techniques were not physiologically or perceptually different after the 60-min rewarming period. Within the limitations of this study (participants, environment, and equipment), any of these three techniques would appear to be suitable for rewarming in the field.

### 1045 Board #224 May 31 3:30 PM - 5:00 PM Performance of Intravenous Insertion is Impaired Following Cold Water Immersion in Military Medical Providers

Christina K. Cooper, Douglas M. Jones, Kaitlyn A. Rostomily, Dale S. Bergquist-Turori, Carina M. Pautz, Jay H. Heaney. *Naval Health Research Center, San Diego, CA.*  
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Accidental cold water immersion or unprepared exposure to extreme cold temperatures can negatively impact warfighter performance and mission outcomes by hindering hands and feet use due to numbness. Skin or extremity temperature has been identified as a relevant variable that predicts impairment in manual dexterity and tactile sensitivity, yet no data have been presented showing performance of medically-specific tasks, such as intravenous (IV) insertion following a cold water immersion. **PURPOSE:** To determine the influence of cold water immersion and rewarming on IV insertion performance among military medical providers. **METHODS:** Thirty-eight military personnel (mean  $\pm$  SD age:  $25.8 \pm 5.4$  yrs, height:  $179.5 \pm 9.9$  cm, weight:  $83.2 \pm 10.9$  kg), trained in the technique of IV insertion, participated in a Cold Weather Medicine course. During the training exercise, students completed six stations: baseline in a classroom ( $5$  min,  $23^\circ\text{C}$ ), pre-immersion (pre) outdoors ( $5$  min,  $-4.6^\circ\text{C}$ ), immersion in cold water ( $10$  min,  $0.2^\circ\text{C}$ ), post-immersion (post) ( $5$  min, wet clothing,  $-4.6^\circ\text{C}$ ), transition ( $5$  min, change into dry clothing), and rewarming ( $60$  min, using various techniques). An IV insertion task was performed upon arrival at baseline, pre- and post-immersion, and after rewarming. The IV insertion task required students to insert an IV using a manikin arm. Students were assessed for time to insert IV and success of administering fluid. **RESULTS:** Assessment revealed a significant increase in IV insertion time ( $p<0.001$ ) and a decrease in IV insertion success rate following cold water immersion. IV insertion times (seconds) for each station were: baseline

82 ± 17, pre 70 ± 12, post 168 ± 45, and rewarm 73 ± 14. IV insertion success rates were similar among baseline (76%), pre (71%), and rewarm (84%) stations; however, post-immersion, IV success trended downward (47%). **CONCLUSION:** Results were consistent with the expected loss of manual dexterity following cold water immersion. When given one hour of rewarming, performance returned to baseline. It is essential that military personnel are educated and trained on the effects of accidental cold exposure, the impact it may have on their performance as medical providers, and appropriate extremity rewarming techniques.

1046 Board #225 May 31 3:30 PM - 5:00 PM

**BMI Of San Francisco Cold-water Swimmers: Comparisons To North American And International Masters Athletes**

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Recreational swimming in cold, open-water without a wetsuit continues to grow in popularity, attracting individuals with a wide variety of athletic backgrounds. Different than a polar bear plunge, cold-water swimming involves consistent swimming throughout the winter months. **PURPOSE:** To determine if cold-water swimmers have substantial differences in body mass index (BMI) vs. North American and International masters pool swimmers and International masters athletes from different sports. It is postulated that a higher BMI might have a protective benefit against heat loss and hypothermia during cold, open-water swims without wetsuits. **METHODS:** BMI was measured in a group of 103 open-water swimmers (mean age: 54 years; 76 men, 27 women), who swam consistently throughout the winter months in the San Francisco Bay, without wetsuits (median water temperature: 11°C [52°F]). Swimmers' values were compared to data from North American Masters pool swimmers (mean age: 57 years), International masters pool swimmers (mean age: 54 years), and International athletes from different sports (age range: 42-57 years). **RESULTS:** The average BMI values for cold-water swimmers in our study (25.9 kg/m<sup>2</sup>) were not significantly different than the average BMI of North American Masters pool swimmers (25.1 kg/m<sup>2</sup>; p=0.17) or International masters pool swimmers (25.3 kg/m<sup>2</sup>; p=0.16). On average, San Francisco cold-water swimmers had slightly higher BMI (kg/m<sup>2</sup>) (p<.05) than ultramarathon runners (23.0), track and field athletes (24.1), soccer players (24.5), and volleyball players (24.9), and lower (p<.05) BMI (kg/m<sup>2</sup>) than softball players (27.3). **CONCLUSIONS:** The BMI of cold-water swimmers is similar to North American and International Masters pool swimmers; and in general, is slightly higher than masters athletes from different sports. It appears that cold-water swimming abilities cannot be attributed to unique body composition; other factors such as acclimatization, heat production while swimming, and limiting time in cold water may be keys to preventing hypothermia.

1047 Board #226 May 31 3:30 PM - 5:00 PM

**BMI Of San Francisco Cold-water Swimmers: Comparisons To U.S. And Regional Populations**

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Higher body mass contributes to protection from hypothermia and one might assume that swimmers who swim consistently in cold water have more adipose tissue than average individuals. **PURPOSE:** To determine if cold-water swimmers have substantial differences in body mass index (BMI) which might have a protective effect against heat loss during swims in cold water without wetsuits. **METHODS:** BMI was measured in a group of 103 open-water swimmers (mean age: 54 years; 76 men, 27 women), who swam consistently throughout the winter months, in the San Francisco Bay, without wetsuits (median water temperature: 11°C [52°F]). Swimmers' values were compared to U.S., California, and San Francisco values, which were obtained through the National Health and Nutrition Examination Survey (NHANES) and the California Health Information Survey (CHIS). **RESULTS:** Average BMI values for cold-water swimmers in our study (25.9 kg/m<sup>2</sup>; range = 19 - 39) were significantly lower than U.S. (28.7 kg/m<sup>2</sup>) and California state BMI (27.3 kg/m<sup>2</sup>) averages (P<.001

for both comparisons). When comparing unadjusted averages, cold-water swimmers had a slightly higher BMI (25.9 kg/m<sup>2</sup>) than San Franciscans (25.1 kg/m<sup>2</sup>) (P=.02); however, after appropriately matching for age and sex, the adjusted average BMI of cold-water swimmers (25.9 kg/m<sup>2</sup>) was lower than the adjusted San Francisco average BMI (26.6 kg/m<sup>2</sup>) (P=.047). 10.7% of the cold-water swimmers were classified as obese (BMI > 30 kg/m<sup>2</sup>) vs. 35.7%, 24.8% and 11.3% in the U.S., California, and San Francisco populations, respectively; and 53.4% as overweight/obese (BMI > 25 kg/m<sup>2</sup>) vs. 68.8%, 59.8%, and 41.8% in the U.S., California, and San Francisco populations, respectively. **CONCLUSIONS:** The BMI of cold-water swimmers is lower or similar to the BMI of U.S., California, and San Francisco general populations. Protection from hypothermia in cold-water swimmers is likely related to other factors such as acclimatization, heat production while swimming, and limiting time in cold water.

1048 Board #227 May 31 3:30 PM - 5:00 PM

**Lipolysis, Substrate Metabolism, & Time Trial Performance In Cold Versus Thermo-neutral Environments In Trained Cyclists**

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The degree to which temperature affects endurance performance and exercise metabolism in trained athletes is not fully known. **PURPOSE:** In the present study, we investigated the impact of cold and neutral environmental temperatures on subcutaneous abdominal adipose tissue (SCAAT) lipolysis and whole-body substrate oxidation during submaximal steady-state cycling in trained cyclists. Additionally, we assessed subsequent time trial (TT) performance. **METHODS:** Ten trained male cyclists (age = 22.80 ± 2.76 yr; height = 178.58 ± 5.65 cm; mass = 74.02 ± 10.95 kg; body fat = 18.35 ± 3.37%; peak oxygen consumption (VO<sub>2peak</sub>) = 60.60 ± 4.67 ml·kg<sup>-1</sup>·min<sup>-1</sup>; power output in Watts (W) at lactate threshold (LT) = 234.00 ± 35.00 W) participated in a randomized, crossover designed study that consisted of baseline testing to determine LT and VO<sub>2peak</sub>; two familiarization trials, and two experimental trials. The experimental trials consisted of 25 min of cycling at 70% LT, followed immediately by 25 min at 90% LT in either cold (3.06±1.78°C; 41.63±5.60%RH) or thermoneutral (19.43±0.98°C; 38.97±2.23%RH) conditions. Following a 15-min break, subjects then completed a 20km thermoneutral trial. SCAAT interstitial glycerol concentrations were measured *in situ* throughout the trial via the microdialysis technique. Two-way (group x time) repeated measures analysis of variance tests and student t-tests (where appropriate) were used to identify differences between measured variables with significance set at p ≤ 0.05. **RESULTS:** A significant time effect was observed for HR (p < 0.001), core temperature (p < 0.001), interstitial glycerol (p < 0.001), blood lactate (p < 0.028), carbohydrate oxidation (p < 0.0001), fat oxidation (p < 0.0001), and VO<sub>2</sub> (p < 0.001). No significant differences were observed between conditions for any measured variable including TT performance (cold, 189.9±24.6 v. neutral, 187.5±27.4 W, p=0.858). **CONCLUSION:** SCAAT lipolysis increases during steady state exercise. However, metabolism and performance are not impacted by cold ambient conditions. This study was funded by the National Strength and Conditioning Association and Florida State University.

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**Leptin, Adiponectin, And Ghrelin Responses To Different Temperature Conditions With Endurance Exercise**

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(No relationships reported)

Obesity can result from a lack of energy expenditure or excessive energy intake. The appetite-regulating hormones leptin, adiponectin, and ghrelin may help decrease energy intake by affecting appetite. Exercise and exposure to extreme temperatures can independently affect these hormones. However, less is known on how exercise and temperature interact to affect appetite. **Purpose:** To determine the effect of exercise in different temperatures on the circulating concentrations of leptin, adiponectin, ghrelin, and acylated ghrelin. **Methods:** Eleven recreationally-trained male participants completed three separate 1 h cycling bouts at 60% W<sub>max</sub> in different environmental temperatures (Hot 33 °C, Cold 7 °C, Room Temperature 20 °C), followed by 3 h recovery at room temperature. Blood was drawn pre-exercise, post-exercise, and 3 h post-exercise from the antecubital vein. Hematocrit and hemoglobin were measured to account for changes in plasma volume. **Results:** Leptin concentrations were lower at post and 3 h post-exercise compared to pre-exercise, with and without correcting for plasma volume shifts, regardless of

temperature ( $p < 0.05$ ). Adiponectin was higher post-exercise than pre-exercise ( $p = 0.021$ ) and then returned to pre-exercise levels by 3 h post-exercise ( $p = 0.084$ ) without correction for plasma volume shifts. However, adiponectin concentrations were not different at any time point when plasma volume shifts were accounted for ( $p > 0.05$ ). Ghrelin and acylated ghrelin concentrations were not affected at post and 3 h post-exercise compared to pre-exercise, with and without correcting for plasma volume shifts, regardless of temperature ( $p > 0.05$ ). No differences in leptin, adiponectin, ghrelin or acylated ghrelin were found between trials ( $p > 0.05$ ). **Conclusion:** Temperature does not effect the circulating concentrations of leptin, adiponectin, or ghrelin during an acute bout of endurance exercise. Supported by the University of Nebraska-Omaha University Committee on Research and Creative Activity and the National Institute for General Medical Science (5P20GM103427).

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### Plasma Interleukin-6 Response to Environmental Temperature with Endurance Exercise

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An effective method to treat and prevent a multitude of low-grade inflammatory diseases is to reduce inflammation through regular exercise. The anti-inflammatory effect of exercise is predominantly influenced by the production of Interleukin-6 (IL-6) from the active skeletal musculature. The pro-inflammatory effects of IL-6 production derived from adipose tissue is reduced during exercise. However, the effect of IL-6 when exercising in different environmental conditions is currently unknown. **PURPOSE:** Determine the effects of exercise in hot, cold, and room temperature environments on plasma IL-6. **METHODS:** Eleven recreationally trained males (age =  $25 \pm 4$  y, height =  $178 \pm 5$  cm, weight =  $79.4 \pm 13.5$  kg,  $14.7 \pm 3.6$  % body fat,  $VO_{2\text{peak}} = 4.29 \pm 0.86$  L · min<sup>-1</sup>,  $W_{\text{max}} = 277 \pm 41$  W) performed a 1 h cycling bout in hot (H), cold (C), and room temperature (RT) environments ( $33$  °C,  $7$  °C,  $20$  °C, respectively) followed by 3 h of supine recovery at room temperature. Expired gases were measured every 15 minutes during exercise and once every hour during recovery. Heart rate (HR) was continuously measured throughout trial. Blood samples were obtained from the antecubital vein pre-exercise, immediately post-exercise, and 3 h post-exercise. Blood samples were analyzed for plasma concentrations of IL-6 using a commercial ELISA kit. **RESULTS:** Plasma IL-6 concentrations were higher immediately post-exercise ( $14.8 \pm 1.6$  pg · ml<sup>-1</sup>,  $p = 0.008$ ) and 3 h post-exercise ( $14.8 \pm 0.9$  pg · ml<sup>-1</sup>,  $p = 0.018$ ) compared to pre-exercise ( $11.4 \pm 2.4$  pg · ml<sup>-1</sup>) regardless of trial. There were no differences in plasma IL-6 concentrations ( $p = 0.207$ ) between H, C, and RT.  $VO_2$  and HR were higher and RER was lower in the hot compared to other conditions ( $p < 0.05$ ). **CONCLUSION:** These data indicate that temperature does not affect the acute exercise response of IL-6, despite differences in metabolic state. Funded by UCRCA Grant and NIGMS # 5P20GM103427

1051 Board #230 May 31 3:30 PM - 5:00 PM

### Irisin and Fibronectin Type III Domain-Containing 5 Responses to Exercise in Different Environmental Conditions

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Fibronectin type III domain-containing 5 (FNDC5) is a skeletal muscle membrane-bound precursor to the myokine irisin. Irisin is involved in stimulating adipose tissue to become more metabolically active in order to produce heat. It is unknown how exercising in different temperature environments affects the response of FNDC5 gene expression and blood irisin concentration. **PURPOSE:** To determine the effects of exercise in a hot ( $33$  °C), cold ( $7$  °C), and room temperature (RT,  $20$  °C) environment on the skeletal muscle gene expression of FNDC5 and the blood concentrations of irisin. **METHODS:** Twelve recreationally trained males completed three separate, 1 h cycling bouts at  $60\%$  of  $W_{\text{max}}$  in a hot, cold, and RT environment followed by three hours of recovery at room temperature. Blood samples were taken from the antecubital vein and muscle biopsies were taken from the vastus lateralis pre-, post-, and 3 h post-exercise. **RESULTS:** Plasma concentrations of irisin did not change from pre- ( $9.23 \pm 2.68$  pg · mL<sup>-1</sup>) to post-exercise ( $9.6 \pm 0.2$  pg · mL<sup>-1</sup>,  $p = 0.068$ ), but decreased from post-exercise to 3 h post-exercise ( $8.9 \pm 0.5$  pg · mL<sup>-1</sup>,  $p = 0.047$ ), regardless of temperature. However, when plasma volume shifts were considered, no differences were found in irisin at pre-, post-, or 3 h post-exercise ( $p = 0.086$ ). There were no differences between trials for irisin plasma concentrations

( $p = 0.984$ ). No differences in FNDC5 mRNA were observed between the hot, cold, and RT trials or between pre-, post-, and 3 h post-exercise time points ( $p > 0.05$ ). **CONCLUSION:** These data indicate that the temperature in which exercise takes place does not influence FNDC5 skeletal muscle transcription or circulating irisin in a human model. Funding provided by the University of Nebraska at Omaha Graduate Research and Creative Activity Grant and the National Institute for General Medical Science (NIGMS, 5P20GM103427).

1052 Board #231 May 31 3:30 PM - 5:00 PM

### Occupational Specific Strength Testing Enhances the Prediction of Astronaut Related Task Performance

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Future space missions beyond low earth orbit will require deconditioned astronauts to perform occupationally relevant tasks while confined within a spacesuit of significant mass. The prediction of task performance times under these conditions will be critical for crew safety, autonomous operations, and mission success. **PURPOSE:** Determine if the addition of task specific upper body strength testing to current National Aeronautics and Space Administration's (NASA) standard lower body testing would enhance the prediction of time-to-completion in a test battery designed to simulate astronaut related occupational tasks. **METHODS:** Eight, healthy participants of astronaut age ( $34.9 \pm 3.7$  years) completed six occupationally relevant tasks while wearing a 48-kg weighted suit designed to emulate the weight distribution of the NDX-2 planetary spacesuit. The six tasks performed were: hatch opening, hand drilling, construction wrenching, half-mile walk, collecting weighted samples, and dragging an unresponsive crewmember to safety. The time-to-complete each task was recorded and summed to obtain a total time for the test battery. In addition to the standard knee extensor-flexor strength and endurance tests employed at the NASA Johnson Space Center for crew health testing, task specific isometric strength was collected prior to each task for hatch opening, hand drilling, and wrenching. Linear regression was used to predict the dependent variable of total time-to-completion with two independent variable models 1): NASA upper leg standard measures alone and 2): NASA upper leg standard measures + task specific isometric testing for wrenching and hand drilling. **RESULTS:** Total time-to-completion of the test battery ranged from 20.2-44.5 minutes. NASA upper leg standard measures alone accounted for 61.5% of the variability in time-to-completion ( $p = 0.15$ ). The addition of hand drilling and wrenching testing to NASA upper leg standard measures accounted for 99.6% of the variability in time-to-completion ( $p = 0.047$ ). **CONCLUSION:** Adding occupational specific strength tests (hand drilling and wrenching) to NASA's standard lower extremity tests successfully predicted time-to-completion of a performance test battery within a weighted suit in 1G. Supported by ND NASA ESPCoR

1053 Board #232 May 31 3:30 PM - 5:00 PM

### Acute Effects of Blood Flow Restriction Resistance Exercise in a Head-down Tilt Position on Growth Hormone and Insulin-like Growth Factor-I Release

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Muscular atrophy is common among astronauts while in spaceflight. Growth Hormone (GH) and IGF-I are key hormones with regards to the preservation and growth of skeletal muscle tissue. Low intensity blood flow restriction (BFR) resistance exercise is a newer training modality employed to various populations to enhance muscle growth, yet has not been thoroughly explored in the astronaut population. **PURPOSE:** To determine the effects of low intensity BFR in a head-down tilt position on the acute release of GH and IGF-I. **METHODS:** Twelve college-aged males with resistance exercise experience were included in the study. The first of three sessions consisted of informed consent, demographic measurements, and 3RM testing. The two experimental sessions consisted of subjects resting in a -6 deg head-down tilt position for 2 hr. Upon rest completion, while tilted, subjects performed the exercise protocol at 30% of estimated 1RM for the following exercises: close-grip bench press, dumbbell bicep curls, and dumbbell triceps extensions. Exercises were performed with or without BFR (160 mmHg) to the upper arms in a counterbalanced order. Venus blood draws (15 mL) occurred 10 min prior to tilt, 10-15 min post exercise protocol, and 24 hr post exercise protocol and were assayed in duplicate. Two 2 x 2 Factorial ANOVAs with repeated measures were utilized for statistical analysis of the dependent

variables (GH, IGF-I). Alpha levels were set at  $p < 0.05$ . **RESULTS:** A significant interaction was found between exercise condition and time for GH ( $p < .05$ ). No significant interaction was found between exercise condition and time for IGF-I ( $p > .05$ ). No significant mean difference was observed between BFR and no BFR for IGF-I ( $p > .05$ ). A significant mean difference was observed pre to post exercise protocol for IGF-I ( $p < .05$ ). **CONCLUSION:** A low intensity BFR exercise protocol in a head-down tilt position elicited a large increase in systemic GH concentrations from pre to post exercise. Post exercise GH levels were elevated to a much greater extent with BFR compared to no BFR. A low intensity BFR modality may be beneficial to employ to astronauts while in spaceflight or post spaceflight to help promote muscular tissue growth.

1054 Board #233 May 31 3:30 PM - 5:00 PM  
**Peripheral Chemosensitivity is Not Blunted during Head Out Water Immersion**

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(No relationships reported)

Carbon dioxide (CO<sub>2</sub>) retention occurs during water immersion. The peripheral chemoreceptors contribute to ventilatory control and the rise in ventilation (V<sub>E</sub>) during hypercapnia. However, it is unclear if peripheral chemoreceptor control of V<sub>E</sub> is altered during water immersion.

**PURPOSE:** We tested the hypothesis that peripheral chemosensitivity (PCS) is blunted during head out water immersion (HOWI).

**METHODS:** We assessed PCS to hypoxia (PCS<sub>O<sub>2</sub></sub>) and hypercapnia (PCS<sub>CO<sub>2</sub></sub>) in 6 participants (age: 23 ± 3 y, BMI: 27 ± 2 kg/m<sup>2</sup>, 3 women) during two randomized trials: a time-control dry trial (DRY) and a thermoneutral (35 ± 0°C) HOWI trial. PCS<sub>O<sub>2</sub></sub> and PCS<sub>CO<sub>2</sub></sub> were assessed at baseline, and at 10, 60, and 120 min of DRY or HOWI. V<sub>E</sub>, arterial oxygen saturation (%SaO<sub>2</sub>), and the partial pressure of end tidal CO<sub>2</sub> (PETCO<sub>2</sub>) were recorded continuously. For the PCS<sub>O<sub>2</sub></sub> test, participants inhaled 2-6 breaths of 100% N<sub>2</sub>, followed by 3 min of room air breathing, 4 separate times. For the PCS<sub>CO<sub>2</sub></sub> test, participants inhaled 1 breath of 13% CO<sub>2</sub>, 21% O<sub>2</sub>, and 66% N<sub>2</sub>, followed by 3 min of room air breathing, 4 separate times. We determined the mean of the three highest consecutive V<sub>E</sub> values, the lowest %SaO<sub>2</sub>, and the peak PETCO<sub>2</sub> within 2 min following each hypoxic or hypercapnic administration. The PCS<sub>O<sub>2</sub></sub> and PCS<sub>CO<sub>2</sub></sub> data are reported as the slope of the linear regression line of V<sub>E</sub> vs. %SaO<sub>2</sub> or PETCO<sub>2</sub>, respectively.

**RESULTS:** V<sub>E</sub> was not different between HOWI and DRY (condition main effect:  $p = 0.12$ ). PETCO<sub>2</sub> was higher during HOWI vs. DRY at 10 (45.9 ± 2.2 vs. 43.9 ± 1.7 mmHg,  $p = 0.01$ ), 60 (46.0 ± 2.6 vs. 43.7 ± 1.8 mmHg,  $p = 0.005$ ), and 120 min (45.9 ± 2.5 vs. 44.0 ± 2.4 mmHg,  $p = 0.01$ ). PCS<sub>O<sub>2</sub></sub> was not different between HOWI and DRY (baseline: 0.41 ± 0.34 vs. 0.69 ± 0.44; 10 min: 0.40 ± 0.46 vs. 0.71 ± 0.57; 60 min: 0.33 ± 0.17 vs. 0.57 ± 0.59; and 120 min: 0.57 ± 0.29 vs. 0.73 ± 0.70 L/min/%SaO<sub>2</sub>; respectively, condition main effect:  $p = 0.20$ ). PCS<sub>CO<sub>2</sub></sub> was not different between HOWI and DRY (baseline: 0.07 ± 0.04 vs. 0.06 ± 0.03; 10 min: 0.06 ± 0.03 vs. 0.06 ± 0.01; 60 min: 0.08 ± 0.04 vs. 0.06 ± 0.03; and 120 min: 0.08 ± 0.02 vs. 0.07 ± 0.02 L/min/mmHg; respectively, condition main effect:  $p = 0.63$ ).

**CONCLUSION:** These data indicate that PCS<sub>O<sub>2</sub></sub> and PCS<sub>CO<sub>2</sub></sub> are not blunted during thermoneutral HOWI while breathing room air. Therefore, CO<sub>2</sub> retention during HOWI does not appear to be due to alterations in PCS.

1055 Board #234 May 31 3:30 PM - 5:00 PM  
**Effects of Consecutive, Long-Duration Water Immersions on Skeletal Muscle Performance in Well Trained, Male Divers**

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**PURPOSE:** Diving operations may require personnel to be immersed for extended periods while breathing compressed air. The objective of this study was to examine the effects of resting, consecutive long-duration water immersion (WIs) at 1.35 atmospheres absolute (ATA) on neuromuscular performance in multiple muscle groups. We hypothesized a decrease in neuromuscular performance will occur following five days of consecutive, resting, long-duration WIs. **METHODS:** Fifteen healthy, active male divers completed five consecutive 6-hour resting dives with 18-hour surface intervals while breathing compressed air at 1.35 ATA. Skeletal muscle performance was assessed immediately before and after each WI, and 24 and 72 hours after the final WI. Assessments included maximum voluntary isometric contractions (MVIC), maximal isokinetic (IK) contractions, maximum handgrip (MHG), and surface electromyography (sEMG) of the vastus lateralis, rectus femoris, vastus medialis, biceps brachii, and brachioradialis. **RESULTS:** MVIC knee extension peak

torque decreased by 6% ( $p=0.001$ ) with an associated 7% increase in rectus femoris activation ( $p=0.048$ ) by day 3. IK knee extension peak torque increased by 11% and 5% post-WI compared to pre-WI on days 3 and 5 ( $p<0.001$ ), respectively, with increased quadriceps sEMG activation ( $p<0.001$ ). However, an overall 3% decrease in torque production occurred on day 5 ( $p=0.015$ ). MVIC elbow flexion peak torque decreased by 2% ( $p=0.014$ ) on day 3 with an associated 12% decrease in biceps brachii sEMG activation ( $p=0.001$ ); both metrics fully recovered by day 5. Biceps brachii sEMG activation increased 3% and 9% during IK elbow flexion on days 3 and 5 ( $p<0.001$ ), respectively, with no change in torque production. MHG force output decreased 5% and 2% on days 3 and 5 ( $p<0.001$ ). Brachioradialis sEMG activation increased by 5% on day 3 ( $p=0.005$ ) and remained elevated through 72-hr post-WI ( $p<0.001$ ). All muscle performance metrics equaled or exceeded baseline levels by 72-hr post-WI. **CONCLUSION:** Consecutive, resting, long-duration WIs cause small, but noticeable decrements to neuromuscular activation and performance after three days of WI with an adaptation towards recovery by the end of the WI 5. Further analyses are required to determine the mechanisms involved.

1056 Board #235 May 31 3:30 PM - 5:00 PM  
**Regional Heat Exchange During a Dry Suit Glove Failure in Cold Water Immersive Diving**

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(No relationships reported)

Dry suit failures causing wet hands during cold-water diving can limit manual dexterity, affect comfort, or result in cold injury or hypothermia. While dry suit leaks are a known problem in the field, it is rarely captured and measured in controlled lab settings. **PURPOSE:** We quantified regional heat exchange with a glove leak while diving in cold water with thermal protective equipment in the form of a water-perfused tube suit (WPT). **METHODS:** A healthy male subject was immersed supine, just below the surface of the water (1.3±0.01 °C), for 115 min while wearing a WPT supplied with 37.8°C water and standard passive insulation under a dry suit. There was a slow leak at both wrists, resulting in wet gloves against the skin that was sensed by the subject within 7 min of immersion. The WPT was instrumented to measure 48 water temperatures for regional thermal exchange. Skin temperature (T<sub>s</sub>) in 13 regions and rectal temperature (T<sub>r</sub>) were measured via thermistors. All data were analyzed after T<sub>s</sub> stabilized 30 min into immersion. **RESULTS:** The WPT delivered a linear increase of heat energy (619±26 W). This maintained T<sub>r</sub>, which only decreased by ~0.24 °C, and mean T<sub>s</sub>, which was stable at 33.3±0.1 °C. T<sub>s</sub> including foot, calf, leg, abdomen, chest, upper and lower back, arm, and head remained stable, but forearm, hand, thumb and pinky T<sub>s</sub> decreased over time; however, all T<sub>s</sub> remained well above tissue injury level with the coldest being the pinky, which was ~22.3 °C at the end of the immersion. The WPT delivered the following mean proportions of heat (all ±1%): head=10%, chest=8%, back=14%, arms=12%, forearms=9%, hands=12%, anterior leg/lower leg=8/5%, posterior leg/lower leg=10/5%, and feet=6%. The leak caused 12% of heating resources to be devoted to hands, which made up only 3% of body surface area. **CONCLUSION:** For the first time, regional heat exchange was quantified with a specially designed WPT during a common cold-water diving scenario in which there is a leak wetting the hands. T<sub>s</sub> and T<sub>r</sub> remained in safe limits and/or unchanged as a result of heat delivery supplied by the WPT. Importantly, the forearm, hand and finger regions were successfully kept warm by the WPT despite the leak. However, there was a 2.7-fold larger amount of heat required per unit surface area to the wet hands than to the dry extremities - the feet. Supported by NAVSEA N0002416WX02277

1057 Board #236 May 31 3:30 PM - 5:00 PM  
**Rear Suspension Decreases Vibration and Impact Transmission in Manual Tilt-in-Space Wheelchairs**

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(No relationships reported)

Vibration and impact experienced by wheelchair users is a detriment to both comfort and health. However, manufacturers of manual tilt-in-space wheelchairs do not provide chairs with suspension. A rear-wheel aftermarket suspension system is now available for these chairs. **PURPOSE:** The goal of this study was to examine the vibration and impact reducing characteristics of rear suspension on manual tilt-in-space wheelchairs. **METHODS:** Four manual tilt-in-space wheelchair users with chairs equipped with rear suspension volunteered for the study (3 with cerebral palsy, 1 with quadriplegia; age = 27.7±7.0 yrs; height = 162±24 cm; mass = 50.2±17 kg (mean±SD)). Subjects were pushed by a trained caregiver over four different surfaces in both their suspended chair and a similar rigid chair. Surfaces included a 1) building exit door with elevated threshold followed by new concrete sidewalk with regularly spaced expansion seams, 2) section of fractured asphalt, 3) road crossing with bubbled transition ramp from sidewalk, and 4) pea gravel. Rigid chair trials were completed

first. Three acceptable trials were collected in each condition. Suspension chair trials needed to be within 0.5 sec (on average) of the matched rigid chair trials. A tri-axial accelerometer was mounted to the rear of the wheelchair seatpan with signals sampled at 2k Hz. Peak resultant accelerations were analyzed from surface 1, root mean square (RMS) resultant accelerations were analyzed from surfaces 2-4. **RESULTS:** Peak accelerations when the rear wheel traversed the door threshold and expansion seems of section 1 were significantly reduced from 47-79% in the suspended chair ( $p < 0.011$ ). Peak accelerations at the front wheel were also reduced with rear suspension, but not to the same extent ( $p$  not consistently  $< 0.050$ ). RMS accelerations were significantly reduced by 50% over surfaces 2 & 3 ( $p = 0.013$  and  $p = 0.050$ , respectively), and 56% over surface 4 ( $p = 0.002$ ) with rear suspension. **CONCLUSION:** Aftermarket rear suspension significantly reduces vibration and impact transmission of rough surface conditions to the users of manual tilt-in-space wheelchairs. The reduced accelerations most likely improve both comfort and health outcomes of users (e.g., low-back pain, neck pain, muscle ache and fatigue).

1058 Board #237 May 31 3:30 PM - 5:00 PM

### Long-duration Spaceflight And Latent Viral Reactivation Alter Plasma Antimicrobial Protein Concentrations.

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Long duration spaceflights have been associated with profound dysregulation of the immune system and latent viral reactivations, which could jeopardize crew safety and mission success. The dearth of information on the impact of long duration spaceflight on innate immunity raises concerns on crewmembers' ability to fight infections during a mission. **Purpose:** To determine the effects of spaceflight on plasma antimicrobial proteins (AMPs) and reactivation of latent herpesviruses. **Methods:** Plasma, saliva and urine samples were obtained from 23 crewmembers who spent 6-months on the International Space Station (ISS). Samples were collected before flight, during (Early flight, Late Flight), immediately upon return to Earth (R+0) and 30 days following return (Recovery). Plasma Albumin, LL-37, HNP 1-3 and lysozyme concentrations were determined by ELISA. Saliva Epstein-Barr virus (EBV), varicella zoster virus (VZV) and urine cytomegalovirus (CMV) DNA levels were quantified by Real-Time PCR. Maximum likelihood linear mixed models (LMM) were used to determine main effects of time, and viral shedding status on the concentration of each AMPs. **Results:** The levels of viral EBV DNA were significantly higher during flight than at baseline, and VZV DNA concentrations increased during and after flight when compared to pre-flight level. CMV DNA level did not change during flight, but significant increased upon return on earth and during recovery, compared to baseline and in-flight viral concentrations. The magnitude of CMV reactivation after return was associated with reductions in plasma LL-37 concentrations, while EBV and VZV reactivations during the early stages of the missions preceded HNP1-3 and Lysozyme increases during Late flight. Following return on Earth and during recovery, HNP1-3 and Lysozyme concentrations were associated with EBV and VZV viral DNA levels, reducing the magnitude of viral reactivation. **Conclusion:** Innate immunity appeared to be partially restored after 6-months in space and the release of plasma HNP1-3 and Lysozyme enabled the reduction of EBV and VZV reactivation rate and magnitude. However, the landing-associated decline in plasma LL-37 is likely to enhance the rate of CMV reactivation in Astronauts following spaceflight, potentially compromising crewmember health after landing.

1059 Board #238 May 31 3:30 PM - 5:00 PM

### Facilitation of Paraspinal Muscles with Kinesio® Tape During Exercise Countermeasures

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Declines in skeletal muscle function and physiological deconditioning during spaceflight have been well documented, giving way to exercise countermeasures such as the Advanced Resistive Exercise Device (ARED). Because of the high loads placed on the spine, a pitfall to using ARED is the possibility of paraspinal muscle overload leading to injury. Enhancing the force production capability of the paraspinal muscles during exercise may help mitigate concern and maintain exercise form. **PURPOSE:** To examine Kinesio® Tape as an intervention to facilitate the paraspinal muscles during back squat. **METHODS:** Thirty-two healthy subjects (age =  $34.4 \pm 7.9$  yrs) completed a maximal voluntary isometric contraction (MVC) for back squat (control). Subjects completed

two sets of eight repetitions at 70% of their MVC. To examine the effect Kinesio® Tape during exercise while controlling for fatigue, subjects were randomized to two conditions: tape applied during the first set ( $N=16$ ) or second set ( $N=16$ ). Prior to each set, an additional MVC was obtained to explore peak force and rate of force development (RFD) with tape. Joint markers were placed on subjects to analyze hip and knee angles. For MVC, a repeated measures ANOVA was completed with Bonferroni adjustment to examine differences between conditions. Paired  $t$ -tests were completed to examine differences in RFD and joint kinematics between the two conditions.

**RESULTS:** Significant decreases in MVC were observed with and without the application of tape when compared with the control (tape =  $92.84 \pm 98.88$  kg, no tape =  $92.68 \pm 38.44$  kg, control =  $96.43 \pm 39.97$  kg,  $p = 0.01$  and  $p = 0.02$ , respectively). However, no significant differences were observed between conditions in RFD ( $p = 0.280$ ). During the last repetition (i.e. most fatiguing), joint kinematics of the hip (tape =  $83.02 \pm 11.98^\circ$ , no tape =  $84.90 \pm 11.81^\circ$ ,  $p = 0.140$ ) and knee (tape =  $90.90 \pm 10.16^\circ$ , no tape =  $91.35 \pm 9.24^\circ$ ,  $p = 0.678$ ) were not significantly different at the lowest point of the squat.

**CONCLUSION:** The application of Kinesio® Tape to the paraspinal muscles during back squat does not enhance peak force, rate of force production, or alter exercise form. However, future studies in deconditioned participants may warrant further investigation especially for application in long-duration spaceflight.

Support ND Space Grant Consortium

1060 Board #239 May 31 3:30 PM - 5:00 PM

### Submaximal Exercise Responses Before and During Long Duration Space Flight

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**PURPOSE:** To document the cardiopulmonary responses to submaximal exercise during long-duration International Space Station (ISS) missions. **METHODS:** Astronauts ( $n=14$ ) assigned to ISS missions (range: 91-192 d) performed cycle exercise testing ~90 d before launch, ~15 d after launch and every ~30 d thereafter. Peak oxygen consumption ( $VO_{2pk}$ ) data were previously reported (Moore, et al, 2014). Heart rate (HR, ECG), and oxygen consumption ( $VO_2$ , Portable Pulmonary Function System, DAC, Denmark) were measured at rest and during 5-min work rates prescribed to elicit 25, 50, and 75% of preflight  $VO_{2pk}$ . Cardiac output (Q, Freon 22/SF6 technique) was measured at rest and the 25 and 50% stages. Stroke volume (SV) and arterial-venous oxygen difference ( $a-v O_2d$ ) were calculated. Inflight outcomes were compared to preflight values using mixed-model linear regression with preflight body weight as a covariate. To account for multiplicity, significance thresholds for  $P$  values were adjusted (Hochberg procedure). No time trend during flight was evident, thus inflight data are reported as a single outcome. **RESULTS:** During spaceflight, neither resting  $VO_2$  (Pre:  $0.41 \pm 0.12$ , In:  $0.33 \pm 0.07$  L/min; Mean  $\pm$  SD) nor HR (Pre:  $71 \pm 10$ , In:  $69 \pm 11$  bpm) differed from preflight, but resting Q (Pre:  $5.8 \pm 0.9$ ; In:  $7.6 \pm 0.9$  L/min) and SV (Pre:  $83 \pm 19$ , In:  $112 \pm 21$  ml/beat) were higher while resting  $a-v O_2d$  was lower (Pre:  $7.0 \pm 2.0$ , In:  $4.4 \pm 0.8$  ml  $O_2$ /100 mL). During exercise,  $VO_2$  was lower at the 25% stage during flight (Pre:  $0.95 \pm 0.19$ , In:  $0.81 \pm 0.14$  L/min), but did not differ from preflight during any other exercise stage. Inflight HR did not differ from preflight in the 25% stage (Pre:  $88 \pm 11$ , In:  $89 \pm 14$  bpm), but HR was elevated during the 50% stage (Pre:  $113 \pm 15$ , In:  $122 \pm 16$  bpm) and the 75% stage (Pre:  $147 \pm 16$ , In:  $158 \pm 16$  bpm). In contrast to rest, exercise Q and SV did not differ from pre-flight, although  $a-v O_2d$  was reduced during both the 25% stage (Pre:  $9.8 \pm 0.8$ , In:  $7.7 \pm 0.5$  ml  $O_2$ /100 mL) and the 50% stage (Pre:  $12.8 \pm 0.9$ , In:  $10.2 \pm 0.8$  ml  $O_2$ /100 mL). **CONCLUSION:** Lower  $VO_2$  during the 25% stage on ISS may result from reduced metabolic cost of pedal upstroke. Maintained exercise Q and SV during flight suggest central cardiovascular factors did not limit submaximal exercise at these levels. Lower  $a-v O_2d$  during flight may be related to altered blood flow distribution in space.

1061 Board #240 May 31 3:30 PM - 5:00 PM

### Metabolic and Cardiovascular Indicators of Intensity and Performance during Astronaut Related Test Battery

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(No relationships reported)

The deconditioning of astronauts from weightlessness exposure in space may limit their ability to complete a variety of occupational relevant tasks efficiently upon landing, especially when confined within a space suit of additional mass. The tradeoff between task specificity and intensity will be important to predict the potential completion times of these tasks. **PURPOSE:** Compare task specific metabolism

and determine if a simple cardiovascular indicator (i.e., resting heart rate, HR) can be used to predict total time-to-completion during an astronaut related test array. **METHODS:** Eight, healthy participants wore a 48-kg weight suit and completed six occupationally relevant tasks. Tasks included hatch opening (HO), hand drilling (HD), construction wrenching (CW), a half-mile walk (HM), sample collection (SC), and dragging a crewmember to safety (DC). Total completion time for the array was calculated by summing each task's completion time. The metabolic demands of each task were recorded using a metabolic cart. One-way ANOVAS were used to identify differences in  $\text{VO}_2$ ,  $\text{VCO}_2$ , RER, VE, and RR between HO, HD, CW, and HM, as well as differences in post HR between all tasks. Tukey Post-Hoc tests were used to distinguish specific task differences. Linear regression was used, with an enter method, to predict total time-to-completion from resting HR values. **RESULTS:** The peak  $\text{VO}_2$  of HD was significantly lower than both CW ( $p = .002$ ) and HM ( $p = .001$ ). The peak  $\text{VCO}_2$  of HD was significantly lower than HO ( $p = .025$ ), CW ( $p = .029$ ), and HM ( $p = .004$ ). Mean RER for HO was significantly higher than both CW ( $p = .024$ ) and HM ( $p = .022$ ). No significant differences were observed for VE ( $p = .082$ ) and RR ( $p = .941$ ), and post HR ( $p = .087$ ). Resting HR was a significant predictor ( $p = .027$ ) of total time-to-completion. **CONCLUSIONS:** Occupational tasks in a weighted suit showed a variety of metabolic characteristics and alterations in fuel sources. The resting HR of subjects significantly predicted the total time-to-completion of an astronaut relevant test array performed within a weighted suit in 1G. Resting HR can be easily monitored in novel environments and may be a useful tool for determining an astronaut's physical activity readiness for space relevant tasks. **Supported by ND NASA ESPCoR**

1062 Board #241 May 31 3:30 PM - 5:00 PM  
**Heart Rate and Blood Pressure Regulation before and after 60 Days of Bed Rest**

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**PURPOSE:** To test the hypothesis that the regulation of heart rate (HR) and mean blood pressure (mBP) in response to moderate work rate (WR) changes differs before and after 60 days of bed rest. **METHODS:** Twenty-two male subjects (mean  $\pm$  SD): 29  $\pm$  6 years, 181  $\pm$  6 cm, 77  $\pm$  7 kg) were tested using a moderate WR protocol with pseudo-random binary sequences (PRBS) between 30W and 80W on an upright cycle ergometer before and after 60 days of 6° head down tilt (HDT) bedrest. Eleven of the twenty-two subjects participated in a near-daily reactive jump training intervention during bed rest, using a horizontal sledge jump system (TRAIN). The other 11 subjects served as a control group (CTRL). The test was performed 9 days before the HDT period (BDC-9) and 2 days after (R+2) reambulation. HR and mBP were measured beat-to-beat during the cycle ergometer test and kinetics responses were calculated via time-series analysis. Higher maxima of the cross correlation function between WR and the respective parameter (CCF<sub>max</sub>) indicate faster kinetics responses. ANOVA with the factors 'group' and 'point in time' combined with LSD post hoc tests were applied to calculate differences in kinetics between sessions as well as absolute values of HR and mBP during the PRBS. **RESULTS:** Significant effects were identified for point in time for the parameters CCF<sub>max</sub>(HR) (BDC-9: 0.328  $\pm$  0.093, R+2: 0.273  $\pm$  0.062;  $P = 0.020$ ) and CCF<sub>max</sub>(mBP) (BDC-9: 0.237  $\pm$  0.069, R+2: 0.338  $\pm$  0.134;  $P = 0.009$ ), but not for point in time x group or group. Absolute values of HR during the PRBS (point in time:  $P = 0.001$ , point in time x group:  $P = 0.002$ , group: n.s.) were significantly higher at R+2 compared with BDC-9 (101  $\pm$  12 min<sup>-1</sup> vs. 115  $\pm$  12 min<sup>-1</sup>,  $P < 0.001$ ), but only in the CTRL group. For the absolute mBP values a significant effect for 'point in time' (100  $\pm$  12 mmHg,  $P = 0.029$ ) but not for point in time x group or group was found. **CONCLUSION:** 60 days of bed rest affected the kinetics response to moderate WR changes during upright cycling, but differently for HR and mBP kinetics. As indicated by the higher absolute HR values during the PRBS, sympathetic nervous system activity might have increased after bed rest. This could have slowed HR kinetics and, as a result of the baroreceptor reflex, accelerated mBP kinetics.

1063 Board #242 May 31 3:30 PM - 5:00 PM  
**Baroreceptor Unloading Attenuates the Increase in Blood Pressure Elicited by Prolonged Face Cooling**

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**Purpose:** We tested the hypothesis that baroreceptor unloading does not interfere with the magnitude of blood pressure elevation elicited by prolonged face cooling. **Methods:** Ten healthy subjects (age: 22  $\pm$  2 y, 6 females) completed two trials in which a 2.5 L bag of ice water (0  $\pm$  0°C) was placed over their cheeks, eyes, and

forehead for 15 min. On separate days, face cooling was carried out in the absence of (REST) and during 30 mmHg lower body negative pressure (LBNP). In REST, face cooling began after 10 min of supine rest, while in LBNP face cooling began following 6 min of lower body negative pressure. Blood pressure (Finometer), heart rate (ECG), stroke volume (Modellflow), cardiac output, total peripheral and cutaneous vascular resistances, and forehead temperature were measured. Data are presented as 1 min averages prior to face cooling and during the final minute of face cooling. **Results:** During face cooling, reductions in forehead temperature did not differ between REST (-21.2  $\pm$  3.7°C) and LBNP (-22.8  $\pm$  2.0°C,  $P = 0.17$ ). Mean arterial pressure before face cooling was lower in LBNP (78  $\pm$  11 mmHg) compared to REST (83  $\pm$  9 mmHg,  $P = 0.02$ ). The magnitude of increase in mean arterial pressure with face cooling was attenuated in LBNP (+12  $\pm$  14 mmHg vs. +22  $\pm$  10 mmHg,  $P = 0.03$ ). Heart rate was higher and stroke volume was lower before face cooling in LBNP (85  $\pm$  23 bpm, 77  $\pm$  18 mL) compared to REST (62  $\pm$  13 bpm, 97  $\pm$  18 mL,  $P < 0.01$ ). During face cooling, stroke volume remained lower in LBNP (90  $\pm$  27 mL vs. 107  $\pm$  23 mL,  $P = 0.02$ ), but heart rate was not different (LBNP: 67  $\pm$  10 bpm, REST: 64  $\pm$  12 bpm,  $P = 0.68$ ). Cardiac output did not differ between trials before face cooling (REST: 5.9  $\pm$  1.4 L/min, LBNP: 6.3  $\pm$  1.4 L/min,  $P = 0.39$ ) but was lower in LBNP during face cooling (5.8  $\pm$  1.4 L/min vs. 6.7  $\pm$  1.7 L/min,  $P = 0.04$ ). Total peripheral (REST: 14.8  $\pm$  4.0 mmHg/L/min, LBNP: 13.0  $\pm$  3.7 mmHg/L/min,  $P = 0.24$ ) and cutaneous vascular (REST: 2.7  $\pm$  1.4 mmHg/PU, LBNP: 3.1  $\pm$  1.7 mmHg/PU,  $P = 0.93$ ) resistances before face cooling were not different between trials and increases in resistance during face cooling did not differ between REST (+2.1  $\pm$  3.7 mmHg/L/min, +1.4  $\pm$  1.6 mmHg/PU) and LBNP (+3.3  $\pm$  3.8 mmHg/L/min, +0.2  $\pm$  0.9 mmHg/PU,  $P < 0.11$ ). **Conclusion:** Baroreceptor unloading, induced by LBNP, attenuates increases in blood pressure elicited by prolonged face cooling. Supported by a UB IMPACT award

**B-71 Free Communication/Poster - Ergogenic Aids II**  
 Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
 Room: Hall F

1064 Board #243 May 31 3:30 PM - 5:00 PM

**Short Bouts Of Resistance Training Reduces Lipid Metabolism Disparities In T2d Offspring In 6 Weeks**

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Having a family history of diabetes (FH+) increases type 2 diabetes (T2D) risk, and is associated with metabolic flexibility, and mitochondrial dysfunction. However, the mechanisms underlying these differences remain elusive. Exercise has a protective effect on metabolic health and mitochondrial function, and we have shown resistance training (RT) can improve fasting glucose in FH+ and those with no family history of T2D (FH-) similarly. However, little is known about the impact of RT on lipid metabolism in the FH+ population.

**Purpose:** To evaluate markers of lipid metabolism in FH+ and FH- before and after 6 weeks of RT.

**Methods:** 10 healthy FH- and 13 healthy FH+ age and gender matched men and women participated in 6 weeks of RT, ~10 min/session, 5 days/week, including full-body, plyometric and core exercises on alternate days. Fasting plasma samples were collected prior to, and after 6 weeks of RT for triglycerides (TG), non-esterified fatty acids (NEFA) and acylcarnitine (AC) determination, followed by an oral glucose challenge (OGC, 50g glucose).

**Results:** No baseline differences in strength, fasting glucose, OGC area under the curve (AUC), body weight, or circulating TG and insulin were noted between groups. Though, FH+ displayed lower circulating NEFA (276  $\pm$  37 vs 412  $\pm$  44 mM for FH+/-,  $p < 0.04$ ), and had lower medium chain (C8-1, C10:1, C14-2, C14-1;  $p < 0.04$ ) and higher long-chain AC (C16:2, C18-2, C18-1 ( $\mu$ M,  $p < 0.05$ ) compared to FH- prior to RT. NEFA and fasting glucose declined (32.1 and 6.8% respectively) overall with RT ( $p < 0.05$ ) with no difference in changes between groups ( $p = 0.33$  and 0.55 respectively). Though AC did not change differently between groups with RT, only C18-1 remained different between FH+ and FH- post-RT. Changes in AC were positively correlated with change in NEFA in FH+ (C8:1-OH/C9, C3-DC/C8-OH, C10-OH/C5-DC, C12/C6:1-DC, C12:1-OH, C14-2, C14-1, C18:2-OH;  $r > 0.6$ ,  $p < 0.04$ ), but not in FH-.

**Conclusions:** Healthy young FH+ display a fasting AC profile different than FH-, suggesting alterations in fat metabolism that may contribute to increased T2D risk. These disparities in AC profiles were diminished after RT, suggesting that 6 weeks of short RT bouts normalizes lipid metabolism in FH+. RT may protect against impaired lipid metabolism in FH+, thereby protecting against T2D.

1065 Board #244 May 31 3:30 PM - 5:00 PM

### Caffeine and Sprint Cycling Performance: The Influence of Torque Factor and Sprint Duration

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**PURPOSE:** The aim of this study was to investigate the effects of caffeine supplementation on sprint cycling performance and how those effects are influenced by torque factor and sprint duration. **METHODS:** 13 recreationally active men (age: 20 ± 2 years; height: 1.78 ± 0.06 m; body mass: 75.3 ± 7.6 kg) completed nine trials on an electromagnetically-braked cycle ergometer. In Trial 1, participants completed a series of 6 s sprints (separated by 5 min passive recovery periods) at progressively increasing torque factors (0.4 - 1.25 N·m·kg<sup>-1</sup>), to determine the torque factor (for each individual) which elicited the highest peak power output (T<sub>OPTIMAL</sub>). The remaining trials followed a counterbalanced randomised design in which torque factor (0.8 N·m·kg<sup>-1</sup> versus T<sub>OPTIMAL</sub>), sprint duration (10 s versus 30 s), and supplementation (caffeine versus placebo) were manipulated such that all possible combinations of conditions were experienced by each participant. One hour before trials 2 - 9, participants ingested a gelatine capsule containing 5 mg·kg<sup>-1</sup> of either caffeine or placebo (maltodextrin). **RESULTS:** There was a significant effect of torque factor on peak power output (PPO) ( $F_{(1,12)} = 188.3; p < 0.001$ ), with higher values at T<sub>OPTIMAL</sub> (mean difference: 168 W; 95% likely range: 142 - 195 W). There was also a significant effect of sprint duration on PPO ( $F_{(1,12)} = 11.4; p = 0.006$ ), with values being higher in 10 s sprints (mean difference: 52 W; 95% likely range: 18 - 86 W). However, there was no effect of supplementation on PPO ( $F_{(1,12)} = 4.5; p = 0.056$ ). Nevertheless, there was a significant torque factor × sprint duration × supplement interaction ( $F_{(1,12)} = 5.5; p = 0.036$ ), with *post hoc* tests revealing that caffeine produced a significantly greater PPO (mean difference: 76 ± 75 W; 95% likely range: 19 - 133 W) only when the sprint duration was 10 s and the torque factor was T<sub>OPTIMAL</sub>. **CONCLUSIONS:** The results of this study confirm previous reports of significant effects of torque factor and sprint duration on PPO. Moreover, when torque factor and sprint duration are optimised to allow participants to express their highest PPO there is a clear effect of caffeine on sprinting performance.

1066 Board #245 May 31 3:30 PM - 5:00 PM

### Caffeine's Effects on an Upper Body Resistance Exercise Strength Workout

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(No relationships reported)

**Purpose:** The purpose of this study was to examine the effects of caffeine on an upper body resistance training strength workout using the barbell bench press.

**Methods:** Fifteen men ( $M \pm SD$ , age: 23.1 ± 1.9 years; body mass: 89.1 ± 13.9 kg; height: 175 ± 6.1 cm), volunteered for three laboratory visits. During visit one, 1RM values were determined. For visit two, subjects consumed either 800 mg caffeine, or a placebo. Subjects then completed three sets of the barbell bench press to failure at 80% 1RM. Visit three was the same as visit two; however, participants consumed the opposite treatment as visit two.

**Results:** Participants completed significantly more average repetitions per set for the barbell bench press in the caffeine condition ( $M \pm SD = 4.80 \pm 2.66$  repetitions) compared to the placebo condition ( $M \pm SD = 4.42 \pm 2.56$  repetitions).

**Conclusions:** These results suggest that caffeine has a positive ergogenic effect on upper body strength workout performance.

1067 Board #246 May 31 3:30 PM - 5:00 PM  
**The Effect of Coffee or Advocare's Spark on Anaerobic Performance and Isometric Strength**

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**PURPOSE:** The purpose of this study was to determine if caffeine in the form of coffee or Advocare's Spark would increase performance in anaerobic exercise and isometric strength.

**METHODS:** Subjects (N = 16) completed three testing sessions on non-concurrent days. Each trial consisted of a standard warm up followed by a 600 yard shuttle run, a maximal grip strength test, and an isometric front plank to exhaustion. The first trial was a control trial where caffeine was absent and served as a baseline. A cross over design was used, and subjects completed two additional trials: one with coffee and the other with Advocare's Spark. The amount of caffeine given to each participant was 4 mg/kg body weight.

**RESULTS:** A MANOVA was run to determine if significant differences existed in isometric strength or anaerobic exercise with the use of Advocare's Spark or coffee. The use of coffee or Advocare's Spark showed no significant ( $p > .05$ ) effect on 600 yard shuttle time when compared to the control trial ( $F = 1.256$ ). ( $M = 123.65 \text{ s} \pm 42.43 \text{ s}$ ;  $M = 121.73 \text{ s} \pm 38.92 \text{ s}$ ;  $M = 123.64 \text{ s} \pm 37.49 \text{ s}$  respectively) The use of coffee or Advocare's Spark showed no significant ( $p > .05$ ) effect on plank time to exhaustion when compared to the control trial ( $F = 2.347$ ). ( $128.89 \text{ s} \pm 60.30 \text{ s}$ ;  $M = 120.44 \text{ s} \pm 53.54 \text{ s}$ ;  $M = 111.10 \text{ s} \pm 48.97 \text{ s}$ , respectively) The use of coffee or Advocare's Spark showed no significant effect on grip strength when compared to the control trial ( $F = 1.289$ ). ( $M = 45.44 \text{ kg} \pm 12.90 \text{ kg}$ ;  $M = 45.44 \text{ kg} \pm 13.30 \text{ kg}$ ;  $M = 43.81 \text{ kg} \pm 14.02 \text{ kg}$ , respectively)

**CONCLUSIONS:** The use of caffeine did not significantly increase performance in either anaerobic exercise or isometric strength. While many studies have shown that caffeine will have a positive effect on exercise performance, the present study may not have provided a great enough dose of caffeine to elicit a positive response. Caffeine consumption greater than 4mg/kg may be necessary to elicit improvements in anaerobic performance & isometric strength.

1068 Board #247 May 31 3:30 PM - 5:00 PM

### Caffeine Mouth Rinse Does Not Affect Sweating Rate And Performance In Runners

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(No relationships reported)

Caffeine plays ergogenic effects improving the physical performance. On the other hand, caffeine supplements and foods can affect sweating rate impairing the performance. **PURPOSE:** To examine the effects of caffeine mouth rinses on sweating rate and performance in runners.

**METHODS:** Ten runners completed two experimental trials performed in acute 10 km test in a double-blind, crossover and placebo controlled design. All subjects are > 18 years old (30.1 ± 6.4 y) and according to DEXA, the fat mass percentage is 19.3. Treatments were placebo or caffeine anhydrous power, separated by a washout time 7d. Athletes were instructed to maintain physical activity and normal diet restricted in caffeine for two days before experimental trial. The running was immediately started after 10 seconds of mouth rinses either caffeine or placebo. The measurement of the sweating rate and performance were evaluated by formula and time record, respectively. Student's t test was applied to evaluate probable difference between placebo and caffeine.

**RESULTS:** Sweating rate (mL/min) was not different among placebo (16.1 ± 9.6) and caffeine (12.9 ± 6.8) groups ( $p = 0.399$ ). Moreover, time running (min) also does not shown statistical difference, 46.8 ± 5.2 in placebo and 47.0 ± 6.3 in caffeine group ( $p = 0.939$ ).

**CONCLUSIONS:** Caffeine mouth rinse does not alter sweating rate and time running in 10 km trial test.

Supported by grant FAPEG, Brazil.

- 1069 Board #248 May 31 3:30 PM - 5:00 PM  
**The Effect Of The Cyp1a2 -163 c>A Polymorphism On The Metabolism Of Caffeine And Effect On Performance**  
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 (No relationships reported)

Prior studies suggest that the -163 C > A polymorphism of the Cytochrome P450 (CYP1A2) gene influences the ergogenic effect of caffeine. Although this polymorphism has been known to influence the inducibility of hepatic CYP1A2 and the rate of caffeine metabolism, levels of caffeine and/or metabolites were not reported. Thus, a mechanistic link between the polymorphism and the ergogenic effect of caffeine is lacking. **Purpose:** The purpose of the present study was to determine if the CYP1A2 polymorphism (AA homozygotes and C allele carriers) affected caffeine metabolism and subsequent performance. **Methods:** Twenty subjects participated in two 3-km cycling time trials with placebo (all-purpose flour) and caffeine (6mg/kg body weight anhydrous caffeine) supplementation. 'Slow metabolizers' were characterized as possessing a 'C' allele (grouped AC heterozygotes, and CC homozygotes), and 'fast metabolizers' were homozygous for the A allele. **Results:** C allele carriers had significantly higher serum caffeine after one hour (C allele carriers = 14.2 ± 1.8 ppm, AA homozygotes = 11.7 ± 1.7 ppm). While there was a main effect for caffeine ingestion on time trial performance, there was no caffeine x genotype interaction (C allele carriers: Placebo = 297 ± 20 sec, Caffeine = 292 ± 20 sec; AA homozygotes: Placebo = 318 ± 35 sec; Caffeine = 308 ± 22 sec). **Conclusions:** Results from this study suggest that C allele carriers have higher serum caffeine after one hour than AA homozygotes, consistent with the assertion that C allele carriers exhibit slower caffeine metabolism. These findings do not support a genetic influence on the ergogenic effect of caffeine in a 3km cycling trial.

- 1070 Board #249 May 31 3:30 PM - 5:00 PM  
**Expression of Strength and Power Relative to Lean Body Mass Impacts Results of Caffeine Intervention**  
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 (No relationships reported)

Differences in performance tests for strength or power could be attributed to the amount of lean body mass (LBM). So it may be important to report results of such tests not only relative to weight, but also relative to LBM. Depending on their proposed ergogenic mechanism(s), discerning between absolute and relative strength may be even more important in dietary supplement research. **Purpose:** Previously, our lab examined effects of caffeine withdrawal and acute caffeine ingestion, while this current investigation aims to elucidate if the prior results are dependent upon whether strength and power variables are expressed in absolute values or relative to body mass / LBM. **Methods:** Subjects were strength trained, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg). Subjects abstained from caffeine for 4 days, consumed 5mg·kg<sup>-1</sup> for 3 days and finally ingested 6mg·kg<sup>-1</sup> caffeine or placebo one hour before final testing. Groups were assigned in matched pairs. Isokinetic peak torque (PT), total work, average power, and average PT were tested in the subjects' dominant leg at 60°·s<sup>-1</sup>, 180°·s<sup>-1</sup>, and 300°·s<sup>-1</sup>. Endurance was assessed by 30 reps at 180°·s<sup>-1</sup>. Isometric PT was measured at 30° and 90° flexion of the non-dominant leg. Absolute performance measures were converted to relative measures by dividing by the subject's body mass, LBM, or LBM of the exercising limb. Data were analyzed with independent or paired t-tests and an alpha of 0.05. **Results:** Caffeine yielded many significant increases in strength and power. However, 5 of these measures were statistically significant in absolute terms, but no longer significant when divided by body mass. Isometric PT at 30° yielded significant results for caffeine supplementation in absolute PT (p=0.042) and relative units (p=0.032), but not when divided by the LBM of the exercising leg (p=0.059). **Conclusion:** This analysis demonstrates that the significant results of a study looking at the effects of acute caffeine ingestion are overestimated when strength variables are reported in absolute units as opposed to relative. Moreover, strength relative to LBM is important to examine changes independent of subjects' %BF. These relative values would then be more associated with differences in neuromuscular stimulation or fatigue irrespective of muscle size.

- 1071 Board #250 May 31 3:30 PM - 5:00 PM  
**Effects Of Energy Drink On Power Performance: Meta-analysis**  
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 (No relationships reported)

Energy drinks have been consumed often in the field of sports to enhance power performance. However, the effects of energy drinks are inconsistent in previous studies. **Purpose:** To assess the effects of energy drinks on power performance using meta-analysis. **Methods:** Published English language studies were located from computerized searches of following databases: Academic Search Complete, Education Source, ERIC, MEDLINE, PsycINFO, SPORTDiscus, and Google Scholar. Studies meeting inclusion criteria were: 1) included caffeine containing energy drinks, 2) reported a quantitative measure of power, 3) reported on supplement intervention, 4) published in peer reviewed journals and/or forms of thesis and dissertation from January 2000 to May 2016. Keywords included 'energy drink or red bull or caffeine drink' and 'power or performance'. Two investigators independently collected data from the search engines and coded data for verification. The studies were coded for methodological, participant and study characteristics. The Comprehensive Meta-Analysis version-3 software was used to compute effect sizes (ES) and 95% confidence interval (CI) using a random effects model. ESs were computed based on a comparison of change scores between pre- and post- intervention. Subgroup analyses were conducted to identify moderators (gender, subject type, and dosage of caffeine). **Results:** A total of 30 ESs were derived from the 10 selected studies for meta-analysis. The overall mean ES was small, but significant (Cohen's d (ES) = 0.163, 95% CI = 0.04, 0.29). Subgroup analyses showed that ESs were not affected by any moderator variables. **Conclusion:** Results of the present analysis indicated that the consumption of energy drink slightly improves the power performance. Other moderating variables should be considered so that the effects of energy drink intake can be explored further.

- 1072 Board #251 May 31 3:30 PM - 5:00 PM  
**Combined Carbohydrate and Caffeine Mouth Rinsing Enhance Anaerobic Power Output in a Reduced Glycogen State**  
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 (No relationships reported)

**Purpose:** The aim of this study was to determine the effects of mouth rinsing with carbohydrate and/or caffeine solutions on peak anaerobic power output during sprint cycling under glycogen reduced conditions. **Methods:** In a counterbalanced, double-blind cross over design, eight trained males (age 21.7±0.7 years, weight 70.8±4.2 kg, height 175.6±7.0 cm, percentage body fat 12.1±3.4%) participated in four experimental mouth rinsing trials after signing an IRB-Approved informed consent where they were informed about the risks and benefits associated with the experiment: (1) Mixed carbohydrate and caffeine solution composed of 7.5% sucrose and 2% caffeine (MR-CCAF), (2) Carbohydrate solution (7.5% sucrose) (MR-CHO), (3) Caffeine solution (2% caffeine) (MR-CAF), (4) No rinse (NR). Each trial was performed in the morning, following an overnight fasting, and performed Wingate test (30 seconds, resistance set at 7.5% of body weight). Circulating glucose and lactate levels were measured at the end of each test. **Results:** Blood lactate and glucose were not significantly different between trials. Peak Power was significantly higher in MR-CCAF in comparison with NR (11.12 ± 0.57 Wt/Kg versus 9.12 ± 1.01 Wt/Kg, p=0.043). MR-CAF and MR-CHO were not significantly different from each other or MR-CCAF. MR-CAF tended to be higher than NR (p=0.053), but lower than MR-CCAF (p=0.182) and MR-CHO (p=0.398). **Conclusion:** Combining carbohydrate and caffeine in a mouth rinsing solution improves power output under reduced endogenous carbohydrate conditions.

1073 Board #252 May 31 3:30 PM - 5:00 PM  
**Caffeine Supplementation Increases Blood Lactate But Not Muscle Endurance - A Balanced Placebo Design Study**

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Caffeine (CAFF) is the most consumed psychoactive substance in the world. About 74% of athletes during international competitions use CAFF to improve performance. However, its effect on muscle endurance (ME) is still controversial. Placebo (PLA) effect may also increase performance and interact with CAFF.

**PURPOSE:** To analyze the physiological and placebo effect of CAFF supplementation on ME using a balanced placebo design (BPD)

**METHODS:** 16 young men, age 21.4±2.9 yrs, body fat 17.2±4.0%, underwent six exercise sessions: one for familiarization, one as control and four experimental (BPD). At the first session, they were submitted to anthropometric measurements, CAFF consumption questionnaire and one repetition maximum test (1RM) in the parallel squat. At the second session they performed the ME test - 3 sets until exhaustion with 3 min interval between sets using 60%1RM. The last four sessions were: Session C/C: Subject told CAFF and given CAFF; Session C/P: Subject told CAFF but given PLA; Session P/C: Subject told PLA but given CAFF; Session P/P: Subject told PLA and given PLA. Subjects waited 1h20min to execute the ME test after receiving CAFF (5 mg/kg of body weight) or PLA. Work was considered as a product of the weight lifted and repetitions performed. Blood samples were collected for lactate (LA) analysis - at rest, 2, 4 and 6 min after the last set. ANOVA (told x given) was performed with a Bonferroni post-hoc - 5% level of significance.

**RESULTS:** CAFF consumption was 93.9 ± 88.2 mg/day, 1RM was 134.7 ± 24.1 kg. CAFF did not increase the number of repetitions or total work (p>0.05) - table 1, nor a particular set or work performed during a set. Use of CAFF and expectation of CAFF increased LA (p<0.05).

Session	Sum of repetitions	Total work (kg)	LA 2 <sup>nd</sup> min (mmol/L)	LA 4 <sup>th</sup> min (mmol/L)	LA 6 <sup>th</sup> min (mmol/L)
C/C	36.5±7.8	2998±881.4	10.9±1.5	11.7±1.7	11.8±1.9
P/C	36.6±7.8	2949±741.2	9.9±1.9 §	11.1±2.1	11.3±1.9
C/P	37.3±8.3	3025±847.1	9.7±1.8 §	10.9±1.6	10.6±1.9
P/P	35.0±7.7	2836±795.0	8.9±1.4 §#	9.9±1.7 §	9.6±1.7 §#

LA: Lactate; §: Lower than C/C; Lower than P/P.

**CONCLUSION:** CAFF did not increase ME in men. LA was affected by both the use of CAFF and the expectation of it. This finding reinforces the need of the BPD when studying CAFF, even when examining physiological variables, because they may be affected by expectation (PLA effect).

1074 Board #253 May 31 3:30 PM - 5:00 PM  
**Caffeine Withdrawal and Acute Consumption Effects on Reaction Time and Muscular Strength, Power, and Endurance**

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 (No relationships reported)

Studies on the benefits of caffeine to anaerobic exercise have varied designs and equivocal results. Previous work in our lab has demonstrated positive effects of caffeine using laboratory-based tests. **PURPOSE:** To study the effects of caffeine withdrawal and caffeine supplementation on field tests of power output, muscular strength, endurance, and reaction time. **METHODS:** Physically active, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg; average caffeine: 258±128mg) participated in a placebo-controlled intervention. All subjects abstained from caffeine for 4 days prior to withdrawal testing (T1), supplemented with 5mg·kg of caffeine for 3 days and on the final testing day (T2) consumed 6mg·kg of caffeine or placebo (insoluble fiber) one hour before testing. Power was assessed using peak vertical jump height, while muscular strength and endurance were assessed using a handgrip dynamometer. Subjects performed three handgrip trials to determine their maximal voluntary contraction (MVC). They then performed an isometric hold to volitional failure at 40% of their respective MVC. Reaction time was measured using a commercial application for a tablet computer. Data are presented as means ± standard deviation and were analyzed with SPSS 22.0 using either independent or paired t-tests with an alpha of 0.05. **RESULTS:** Following four days of caffeine withdrawal, peak vertical jump height decreased from 17.49±3.70in to 17.00±3.58in (p<0.001). There was a trend for an increase in power output (calculated from vertical jump) in caffeine:

3583.6±893.0W vs placebo: 3120±691W (p=0.065). Following caffeine withdrawal, there was also a trend for reaction time to slow by 0.01415±0.05414 sec (p=0.083). There was no significant difference in handgrip strength or muscular endurance following caffeine withdrawal or acute supplementation. **CONCLUSION:** This study demonstrates that caffeine withdrawal may be detrimental to performance and supplementation provides limited benefit using these chosen field tests. However, our previous findings using an isokinetic dynamometer to assess muscular strength and power provide more conclusive results indicating that caffeine withdrawal can hinder muscular strength and power and that supplementation may provide an acute ergogenic effect.

1075 Board #254 May 31 3:30 PM - 5:00 PM  
**The Effects of Caffeine and Pre workout Supplementation on Exercise Repetition during Sets and Muscular Endurance**

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 (No relationships reported)

Previous research has suggested that both caffeine and pre-workout supplementation prior to resistance training may be able to lead to increases in muscular endurance and repetition number. Popular pre-workout supplements can be fairly costly whereas caffeine is an inexpensive supplement found in many natural plant sources. **PURPOSE:** The aim of this study was to compare the effectiveness of caffeine and pre-workout supplementation on resistance exercise performance. **METHODS:** Eighteen healthy young adults (12 males and 6 females, 22.4±1.7 years) were recruited to participate in four separate exercise sessions in which they performed the same workout which consisted of 4 exercises: leg press, chest press, row, and lat pull downs. On day 1 all participants performed a 1-repetition max (1-RM) test for that movement. On days 2-4 each subject was randomly given a placebo, caffeine (260mg) or pre-workout (N.O.-Xplode, BSN, Boca Raton, FL, United States). During each of these sessions participants were asked to perform one set of each movement at 80% of their 1-RM as many times as they could. Participants were given a minimum of 72 hours between each trial session. Significant differences were determined by using repeated measures ANOVA. **RESULTS:** There was no significant difference found between the lat pull downs (Placebo 14.62±5.8, Caffeine 17.1±5.7, Pre-Workout 17.6±5.6 Repts) and chest press (Placebo 9.5±3.0, Caffeine 11.2±3.6, Pre-Workout 10.2±3.2 Repts) trials, however Caffeine and Pre-workout showed a significant (p≤0.05) increase (43% for caffeine & 35% for pre-workout) in the number of repetitions performed in the leg press (Placebo 11.6±6.8, Caffeine 20.25±7.1, Pre-Workout 17.6±6.7 Repts) and row (27% for caffeine & 28% for pre-workout) (Placebo 14.5±5.2, Caffeine 19.75±6.7, Pre-Workout 20.0±7.0 Repts) trials. There was not a significant difference found between caffeine and pre-workout trials. **CONCLUSION:** This data suggests that both caffeine and pre-workout may have a positive effect on exercise performance in multiple muscle group movements, but was less effective in increasing muscular endurance in lat pull downs and chest press.

1076 Board #255 May 31 3:30 PM - 5:00 PM  
**Caffeine Alters RPE-Based Intensity Production**

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 (No relationships reported)

This study examined effects of caffeine (CAF) on power output (PO) selection and associated physiological responses during cycling at moderate and high intensities prescribed by RPE (0-10 scale). Participants (n = 9) ( $VO_{2peak}$ : 55.4 ± 6.32 mL · kg<sup>-1</sup> · min<sup>-1</sup>) cycled for 20 min at RPE<sub>4</sub> and 20 min at RPE<sub>7</sub>, separated by 10 min recovery following caffeine (CAF) (6 mg · kg<sup>-1</sup>) and placebo (PLA) ingestion. PO, HR, serum lactate [La],  $VO_2$ ,  $V_E$ , and RER were recorded every 5 min. Session RPE (S-RPE) was recorded following 10 min recovery. Repeated-measures ANOVA's, 2 (trial) x 4 (time pt), showed significantly greater PO during RPE<sub>4</sub> for CAF (130 ± 23 W) vs PLA (112 ± 26 W) and during RPE<sub>7</sub> (CAF: 165 ± 37 vs PLA: 143 ± 41 W). Overall HR,  $VO_2$ , and  $V_E$  were significantly greater for CAF vs PLA during RPE<sub>4</sub>, RER for RPE<sub>4</sub> and RPE<sub>7</sub> were not significantly different (CAF vs PLA). Overall [La] was significantly greater for CAF during RPE<sub>4</sub> (CAF: 2.32 ± 0.94 vs PLA: 1.73 ± 1.09) and RPE<sub>7</sub> (CAF: 3.22 ± 1.44 vs PLA: 2.22 ± 1.49). Paired T-tests for S-RPE revealed no significant difference for RPE<sub>4</sub> (CAF: 4.0 ± 0.5 vs PLA: 3.7 ± 0.5) or RPE<sub>7</sub> (CAF: 7.1 ± 0.3 vs PLA: 6.9 ± 0.6) despite greater PO for CAF. Although individual responses varied, the current study indicates caffeine ingestion results in elevated self-selected PO with significant systematic changes in associated physiological responses particularly at a higher intensity (RPE<sub>7</sub>).

1077 Board #256 May 31 3:30 PM - 5:00 PM  
**Effects Of Individualised Nahco3 Ingestion On Peak Alkalosis**  
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 (No relationships reported)

**PURPOSE.** Recently it has been suggested, that an individualised sodium bicarbonate (NaHCO<sub>3</sub>) ingestion strategy might be the most appropriate method to elicit a state of peak alkalosis. Such a strategy can then be used to "marry up" time to peak alkalosis with the performance required. However, such ingestion strategies have displayed large inter-individual variation (range 10-180 min). Hence, if such a strategy is to be practically applied, the blood analyte response needs to be reproducible. This study aimed therefore, to evaluate the reproducibility of blood pH, HCO<sub>3</sub><sup>-</sup> and Na<sup>+</sup> following acute NaHCO<sub>3</sub> ingestion on more than one occasion. **METHODS.** Fifteen team sports players completed six randomised trials entailing ingestion of 0.2 g.kg<sup>-1</sup> BM NaHCO<sub>3</sub> twice (SBC2A and B), 0.3 g.kg<sup>-1</sup> BM NaHCO<sub>3</sub> twice (SBC3A and B), or two control trials (CON1A and B) on separate days. Blood analysis included pH, HCO<sub>3</sub><sup>-</sup> and Na<sup>+</sup> prior to and at regular time points following NaHCO<sub>3</sub> ingestion over a three hour period. **RESULTS.** Compared to pH, a greater relationship for HCO<sub>3</sub><sup>-</sup> in both time to peak (HCO<sub>3</sub><sup>-</sup> SBC2 = 0.772, P = 0.003, SBC3 = 0.942, P < 0.001; pH SBC2 = 0.618, P = 0.044 SBC3 = 0.712, P = 0.016) and absolute change (HCO<sub>3</sub><sup>-</sup> SBC2 = 0.890, P < 0.001, SBC3 = 0.755, P = 0.008; pH SBC2 = 0.842, P = 0.001, SBC3 = 0.624, P = 0.041) was observed. **CONCLUSIONS.** The results indicate that both time to peak and absolute change in HCO<sub>3</sub><sup>-</sup> are more reliable when compared to time to peak pH. Future work should utilise an individualised NaHCO<sub>3</sub> ingestion strategy based on HCO<sub>3</sub><sup>-</sup> responses and evaluate the effects on exercise performance.

1078 Board #257 May 31 3:30 PM - 5:00 PM  
**Impact of Aspartate and Sodium Bicarbonate Supplementation Upon Muscle Contractile Properties within Trained Men**  
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**PURPOSE:** To examine the effects of ammonia accumulation and changes in muscle contractile properties in trained men following Aspartate and NaHCO<sub>3</sub> supplementation. **METHODS:** Twelve men (21.9±1.5 yr) ingested 4 conditions all separated by 1 week and included: placebo (PL), L-Aspartate (12.5 mg)(LA), NaHCO<sub>3</sub> (0.3g.kg<sup>-1</sup>)(SB), or combination of LA and SB (CB). For each day of testing, participants performed one high-intensity exercise session along with a pre- and post-exercise (pre-/post-ex) isometric mid-thigh pull test to measure peak force production (PF) and rate of force development (RFD). Blood was collected for all testing sessions before/after the high-intensity exercise to determine ammonia accumulation (AMM). Exercise sessions consisted of 4 exercises: barbell thrusters, squat jumps, lunge jumps, and forward jumps, with total amount of work being equated for all 4 exercises across all 4 testing sessions. **RESULTS:** Treatments did not differ (p>0.05) for AMM when pooled across pre-/post-exercise (PL=101±89, LA=62±17, SB=45±26, CB=87±86 mmol.L<sup>-1</sup>), but when pooled across treatments AMM was higher post-ex (86±46 mmol.L<sup>-1</sup>) than pre-ex (60±51 mmol.L<sup>-1</sup>) (p=0.004). There was also a trend towards a significant treatment x time interaction (p=0.067) where AMM in PL seemed to rise at a faster rate than in the treatments. There was a trend (p=0.064) for PF when pooled across pre-/post-ex where PL appeared to be greater than LA and CB (PL=3332±664, LA=3143±583, SB=3237±600, CB=3136±571 N), but PF did not differ when pooled across treatments from pre- (3269±655 N) to post-ex (3156±525 N) nor was there a treatment x time interaction (p>0.05). The treatments for RFD did not differ (p>0.05) for RFD when pooled across pre-/post-ex (PL=5527±1648, LA=5019±1249, SB=5327±1505, CB=5092±1238 N s<sup>-1</sup>), or between pre-/post-ex when pooled across treatments (pre-ex=5155±1311, post-ex=5328±1389 N s<sup>-1</sup>). However, there was significant treatment x time interaction (p=0.019) where the RFD increased in SB and CB, decreased in PL, and did not change in LA. **CONCLUSIONS:** RFD increases with SB supplementation. Additionally, both LA and SB have the potential to reduce post-ex AMM, as does SB in reducing exercise related decline in PF.

1079 Board #258 May 31 3:30 PM - 5:00 PM  
**The Influence of Alkalosis on Muscle Force and Power in the Triceps Surae and Brachii**  
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 (No relationships reported)

The effect of metabolic alkalosis on fibre-specific maximal force production and rates of force development (RFD) has been previously investigated in animal models, with evidence suggesting an improved capacity to rapidly develop force in fast- compared to slow-twitch muscle. To date, the fibre-type dependent findings related to pH and rapid force generation have not been replicated in the exercising human. **PURPOSE:** To model *in vivo* the fatigue profile of voluntary and *involuntary* maximal force and rate of force development in the triceps' surae and brachii after sodium bicarbonate (NaHCO<sub>3</sub>) ingestion. **METHODS:** In a double-blind, 3-way repeated measures design participants (n=10) ingested either 0.3 g.kg<sup>-1</sup> NaHCO<sub>3</sub> (ALK) or equivalent calcium carbonate (PLA) prior to 2-min of continuous (1Hz) supramaximal stimulation (300ms at 40Hz) of the triceps' surae or brachii, with maximal voluntary efforts (MVT) coupled with direct muscle stimulation also measured at baseline, 1-min and 2-min. **RESULTS:** Metabolic alkalosis was achieved in both ALK trials but was not different between muscle groups. Regardless of condition, *involuntary* torque declined nearly 60% in the triceps brachii (p < 0.001) and ~ 30% in the triceps surae (p < 0.001). In all trials there was a significant decline in normalised *involuntary* RFD (p < 0.05). MVT declined nearly 28% but was not different between conditions (p < 0.01), and although declining nearly 21% in voluntary RFD (p < 0.05) there was no difference between PLA and ALK in either muscle group (p = 0.93). **CONCLUSION:** NaHCO<sub>3</sub> exhibited no effect on the fatigue observed between representative fibre-type muscle groups on maximal voluntary and *involuntary* torque or rates of torque development during and after 2-min of tetanic stimulation.

1080 Board #259 May 31 3:30 PM - 5:00 PM  
**L-Citrulline Supplementation Did Not Improve Time Trial or Sprint Repeat Performance in Trained Endurance Cyclists**  
 Kelsey McLaughlin<sup>1</sup>, Stephen F. Crouse, FACSM<sup>2</sup>. <sup>1</sup>East Carolina University, Greenville, NC. <sup>2</sup>Texas A&M University, College Station, TX. (Sponsor: Stephen F. Crouse, FACSM)  
 (No relationships reported)

L-Citrulline (CIT) is an amino acid that has been shown to act as a nitric oxide donor when ingested, making it appealing to athletes as a dietary supplement. However, there is currently no evidence to suggest that CIT conveys any performance benefit to endurance athletes. **PURPOSE:** To determine whether 7 days of CIT supplementation would improve cycling performance in a time trial (TT) or sprint repeat task (SRT) compared to placebo. **METHODS:** Ten competitive male cyclists (24 ± 4 yr; 181 ± 7 cm; 76 ± 13 kg; 4.09 ± 0.56 L/min VO<sub>2</sub> max) consented to participate in this randomized, double-blind, crossover study design. Baseline evaluation included dual-energy X-ray absorptiometry (DEXA) scans, a maximal oxygen uptake (VO<sub>2</sub> max) protocol on a cycle ergometer, and an SRT familiarization session (6x1-min sprints at 120% max wattage from VO<sub>2</sub> max protocol). Supplementation consisted of 6g/day (three 2g doses) of either CIT or maltodextrin (PLAC) capsules for 6 days. The final 6g dose was given in the lab 2 hours prior to the experimental protocol, which consisted of a 40-km TT on a cycle ergometer, followed 2.5 mins later by the SRT. After a minimum washout period of 7 days, supplementation with the opposite treatment began. The main variables of interest were TT time and the average and maximal pedal force moments (PFM) sustained during the SRT. Other variables measured included heart rate (HR), mean arterial pressure (MAP; TT only), VO<sub>2</sub> (TT only), RPM, and RPE (Borg scale). Statistical comparisons were made using a 2x2 (Trial Number X Supplement) ANOVA, with an alpha level of 0.05. **RESULTS:** There were no significant main effects of supplement, trial, or their interaction for TT time or maximal PFM during the SRT. There was a significant interaction for average PFM during the SRT (P=0.0018) such that subjects taking PLAC for Trial 2 had significantly lower average PFM than those taking either supplement during Trial 1. There was also a significant main effect of supplement on %HR max sustained during the TT, with those taking CIT having significantly higher %HR max than PLAC (P=0.0469). No other variables had significant main effects or interactions. **CONCLUSIONS:** CIT supplementation provided no clear advantage over PLAC for measures of endurance cycling performance or physiological variables.

**B-72 Exercise is Medicine®/Poster - EIM - Health Professionals and Vital Signs**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

1081 Board #260 May 31 2:00 PM - 3:30 PM

**Evaluation Of Exercise is Medicine From The Perspective Of Fitness Professionals**

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**PURPOSE:** Exercise is Medicine (EIM) promotes physicians prescribing exercise and referring patients to fitness professionals (FP). Early focus in research has been on improving the knowledge of physicians on how to prescribe exercise and encouraging physicians to refer patients to FPs, however the receiving end of the referral procedure has not been examined. This mixed method pilot study aimed to identify level of awareness for FPs regarding EIM initiatives and whether a brief educational session enhanced that level of awareness. The second aim was to engage FPs in dialogue to indicate barriers to and enablers of the exercise prescription and referral procedure. **METHODS:** Twelve certified personal trainers employed at a university campus recreation facility with an active EIM on campus group, were recruited to participate in an EIM information session and focus group. Personal trainers completed a pre-information session questionnaire on EIM goals, mission, and contents of the exercise prescription pad. A 15 minute EIM information session was provided and then the same questionnaire was completed again. Immediately after the information session personal trainers participated in a focus group to indicate if problems exist and discuss solutions regarding the EIM goal of engaging FPs and physicians to implement exercise prescription and referrals in the health care system. **RESULTS:** Average score on the pre-information questionnaire (7 questions) was 30% which significantly improved to 82% ( $p < 0.05$ ) after the information session. Thematic analysis of the focus group identified four suggestions: increase communication opportunities between physicians and FPs, increase promotion of EIM to both physicians and FPs, add progression and follow-up details to the EIM prescription pad and increase educational opportunities about EIM for all staff employed at a recreational facility. **CONCLUSION:** EIM should consider increasing opportunities to educate FPs about the EIM initiative so they are better prepared to receive patients referred to exercise and can engage with physicians to promote EIM. Furthermore, by incorporating the suggestions of FPs to enhance the exercise prescription and referral procedure, the effectiveness of EIM for increasing physical activity levels in all populations can improve.

1082 Board #261 May 31 2:00 PM - 3:30 PM

**Physical Activity Levels and Counseling Practices of Physicians & Patients in a Chilean Sports Medicine Clinic**

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**PURPOSE:** Promoting physical activity (PA) among physicians and patients is one of the main pillars of Exercise is Medicine® (EIM). The purpose of this study was to evaluate the PA levels of physicians and their patients in a private sports medicine clinic in Santiago, Chile, in which a printed PA prescription and a small box recommending PA as a "medicine", are delivered to all patients. **METHODS:** This study examined responses from 65 physicians (75% orthopedic surgeons) and 2,688 patients. Physicians answered the short IPAQ and questions regarding how often, and how, they recommend PA to their patients. Patients (59.5% men; 40.5% women; between 25-65 years of age) answered an online survey with questions regarding the frequency and duration of their weekly PA levels. **RESULTS:** A small percentage of patients (26.5%) reported practicing PA five or more days per week with 86.7% reporting 30-90 minutes per day. Results from the physicians showed that just 26.1% reached the recommendation of at least 150 min/week of PA, and 55% reported not performing any resistance exercise. The median time sitting and attending patients was 6.1 hours per day. Median frequency of moderate and vigorous PA was 2 days/week for a duration of 45 minutes and 2 days/week and 30 minutes/day, respectively. In regards to their PA counseling attitudes and practices, 66% of the physicians considered it their responsibility to help their patients become physically active, 55% agreed that if they were physically active themselves they will have better capacity to counselling PA, and 40% of the physicians evaluating

the PA levels of their patients and always recommending PA for them. Although 89% of the physicians in the clinic agreed to use PA prescription with their patients, just 50% delivered a written PA prescription.

**CONCLUSIONS:** From this study, we conclude that physicians who are regularly involved with patients in a sports medicine clinic are aware of the importance of evaluating the PA levels of their patients, but that they need to improve their regular practice of prescribing PA to their patients.

1083 Board #262 May 31 2:00 PM - 3:30 PM

**Physician Assistant Students' Perceptions of the Fitness Industry and Lifestyle Medicine**

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**INTRODUCTION:** With nearly two-thirds of all chronic disease having a lifestyle cause, there is spurred interest in curricular changes for Physician Assistants (PA) and other medical providers to learn Lifestyle Medicine (LM) - the therapeutic use of lifestyle changes to prevent, treat and reverse disease. A key competency in LM practice involves an interdisciplinary approach, including aid from fitness professionals. Yet, perceptions of the fitness industry might hinder such a relationship. **PURPOSE:** To assess PA students' knowledge of LM and perceptions of the fitness industry, to guide curriculum implementation efforts. **METHODS:** An online survey was advertised to all PA students at Baylor College of Medicine. Students' competence in assessing and prescribing physical activity and diet, knowledge of LM, current curriculum time spent on LM, and desire to learn more about LM were assessed. Students were also asked to share their attitude of both health clubs and personal trainers, alongside referral perceptions. **RESULTS:** 76 (84%) of students ( $25.57 \pm 4.86$  years;  $22.77 \pm 4.20$  kg/m<sup>2</sup>) completed the survey, self-reporting moderate competence (range: 1-6) in conducting a physical exam to approve an exercise program ( $4.22 \pm 1.22$ ), determining caloric and nutritional needs ( $3.80 \pm 1.34$ ), and designing an exercise prescription ( $3.57 \pm 1.35$ ). However, only 18%, 6%, and 6% self-rated full competence in each, respectively. 31% of students had heard of the discipline of LM, with 43% self-reporting inadequate or poor knowledge. 0% felt they spent enough time on LM in their program, and 78% rated their time spent on LM was either poor or inadequate. Yet, 100% wanted to learn more. Perceptions of health clubs and personal trainers were positive ( $8.16 \pm 1.68$ ; range: 1-10), with them being appropriate exercise venues for patients ( $7.78 \pm 1.76$ ). However, only 6% - 16% believed that health clubs and personal trainers were fully qualified, effective, smart, and concerned about patient health. **CONCLUSIONS:** Despite the role of lifestyle on chronic disease, PA students had limited competence and knowledge in LM, but held a unanimous desire for more in their educational training. Perceptions of the fitness industry were generally positive; yet educational efforts might be needed to encourage a team-approach to chronic disease care.

1084 Board #263 May 31 2:00 PM - 3:30 PM

**Effectiveness of the Exercise is Medicine Canada Training Workshops on Physician Counselling and Prescription Practice**

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**PURPOSE:** Comparing perceptions and practices around physical activity counselling and exercise prescription in physicians initially and three-months following Exercise is Medicine Canada training. **METHODS:** Initially, physicians (n=113) from 7 provinces completed self-reflection questionnaires. Of that sample, (n=46) physicians completed questionnaires again at three months following the workshop. **RESULTS:** At baseline, physicians reported low confidence (46%) and rated the impact of primary barriers that prevent physical activity and exercise (PAE) counselling and prescription as (scale out of 4): patient interest (2.77), resources (2.65), and time (2.62). The majority of physicians (85%) provided a written prescription for exercise in <10% of appointments. At follow-up, the workshop increased physicians' confidence (% score) to: assess patient physical activity/exercise (PAE) (44 to 69;  $p = 0.005$ ); provide PAE information to patients (55 to 79;  $p < 0.001$ ), answer patient PAE questions (54 to 78;  $p < 0.001$ ), provide PAE advice (43 to 71;  $p < 0.001$ ), and appropriately refer to qualified professionals (52 to 77;  $p = 0.002$ ). Confidence composite score increased from  $251 \pm 119$  to  $376 \pm 66$  ( $p < 0.001$ ) out of 500. At follow-up, physicians self-perceived barriers' impact decreased, including: patient interest (2.75 to 2.25 out of 4;  $p < 0.001$ ), lack of resources (2.59 to 2.00 out of 4;  $p < 0.001$ ), and lack of time (2.41 to 2.14 out of 4;  $p = 0.017$ ). Initially, the vast majority (n=98/113; 86.7%) of physicians proposed at

least one change to practice (205 change statements) and 71% proposed two or more changes to practice (155 change statements). Physicians who completed baseline and follow-up questionnaires (n=46) generated 93 statements regarding proposed changes to practice, including prescribe exercise (27%) and discuss PAE in more depth (26%). At follow-up, (n=46) physicians provided 88 statements regarding actual changes to practice. 46% of statements were reflective of at least one of the proposed changes and 40% reflecting changes that were different than originally proposed. **CONCLUSION:** Providing a comprehensive workshop improves confidence and supports for counselling, reduces impact of barriers and effectively changes physician's practices. Support provided by the Lawson Foundation

1085 Board #264 May 31 2:00 PM - 3:30 PM  
**The Effects of Physician Discussion/Recommendation on Physical Activity Behaviors During Pregnancy**  
 Samantha J. Deere, Jessica L. Walker, Meghan Baruth, Rebecca A. Schlaff. *Saginaw Valley State University, University Center, MI.*  
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 (No relationships reported)

Little is known about physical activity (PA) behavior during pregnancy following PA discussions and recommendations from a prenatal health care provider (HCP). **PURPOSE:** To investigate 1) patient perceived value of prenatal HCP advice and 2) the differences in PA behavior between patients that did and did not a) discuss current PA behaviors with their prenatal HCP and b) receive PA recommendations from their prenatal HCP. **METHODS:** Participants (n=25) included pregnant women enrolled in a pilot nutrition and PA intervention. A baseline survey assessed 1) demographics, 2) participants' perceived value of prenatal HCP opinions (5-point likert scale; 1=do not value, 5=highly value), and whether 3) participants' current PA habits were discussed with a prenatal HCP, and 4) prenatal HCPs recommended participation in PA. An accelerometer was used to assess participant PA. Means±SD and frequencies were calculated and independent samples t-tests were used to assess differences in PA between participants that did and did not 1) discuss current PA habits with their prenatal HCP, and 2) receive PA recommendations from their prenatal HCP. **RESULTS:** On average, participants were 27.5±4.4 years of age. A majority of the sample was Caucasian (79.2%), married (80.0%), and had some college education (80.0%). Less than half of participants (43.5%) discussed current PA habits with their prenatal HCP and received a PA recommendation from their prenatal HCP (43.5%). Participants valued their prenatal HCP's advice, mean±SD=4.68±0.6. No differences in moderate and vigorous PA per day were found between participants that did (n=13, 12.4±10.6 min/day) discuss current PA behaviors with their prenatal HCP and those that did not (n=10, 13.1±10.7 min/day), (t(21)=0.17, p=0.87). Similarly, no PA differences were found between participants that did (n=10; 12.5±10.8 min/day) receive a PA recommendation from their prenatal HCP and those that did not (n=13; 13.0±10.4 min/day), (t(21)=0.11, p=0.91). **CONCLUSION:** Participants valued prenatal HCP opinions. However, PA discussions and recommendations with prenatal HCPs do not appear to impact PA behavior of pregnant women. Future research should explore the extent of PA discussions and recommendations between prenatal HCPs and patients to better understand the impact of discussions.

1086 Board #265 May 31 2:00 PM - 3:30 PM  
**Exercise Is Medicine In Traditional Chinese Medicine**  
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 (No relationships reported)

**PURPOSE:** The exercise therapy used for prevention, treatment, health care and rehabilitation were called the exercise prescription of Traditional Chinese Medicine (TCME<sub>x</sub>R). We made a systematic combing of its historical evolution to know how Exercise is Medicine (EIM) developed in Traditional Chinese Medicine (TCM). **METHODS:** We checked the documents of TCM, and sorted out the related content of exercise prescription. **RESULTS:** There were 7 stages of the development. It originated from the primitive society. Around 2300 BC, people made a "big dance" to cure joint disease, which is the earliest record of TCME<sub>x</sub>R. The formation was from the Spring and Autumn Periods. Exercise was combined with breathing, and was used for treatment and prevention. It was proposed that exercise can make us live longer and reduce disease, and should comply with the natural environment. Excessive exercise could do harm to organs. *Inner Canon of Huangdi* recorded a prescription of kidney disease including time choose, types, frequency, duration and position, which was very similar to the modern ones. Theories developed since Qin Dynasties. Doctors and Taoisms made great contributions. TCME<sub>x</sub>R was based on the meridian circulation and syndrome differentiation, which was used to treat various diseases. Large number of documents and pictures were found. Complete sets like *Wuqinxi* had been invented. Taoism, Buddhism and Confucianism developed since Northern and Southern Dynasties.

The theory was enriched and grew systematically. Types increased and application range expanded. *General Treatise on the Cause and Symptoms of Diseases* gave 278 kinds of ExR. Dr. Sun advised that exercise should control volume. The balance of diet, sleep, breathing, physical and mental was proposed. Along with the invention of papermaking and printing, TCME<sub>x</sub>R went to flourish. Numerous types were created. Doctors had good application of TCME<sub>x</sub>R, possessing their own experiences. Tai Chi was born from the combining of martial arts and medical concepts. Research stayed still since the Opium War but developed again after the founding of new China. **CONCLUSIONS:** The use of exercise in TCM had long history. Until now, doctors and sports experts worked together to make it perfectly, and to jointly promote the project of EIM. Supported by MOST-China(2016YFC1300202)

1087 Board #266 May 31 2:00 PM - 3:30 PM  
**Validation Of A Multi-staged Step Test For Measuring Fitness As A Clinical Vital Sign**  
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 (No relationships reported)

The Exercise is Medicine™ initiative utilizes three questions that subjectively indicate how many minutes per week an individual engages in physical activity. The reported amount of activity is subsequently classified as a vital sign based on the association between the amount of physical activity and morbidity and mortality. However, there is little research examining how to objectively measure cardiorespiratory fitness within a clinical setting. Limitations exist with current valid step tests regarding 2 major barriers to practice settings: administration time and fixed step heights and step rates unable to accommodate various fitness levels and musculoskeletal limitations. **PURPOSE:** To determine the validity of a brief, submaximal, variable height, step test used to predict VO<sub>2</sub>max. **METHODS:** Healthy participants aged 18-65 were recruited to perform a 4 minute step test that consisted of stepping for 1 minute successively on steps that were 6, 8, 10, and 12 inches in height. Following each minute, the heart rate of the participants was recorded. The participants then performed a VO<sub>2</sub>max test on a treadmill. Multivariable regression analysis was used to develop a predictive model of VO<sub>2</sub>max from the step test. The variables included in the multivariable regression equation were gender, BMI, steps/min, and avg. HR for the 4 steps. **RESULTS:** A total of 113 participants were included in this study .67 men (age = 24.3±5.93 yr, BMI = 25.7±4.00, VO<sub>2</sub>max = 44.69±7.82) and 46 women (age = 24.7±7.62 yr, BMI = 23.5±3.02, VO<sub>2</sub>max = 36.63±5.57). The model explained 55% of the variance in VO<sub>2</sub>max (R = 0.74, p = 0.0001). **CONCLUSION:** The model was an accurate predictor of VO<sub>2</sub>max for this sample. Further investigation will aim to enhance the generalizability of the test through targeting older age groups.

1088 Board #267 May 31 2:00 PM - 3:30 PM  
**Exercise Vital Sign Correlates With New Diagnosis of Depression**  
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 (No relationships reported)

Kaiser Permanente in Southern California (KPSC) has pioneered use of an exercise vital sign (EVS) to record minutes per week of PA at every visit. Given the established connection between regular PA and depression, it stands to reason that patients who report doing recommended amounts may be less likely to suffer from a new diagnosis of depression than those who report being sedentary. **PURPOSE:** To evaluate the correlation between self-reported PA level (using EVS) and the likelihood of being diagnosed with clinical depression. **METHODS:** Data were abstracted from electronic medical records of adult KPSC members (N=1,077,140) in a cohort study to investigate use of an EVS in predicting a new diagnosis of depression. The cohort consisted of all adult patients (>18 yr.) with minimum of 3 EVS measurements spanning a year from January 1, 2009 to December 31, 2011, that did not have a prior diagnosis of depression on or before the date of their last EVS measurement. Patients were classified into 1 of 3 distinct categories for EVS; Consistently Sedentary (CS) EVS=0 min/wk for every measure, Insufficiently Active (IA) EVS 10-149 min/wk and Consistently Active (CA) EVS>150 min/wk for every measure. Estimates were adjusted for age, gender, race, marital status, education level and Charlson comorbidity score. Results are presented as odds ratios (OR) with corresponding 95% confidence intervals (CI). **RESULTS:** Patients who were CA were 20% less likely to be diagnosed with depression compared to CS patients (OR (CI) = 0.80 (0.86, 0.90)), while IA patients were found to be 12% less likely (OR = 0.88 (0.78, 0.82)). In addition to low EVS, other risk factors for depression were female gender, race (Hispanic>White>Black>Asian), Unmarried status, lower education level and higher Charlson comorbidity score.

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**CONCLUSIONS:** We conclude that self-reported PA is strongly correlated with the likelihood of suffering a new diagnosis of depression. For this reason, any patient presenting with symptoms suspicious for depression should be asked about their exercise habits and a low EVS should add to the clinical suspicion for depression.

1089 Board #268 May 31 2:00 PM - 3:30 PM  
**Exercise Vital Sign and Health Care Utilization**

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(No relationships reported)

**Background:** It is well established that >150 minutes of weekly physical activity significantly improves health and Kaiser Permanente Southern California (KPSC) has pioneered the use of an Exercise Vital Sign (EVS) to record Physical Activity (PA). However, there is less data on exercise and impact on healthcare utilization. **Purpose:** To evaluate the correlation of EVS and healthcare utilization, in our SCKP patient population. Specifically, do those patients who report consistent exercise for >150 minutes per week have reduce utilization of the health care system. **Methods:** KPSC Electronic Health Record data was abstracted to determine 3 cohorts of adults (18-65yrs) (N=2,534,895) who were Consistently Sedentary (CS) (EVS=0min/wk consistently), Insufficiently Active (IA) (EVS=1-149min/wk), or Consistently Active (CA) (EVS>150min/wk consistently), meeting the World Health Organization recommendations. Each cohort had at least 3 encounters and self reported EVS that were consistent. Each cohort was then compared to their health care utilization over a 1, 3 and 5 year period. Because KPSC is a closed system we were able to accurately capture utilization of pharmacy, hospital, radiology, laboratory and outpatient departments. Data was adjusted for age, gender and ethnicity. **Results:** Compared to CS patients, CA patients have consistently lower use of the KPSC health care system. This relationships held true across the 1, 3 and 5 year analysis. Of note patients who were CA were 75% less likely to be hospitalized (OR 0.23-0.26), 43% less likely to use the ER (OR 0.55-0.58) and 45% less Urgent Care services (OR 0.54-0.56), 25% less laboratory blood draws (OR 0.73-0.74), and 27% less pharmaceuticals fills (OR 0.71-0.74). Other factors that were associated with lower health system utilization were female gender, caucasian ethnicity and **Conclusion:** Based on EVS data, and analysis of health utilization we conclude that CA individuals have significantly lower utilization of the health care system than those who are CS.

### B-73 Free Communication/Poster - Exercise Psychology - Cognition and Emotion

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

1090 Board #269 May 31 2:00 PM - 3:30 PM  
**Correlates Among Physical Activity, Physical Function, and Cognitive Function in Older Adults**

Victoria E. Warren, Megan C. Rigot, Kelsey D. Loss, Colleen A. Osburn, Kyle L. Timmerman. *Miami University, Oxford, OH.* (Sponsor: Helaine Alessio, FACSM)  
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(No relationships reported)

Current adverse components of aging include the increase in both cognitive impairment and the incidence of dementia. Previous studies have shown positive associations between physical activity and the prevention and treatment of cognitive impairment and dementia. The **PURPOSE** of the present study was to identify correlates among physical activity, physical function, and cognition in independent older adults. **METHODS:** In 77 older adults (77±7.8 years), self-reported physical activity (Community Healthy Physical Activities Model Program for Seniors, CHAMPS), cognitive function (Addenbrooke's Cognitive Examination-Revised, ACE-R), and physical function (Six Minute Walk Test, 6MWT; Short Physical Performance Battery, SPPB; and Grip Strength) were measured. Partial correlations were run between the variables while controlling for age and sex. Significance was set to  $p < 0.05$ . **RESULTS:** The mean values±standard error (SE) for the physical function variables were: CHAMPS: 1202±130 kcal·wk<sup>-1</sup> of moderate-to-vigorous physical activity; 6MWT (distance): 417±14 m; and grip strength: 27.0±1.1 kg. The average score on the ACE-R was 91.6±0.5 out of 100 (≤88 = 94% specificity for dementia). Age was correlated with ACE-R ( $r = -0.59$ ,  $p < 0.05$ ). When controlling for age and sex, ACE-R was correlated with SPPB performance ( $r = 0.39$ ,  $p < 0.05$ ), 6MWT performance ( $r = 0.33$ ,  $p < 0.05$ ), and grip strength ( $r = 0.25$ ,  $p < 0.03$ ). ACE-R was not correlated with self-reported physical activity ( $r = 0.14$ ,  $p > 0.05$ ). **CONCLUSIONS:** Although previous research has shown positive associations between physical activity

and cognitive function, our preliminary data do not support these previous findings. However, indices of physical function, as measured by three standard clinical tests, were associated with cognitive function in this population of independent older adults.

1091 Board #270 May 31 2:00 PM - 3:30 PM  
**Psychological Factors Of Burnout In Former/retired Elite-level Race Walkers In The United States**

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**PURPOSE:** The study aims to determine and extrapolate the causation of psychological factors of burnout in former/retired female and male elite-level race walkers (N=75) in the United States (U.S.). The results of this project will assist in identifying influential factors of burnout, hence improving the future of the sport of race walking in the U.S. **METHODS:** Seven factors of burnout were derived and analyzed based on the subjects' responses to a validated anonymous online survey. This research was analyzed through exploratory analysis with an eigenvalue set at 1.00 using varimax rotations. These seven factors retained 75.99% of total variance which were accounted for and explained by the factors success (1), accomplishment (2), fatigue (3), apathy (4), awareness (5), appreciation (6), and lack of marketing (7). An independent t-test and a one-way ANOVA were conducted to determine a significant difference in responses between genders. **RESULTS:** Profile analysis/one way repeated measures analysis of variance of the seven factors indicate statistical significance and efficacy based on the Partial eta<sup>2</sup> of 0.489 using the Lower-bound being 49% of the total variance explaining the differences among the seven factors. Across all factors, factors 5 and 7 scored the highest means, which indicated the most significant impact of burnout while factors 1 and 2 demonstrated the least impact. Both the independent t-test and the one-way ANOVA found no significant ( $p < 0.05$ ) differences in responses to factors 1 (.615), 2 (.611), 3 (.820), 4 (.633), 5 (.760), 6 (.854), and 7 (.369) between genders. **CONCLUSIONS:** Based on the profile analysis, the common underlying factors in this research investigation narrowed down to "Awareness" and "Lack of Marketing" in U.S. race walking. This represents crucial components to the declining state of elite-level race walking as well as the most significant impact of burnout in former/retired female and male elite-level race walkers in the U.S. The results of this project will assist in identifying influential factors of burnout, hence improving the future of the sport in the U.S. The continuation of research on elite-level race walking burnout is imperative for the growth of the sport and the well-being of these athletes.

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**The Effects of Caffeine on Selective Attention after Exercise in Older Adults: A Pilot Study**

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**PURPOSE:** The purpose of the present study was to determine if caffeine influenced selective attention following a bout of cycling in older adults. **METHODS:** Five older (60 ± 7 years), adults (3 males, 2 females) participated in three separate laboratory sessions. During the first visit, subjects underwent a submaximal cycling task (YMCA) to predict maximal oxygen consumption ( $VO_{2max}$ ) and were allotted time to practice the Stroop Color Word Task (SCWT). For the next two visits, subjects reported to the Laboratory in the post-absorptive state. Upon arrival subjects rested for 5 min then completed the SCWT. Two pieces of chewing gum (CAFF vs. PLA) were then administered in a counterbalanced, double blind manner. Following gum administration subjects rested for 10 min, performed a standard warm-up, and then cycled for 30 min at constant wattage (workload corresponding to 60% predicted  $VO_{2max}$ ). Subjects rested for 5 min then completed the SCWT. **RESULTS:** Stroop Color Word Task Interference Scores (SCWT-INF) were calculated and used as an indicator of selective attention. A preliminary analysis of variance (ANOVA) demonstrated that SCWT-INF remained unchanged from baseline to post exercise (2.7 ± 2.8 vs. 3.4 ± 2.5 respectively,  $p = 0.759$ ). Further, SCWT-INF were similar across treatments (caffeine versus placebo, 6.3 ± 3.2 vs. -0.2 ± 3.2 respectively,  $P = 0.196$ ) and no treatment by time interaction was evident ( $p = 0.703$ ). **CONCLUSIONS:** These data demonstrated that a low dose of caffeine and moderate exercise had no impact on selective attention.

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**Acute Effect of Exercise on Cognitive Function Changes by Exercise Mode**Shinji Takahashi, *Tohoku Gakuin University, Sendai, Japan.*  
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(No relationships reported)**PURPOSE:** To assess the differences of influence of acute bouts of aerobic, resistance and badminton on the cognitive control measured by Stroop task.**METHODS:** Twenty-five men (age: 20.8 +/- 1.0 yrs, height: 173.8 +/- 3.9 cm, weight: 73.8 +/- 11.7 kg) and 20 women (age: 20.3 +/- 1.0 yrs, height: 156.6 +/- 4.0 cm, weight: 50.1 +/- 6.0 kg) performed an incremental treadmill running test to determine peak oxygen consumption (VO<sub>2</sub>peak). On subsequent days, the participants underwent four counterbalanced an intervention consisting of 10 min of either walking, resistance exercise, badminton and seated rest control. A matching type Color-Word Stroop test (writing) consisting of a neutral condition and an incongruent condition was completed before and 8 min after each session. Oxygen consumption (VO<sub>2</sub>) was measured during 4 sessions. Stroop task performance (scores) in both of the neutral and the incongruent condition were compared by 2-way ANOVA model in mixed model, two factors were sessions (4 levels) and time (2 levels), respectively.**RESULTS:** Intensities of walking, resistance exercise, badminton and seated rest control were 45+/-10%, 41+/-7%, 74+/-11% and 9.7+/-1.7%VO<sub>2</sub>peak, respectively. For the neutral condition scores, the interaction was not significant (P = 1.08) although the main effect of time was significant (P < 0.001). For the incongruent scores, ANOVA model indicated significance in the main effect of time (P < 0.001) and the interaction (P = 0.012), badminton significantly improved scores larger than seated rest control (P = 0.021). Differences between walking, resistance exercise and seated rest control were not significant (P ≥ 0.477).**CONCLUSIONS:** These results indicate that complex and high-intensity exercise such as badminton appear to improve cognitive function relative to low-intensity simple aerobic exercise and anaerobic exercise.

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**The Effects Of Long-term Open- And Closed-skill Exercise Interventions On A Task-switching Paradigm In The Elderly**Chia-Liang Tsai<sup>1</sup>, Chien-Yu Pan<sup>2</sup>, Fu-Chen Chen<sup>3</sup>, Chun-Hao Wang<sup>1</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan. <sup>2</sup>National Kaohsiung Normal University, Kaohsiung, Taiwan. <sup>3</sup>National Pingtung University of Science and Technology, Pingtung, Taiwan.  
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(No relationships reported)Although previous studies have demonstrated that regular participation in open- and closed-skill exercise could produce distinct benefits on neurocognitive performances in the elderly, these cross-sectional studies cannot establish causality and obviate the participants' inherent executive-control capacities. **PURPOSE:** To investigate the effects of long-term open- and closed-skill exercise intervention on the neurocognitive performances in the elderly. **METHODS:** Fifty-seven healthy elderly males were randomly assigned to either an open-skill (n=19), closed-skill (n=19), and control (n=19) group and assessed behavioral and electrophysiological measures when performing the task-switching paradigm at baseline and after either a 24-week exercise intervention or control period. All independent variables were separately analyzed with a repeated-measures ANOVA. **RESULTS:** Both the exercise groups exhibited significantly larger P3 amplitudes after the exercise intervention relative to baseline when performing the task-switching paradigm (open-skill: 3.93±2.19 vs. 5.97±2.55 μV, p<.05; close-skill: 3.82±1.61 vs. 5.30±1.68 μV, p<.05). Although two exercise groups relative to the control group showed significantly faster reaction times (RTs) in the switch trials after the exercise intervention, only the open-skill group showed RTs facilitation in the non-switch (pre vs. post: 1183.41±144.36 vs. 1026.19±126.18 ms, p=.001) and switch (pre vs. post: 1396.99±301.51 vs. 1159.11±190.46 ms, p=.001) trials after an exercise intervention when performing the cognitive task. **CONCLUSION:** Regularly participation in open- or closed-skill exercise could facilitate overall neurophysiological effects and produce distinctive neuropsychological performance in the elderly.

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**Taekwondo Practice Improves Working Memory in Sedentary Children**Sonia Montero-Briceño, Isaura Castillo-Hernández. *University of Costa Rica, San José, Costa Rica.* (Sponsor: Luis Fernando Aragon-Vargas, FACSM)  
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(No relationships reported)Martial Arts training have a favorable effect on cognitive variables; however, there is a lack of evidence comparing the effects of practicing one of the taekwondo modalities (i.e., fighting and *poomsae*) on working memory (WM) in children. **PURPOSE:** To determine the chronic effect of *poomsae* taekwondo routines and fighting training programs on WM variables in Costa Rican sedentary schoolchildren.**METHODS:** Forty-eight children (25 males and 23 females, mean age 11.0 ± 0.9 yr.) were paired by gender and randomly allocated to either a fighting (60-min taekwondo fighting exercises including a 10-min aerobic warm up, 40-min of technical and tactical fighting exercises and 10-min cool down stretching exercises per session), a *poomsae* (60-min taekwondo *poomsae* including a 10-min aerobic warm up, 40-min of the first and second progressive *poomsae taeguk* standardized routine and 10-min cool down stretching exercises per session), or a control (no practice of taekwondo) group. Participants in the experimental fighting and *poomsae* groups performed two training sessions per week during six weeks. In both groups the exercises were taught by a black-belt taekwondo expert. WM was determined using the Words Backward (WBT), Digits Forward (DFT) and Digits Backward Tests (DBT) at the beginning (pre-test) and six weeks after (post-test) training.**RESULTS:** Two-way analysis of variance with repeated measures on one factor (time) revealed a statistically significant between-group interaction on WM measured by WBT (p = 0.009). A significant interaction was found between fighting and control groups over time (p = 0.024), and *poomsae* and control groups over time (p = 0.005). Follow-up simple effects tests revealed differences for time in the fighting (pre-test = 24.20 ± 6.27 vs. post-test = 26.53 ± 5.07) and *poomsae* (pre-test = 22.53 ± 4.72 vs. post-test = 26.47 ± 2.75) groups. No differences were observed in the control group (pre-test = 23.11 ± 6.51 vs. post-test = 22.67 ± 6.74). Cohen's *d* effect size was considered high in *poomsae* (Δ = 0.83) and moderate in the fighting (Δ = 0.48) group. No between-group interactions were found on DFT (p = 0.674) and DBT (p = 0.206) scores.**CONCLUSIONS:** Taekwondo training improves working memory in sedentary Costa Rican children; *poomsae* has higher positive effect than fighting exercises.

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**Effects of An 8-Week Moderate-Intensity Aerobic Exercise Intervention on Episodic Memory and Cognitive Control**Anthony J. Bocchine<sup>1</sup>, Ryan L. Olson<sup>2</sup>, Christopher J. Brush<sup>1</sup>, Peter J. Ehmann<sup>1</sup>, Brandon L. Alderman<sup>1</sup>. <sup>1</sup>Rutgers, The State University of New Jersey, New Brunswick, NJ. <sup>2</sup>University of North Texas, Denton, TX.  
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(No relationships reported)Although the effects of exercise on global cognitive function are well documented, there have been few randomized trials of aerobic exercise that focus specifically on select aspects of cognition, including episodic memory and cognitive control processes. Understanding these cognitive processes may be particularly important for individuals with major depressive disorder (MDD), as deficits in both memory and cognitive control are well recognized in MDD. **PURPOSE:** The primary aim was to assess the effects of an aerobic exercise intervention on episodic memory and cognitive control in individuals with and without MDD. **METHODS:** 48 participants (24 healthy, 24 MDD) were randomly assigned to either 8-weeks of aerobic exercise (AE) or a control group of time-matched light stretching. AE and stretching groups consisted of three weekly 30-45-min sessions per week. Depressive symptoms (BDI), peak aerobic fitness (VO<sub>2</sub> peak), episodic memory, and cognitive control were assessed at baseline and follow-up. Episodic memory and cognitive control were assessed using behavioral and event-related brain potential (ERP) measures during old/new and modified flanker tasks. **RESULTS:** After 8-weeks of AE, there were significant reductions in depressive symptoms, despite no change in aerobic fitness. No significant behavioral findings were observed for the old/new task; however, ERP analyses indicated significant increases in the parietal late positive component (LPC) from pre- to post-intervention, p < .05. Improvements were observed for reaction time during the flanker task, F(1,17)=16.89, p < .001, but not accuracy. Significant increases in flanker N2 and P3 component amplitudes were observed, p < .05. **CONCLUSION:** These findings suggest that 8-weeks of moderate-intensity AE has a significant influence on both episodic (recognition) memory and cognitive control processes, particularly among individuals with MDD. However, the effects were larger for cognitive control relative to recognition memory. The 8-week AE program improved select aspects

of cognitive function, in addition to reducing depressive symptoms. These benefits occurred without a change in fitness, suggesting other psychobiological mechanisms of action.

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### Effects of Two Types of Acute Exercise on Young Adults' Psychomotor Learning

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(No relationships reported)

Physical arousal coinciding with periods of memory consolidation facilitates long-term memory storage. Unknown is the role of exercise type on long-term memory.

#### PURPOSE:

To evaluate the effects of two types of acute exercise on young adults' immediate and delayed psychomotor learning.

#### METHODS:

30 young adults (22.9 yrs, F=73.3%) were randomly assigned to one of three conditions: Control, Simple Step Dance, or Complex Step Dance. Participants practiced a manual pursuit-rotor tracking task for 5 blocks of 10 trials and then engaged in 10-min of either seated rest, a simple Dance-Dance Revolution (DDR) type exercise, or a complex DDR exercise. Psychomotor learning was assessed in a single block of 10 trials administered immediately, 24 hours, and 7-days following exercise or rest. Exercise intensity was measured by the Borg Perceived Exertion Scale, administered at minute 3, 5, 7 and 10.

#### RESULTS:

For each participant, difference scores were calculated based on average time-on-target during the last block of training and during each retention test. A 3 (Group: Rest, Simple DDR, Complex DDR) X 3 (Time: Immediate, 24-hr, 7-day) analysis of variance revealed a significant Group X Time interaction ( $F(2,54) = 3.11, p = 0.02$ ). Planned contrasts revealed that at 24-hr, both exercise types significantly increased time-on-target performance (Simple DDR = 2.62 sec; Complex DDR = 2.84 sec), compared to rest (2.03 sec); at 7 days, performance improved for those in the complex DDR condition (4.60 sec) compared to the simple DDR condition (2.30 sec) and rest condition (1.67 sec). Ratings of perceived exertion differed between the exercise groups only at the end of exercise.

#### CONCLUSION:

The results support prior research showing that psychomotor memory is enhanced when practice is followed by acute exercise and suggest that physical arousal enhances memory consolidation. The results add to the research findings by showing that the type of exercise differentially affects memory consolidation, with exercise involving complex cognitively-demanding movements producing greatest benefits.

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### Comparison of Whey Protein and Alpha-lactalbumin in Muscle Pain, Pressure Pain Threshold and Mood States following Strenuous Prolonged Running

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**PURPOSE:** To compare the effect of whey protein and alpha-lactalbumin ingestion on muscle pain, pressure pain threshold (PPT) and mood state following prolonged strenuous running.

**METHODS:** 12 apparently healthy, active male subjects (age:  $30.4 \pm 2.8$  yr., height:  $172.7 \pm 5.6$  cm, weight:  $66.7 \pm 6.5$  kg,  $VO_{2max}$ :  $58.0 \pm 6.9$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) participated in the double-blind counterbalance crossover study. During the main trial, two treatments were applied CHO + Whey PRO or CA: CHO + Alpha-lactalbumin. Participants ran at 70%  $VO_{2max}$  on a standardized treadmill and recovered for 4 hours. Treatments were ingested every 30 minutes during the first two hours of the recovery period, with the amount of 0.66g/kg/h CHO and 0.34g/kg/h PRO. PPT and pain intensity at the biceps femoris muscle and mood state (evaluated by Brunel Mood Scale, BRUMS-C) were evaluated before exercise (Ex 0), 90 min during exercise (Ex- 90) and at 120 min (Re-120) and 240 min (Re-240) post recovery.

**RESULTS:** Compared with Ex-0, muscle pain was significantly higher at Ex-90 in both trials (CA:  $4.79 \pm 0.72$  vs.  $0.46 \pm 0.22$ ,  $P < 0.01$ ; CW:  $4.58 \pm 0.67$  vs.  $0.45 \pm 0.16$ ,  $P < 0.01$ ). No treatment effect was found in the rating of muscle pain ( $P > 0.05$ ). Compared with CW, PPT was significantly higher at Re-120 min in CA trial (CA vs. CW:  $31.55 \pm 3.09$  vs.  $26.99 \pm 2.32$  N/cm<sup>2</sup>;  $F = 5.223$ ,  $P = 0.033$ ). Vigor was slightly higher following CA ingestion than CW ingestion. (CA vs. CW:  $4.08 \pm 0.47$  vs.  $3.16 \pm 0.47$ ;  $F = 4.382$ ,  $P = 0.066$ ).

**CONCLUSIONS:** Strenuous prolonged running increases muscle pain. Compared with whey protein, alpha-lactalbumin elevates PPT in muscle and potentially enhances the feeling of vigor during short term exercise recovery.

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### Visceral Adipose Tissue Is Negatively And Selectively Associated With Cognition Among Obese Children

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**Purpose:** Although obesity later in life is a recognized risk factor for cognitive dysfunction, the relation of excess adiposity on childhood cognition remains controversial. In particular, visceral adipose tissue is metabolically active pathogenic tissue that is mechanistically implicated in inflammation, insulin resistance, and dyslipidemia. However, the influence of visceral adipose tissue on children's cognition remains understudied. Thus, the aim of the present investigation was to evaluate the differential impact of adiposity, particularly visceral adipose tissue, on cognitive function among obese and healthy weight children.

**Methods:** Obese (BMI  $\geq 95^{\text{th}}$  %tile) children (ages 7-9 years old, N= 64, 37 females) completed tests from the Woodcock Johnson Tests of Cognitive Abilities. A group of healthy weight children (BMI:  $5^{\text{th}}$ - $85^{\text{th}}$  %tile) were matched to the obese children on demographic characteristics (age, sex, SES) and aerobic fitness. Adiposity (i.e., whole body percent fat (%Fat), subcutaneous adipose tissue (SAAT), and visceral adipose tissue (VAT)) was assessed using dual energy X-ray absorptiometry.

**Results:** Bivariate correlational analyses revealed that %Fat and SAAT were not related to cognitive function in obese children. However, among obese children, VAT was a significant negative predictor of cognitive function, such that increased VAT was associated with poorer intellectual abilities,  $r's \geq -0.26, p's \leq 0.04$ ; and performance on two out of three cognitive performance clusters: thinking ability,  $r = -0.26, p = 0.04$ ; and cognitive efficiency,  $r = -0.26, p = 0.04$ . In contrast, among healthy weight children, adiposity measures were not associated with intellectual abilities or any of the cognitive performance clusters.

**Conclusion:** The results suggest that VAT, rather than SAAT or %Fat, was selectively and negatively related with cognitive function among obese children. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and mental health of children. Along with the dangerous metabolic nature of VAT, its detrimental relationship with obese children's intellectual and cognitive functioning raises additional concerns regarding the public health concerns of childhood obesity.

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### The Effects Of Using A Treadmill Workstation On Mental Arithmetic Performance

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(No relationships reported)

The effectiveness of using treadmill workstations in work environment to increase daily physical activity is well demonstrated in previous studies. However, there is limited evidence about the effects of using treadmill workstation on cognitive functions. To our knowledge, no previous study examines the effects of using treadmill workstation on mental arithmetic, which is a crucial cognitive skill in our daily life and is highly related to the working memory.

**PURPOSE:** To assess the impacts of using treadmill workstation on mental arithmetic performance, as well as to evaluate whether the impacts differ in different walking speeds. **METHODS:** Twenty four college students (12 female and 12 male, mean age =  $23 \pm 1.8$  yrs) each performed mental arithmetic test in four workstation conditions: sitting, standing, walking at a self-paced speed (mean = 2.3 km/h), and walking at a faster speed (mean = 3.5 km/h), during four days visits to an office-setting lab. The sequence of the workstation conditions was counterbalanced among participants with Latin Square design. The mental arithmetic test consists of fifty arithmetic problems adapted from the *Kit of Factor-Referenced Cognitive Tests* published by Educational Testing Service. The test was conducted on a computer and the accuracy, as well as speed, was measured by Matlab programs. Repeated measures of ANOVA was employed in a data analysis with workstation condition as a within-subjects factor and gender as a between-subjects factor. **RESULTS:** There is no significant main effect for workstation conditions either in accuracy ( $F = 0.698, p = 0.562$ ) or in speed ( $F = 0.908, p = 0.442$ ). In addition, ANOVA revealed no significant interaction effect of workstation conditions with gender either in accuracy ( $F = 1.528, p = 0.215$ ) or in speed ( $F = 1.812, p = 0.154$ ). **CONCLUSIONS:** Performance of mental arithmetic dose not differ across

the four workstation conditions, indicating that working memory may not be impaired when using a treadmill workstation. Given the benefits of using treadmill workstations in increasing daily physical activity, this could be taken as supportive evidence for the feasibility of adopting treadmill workstations as a solution for workplace inactivity. Further research focusing on long-term effects of using treadmill workstations on cognitive functions is suggested.

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### Acute Stretching Improves Affective States And Cognitive Function In Physically Inactive People.

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Physical inactivity appears to have negative effects on affective states and cognitive function, whereas acute exercise has beneficial effects on them. Stretching is a common activity used in a physical fitness program. In the present study, we hypothesized that acute stretching is beneficial to affective states and cognitive function in physically inactive people. **PURPOSE:** To test the specific hypothesis that acute stretching improves affective states and cognitive function in physically inactive people. **METHODS:** Nineteen sedentary young subjects participated in the present study. They were randomized to stretching condition (SC) and resting condition (RC) in a cross-over manner. The stretching program was 10-min whole body stretching using yoga techniques and poses. Before and after stretching or resting, they performed the Stroop task and completed the Short form of Profile of Moods Scale (POMS). Saliva samples were also collected to determine salivary cortisol levels. During the cognitive task, middle cerebral artery mean velocity (MCA Vmean) were monitored. **RESULTS:** In the SC, we observed a reduction in depression-dejection score (pre 3.32±/-.3.53 vs. post 2.05±/-.3.03,  $P = 0.02$ ) and an increase in vigor score (pre 4.63±/-.3.58 vs. post 6.68±/-.4.50,  $P = 0.03$ ). In the RC, we found no changes in depression-dejection score (pre 2.63±/-.2.93 vs. post 2.58±/-.3.15) or vigor score (pre 5.21±/-.4.02 vs. post 5.05±/-.4.21). The Stroop-interference, which was calculated by subtracting reaction time (RT) in the neutral trials from RT in the incongruent trials, decreased in the SC (pre; 33 ±/-.40 ms, post; -23 ±/-.49 ms,  $P < 0.001$ ). In contrast, the Stroop-interference did not change in the RC (pre; 11 ±/-.38 ms, post; -2 ±/-.43 ms). Stretching did not affect MCA Vmean during the cognitive task (SC; pre 52.2±/-.16.7 cm/s, post 51.2±/-.15.2 cm/s, RC; pre 50.7±/-.10.3 cm/s, post 48.2 ±/-.9.4 cm/s) or the salivary cortisol levels (SC; pre: 0.15 ±/-.0.08 µg/dL, post: 0.13 ±/-.0.05 µg/dL, RC; pre: 0.16 ±/-.0.07 µg/dL, post: 0.14 ±/-.0.04 µg/dL). **CONCLUSION:** Acute stretching improved affective states and cognitive function, but did not affect the measured physiological variables. Acute stretching seems to improve cognitive function in physically inactive individuals, possibly via improved affective states.

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### Vitamin D Status: Associations with Chronic Disease Risk Factors and Cognitive Function

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(No relationships reported)

Vitamin D deficiency has become commonplace in US adults, and has been linked to increased risks of chronic diseases. Decreased cutaneous vitD synthesis, low sun exposure, and other risk factors put older adults at higher risks of vitD deficiency. Identifying and correcting a low vitD status may be an easy way for individuals to improve health and reduce their risks for disease. **PURPOSE:** To investigate the relationship between current vitD status and risk factors for numerous diseases in older men and women. **METHODS:** Seventy-two (72) recreationally active older individuals aged 50-70 years completed medical history, food frequency, sun exposure, and IPAQ questionnaires, and had fasting blood draws and lipid panel, glucose, and vitD values measured. Testing included measures of height, weight, waist circumference, peripheral blood pressure, central blood pressure, arterial stiffness, % body fat, and cognitive function. Two-way ANOVA (PA, gender) was used to determine group difference for all measures based on PA and gender. Pearson correlation coefficient was used to explore relationships between vitD levels and disease risk factors. One-way ANOVA was used to measure differences across three levels of vitD status (deficient, insufficient, sufficient) for each risk factor for disease. Significance was set at  $\alpha=0.05$ . **RESULTS:** Low vitD status was found to be associated with GLU, TG, %BF, and android/gynoid (A/G) ratio. Males had stronger associations of vitD levels and disease risk factors than females. For males, vitD levels were moderately, negatively correlated with PSP ( $r=-0.557$ ;  $p=0.016$ ), PmeanP ( $r=-0.496$ ;  $p=0.036$ ), CSP ( $r=-0.534$ ;  $p=0.022$ ). For females, weak, negative correlations

found between vitD levels and GLU ( $r=-0.386$ ;  $p=0.004$ ), TG ( $r=-0.296$ ;  $p=0.030$ ), A/G ratio ( $r=-0.425$ ;  $p=0.001$ ). 70% of subjects in low PA group were vitD deficient or insufficient vs. 51.5% and 41.4% for moderate and high PA groups, respectively. A strong association was found between vitD status and the time of year vitD levels are measured ( $p=0.036$ ). **CONCLUSIONS:** Low vitD status is associated with risk factors for disease. Low vitD status is more likely during the winter months due to low sun exposure. Individuals would benefit from sufficient vitD intake in regards to overall health and reduced risks for chronic disease.

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### The Influence of Hydration on Childhood Cognitive Control

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Converging evidence indicates that health behaviors during childhood impact cognitive control (CC). However, the influence of water intake or hydration on specific aspects of CC remain understudied. This is concerning since recent epidemiological data demonstrates that ~55% of children in the United States are inadequately hydrated. Therefore, experimental studies are needed to delineate the influence of markers of hydration and changes in water intake on childhood CC.

**PURPOSE:** The current study aimed to: 1) assess the effects of changes in water consumption on modulation of CC among preadolescent children; and 2) elucidate the within condition relationships between urinary markers of hydration and children's CC.

**METHODS:** A counter-balanced cross-over design was utilized whereby 9-10-year-olds ( $N=26$ , 11 females) underwent high (HIGH; 2L/d) and low (LOW; 1L/d) water intake conditions for 4d. Following each condition, children completed a modified flanker task to assess attentional inhibition, an important component of CC. Urine osmolality was measured using pooled samples collected during the 24-h period (24-h  $U_{osm}$ ) preceding cognitive testing.

**RESULTS:** There was a significant difference ( $p<0.01$ ) in 24-h  $U_{osm}$  between the HIGH (393mOsm/kg ± 168) and LOW (787mOsm/kg ± 206) conditions. There were no significant effects of condition on flanker task performance (all  $p$ 's > .271). However, within condition analyses revealed that 24-h  $U_{osm}$  was correlated with CC. During the HIGH condition, 24-h  $U_{osm}$  was associated with congruent ( $r = -.441$ ,  $p = .024$ ) and incongruent ( $r = -.468$ ,  $p = .016$ ) accuracy, indicating that higher 24-h  $U_{osm}$  was associated with poorer accuracy.

**CONCLUSIONS:** Although there were no significant intervention effects on CC, these data link lower urine osmolality (i.e., better hydration) to greater CC among preadolescent children. Ongoing research is examining the effects of water modulation on changes in children's CC while accounting for baseline hydration. Supported by Danone Research

1104 Board #283 May 31 2:00 PM - 3:30 PM

### Viewing Television While Walking: Effects on Preference For Exercise, Treadmill Endurance Time and Behavioral Outcomes

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(No relationships reported)

**PURPOSE:** To determine the effects of television viewing while walking on: 1) preference for exercise and 2) treadmill endurance time. **METHODS:** Twenty-five insufficiently active adults (means±SD; age: 46±12 years; body mass index: 31.2±5.3 (kg/m<sup>2</sup>) completed this study. Part 1: participants performed three randomized 1/3-mile walking bouts at an intensity equivalent to 70% of their oxygen consumption at ventilatory threshold ( $VO_{2-at-VT}$ ). During these exercise bouts, individuals viewed 1) their favorite television program (FavTV), 2) a standardized nature program (NatTV) or 3) no-TV (NoTV). A behavioral choice paradigm approach was used to assess preference for exercising with each television condition. Part 2: participants completed two randomized 60-minute visits where they were asked to walk at 70% of  $VO_{2-at-VT}$  for 10-minutes under FavTV or NoTV conditions. After 10 minutes, participants could choose to continue exercising under the current television condition or stop exercising and watch television while seated. Participants were allowed to switch between exercise and rest as they desired during the remaining time. **RESULTS:** Part 1: in regards to preference for exercise, lower scores indicate greater preference for exercise during specified television condition. FavTV (preference score: 1.1±1.3;  $p<0.001$ )

and NatTV (preference score: 1.8+1.9;  $p=0.002$ ) were significantly greater than NoTV (preference score: 3.0+2.7). There was no significant difference in preference scores between FavTV and NatTV conditions ( $p=0.132$ ) Part 2: despite this difference in preference for exercise there was no significant difference in treadmill walking time (FavTV vs. NoTV; 50.0+2.6 vs. 44.7+3.2 minutes, respectively;  $p=0.102$ ). **CONCLUSIONS:** This study provides empirical evidence that inactive individuals prefer walking with television viewing versus with no television. Further research is needed to determine if active television viewing can translate to observable changes in exercise behaviors.

1105 Board #284 May 31 2:00 PM - 3:30 PM

### Complexities of the Body Weight Screening Experience: A Qualitative Analysis

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**INTRODUCTION:** The U.S. Preventive Services Task Force and NIH emphasize the use of weight-related screenings as a means to increase motivation of overweight/obese individuals to manage body weight. Yet, little is known about individual responses to receiving such screenings, which could inform future research. **PURPOSE:** To examine the acute, qualitative responses to a common body weight and composition screening in a sample of women classified as 'overfat' by a validated body fat percentage (BF%) cutoff. **METHODS:** Of 14 volunteers responding to a study assessing personal experience to a weight screening, 10 women (30.21 ± 16.64 years; 39.39% ± 6.60%; 28.25 ± 6.15 kg/m<sup>2</sup>) were classified as 'overfat'. Following DEXA testing, participants were provided with their weight and composition results, and then given 1-minute to evaluate. Participants were asked a series of questions guided by qualitative description regarding their experience. Interviews were digitally recorded, transcribed, and analyzed with open and axial coding to identify recurring themes. **RESULTS:** Five themes, represented here as internalized questions, emerged to summarize the individual experience: (1) Is this a threat to me? (2) Why is this a threat? (3) How does this make me feel? (4) Am I motivated? (5) What am I motivated to do? Theoretically, the results support a novel confluence of self-regulation and coping theories, where a weight-related discrepancy produced by the screening triggered perceptions of threat to self, including the appraisal of what is at stake during a stressful encounter (self-esteem, survival/health, sex/attractiveness, social status, family, physical functioning), which guided the appraisal process. Subsequently, emotional and motivational responses varied, as did coping choices (physical activity, healthy/unhealthy dietary changes, heightened self-regulation, seeking social support). **CONCLUSIONS:** The findings support the use of screenings to heighten awareness to one's body weight, yet highlight the complexity of individuals' responses and importance of 'appraisal stakes'. This study challenges the belief that screenings always trigger healthy, weight control efforts, while highlighting difficulties and potential bias in recruiting overweight women to volunteer for such screenings.

1106 Board #285 May 31 2:00 PM - 3:30 PM

### Acute Effects of Exercise on Attentional Bias in Low and High Anxious Young Adult Females

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(No relationships reported)

**PURPOSE:** To examine the effects of an acute bout of exercise on attentional bias, mood, and memory in young adult females who differ in trait anxiety. **METHODS:** Sixty-four participants between the ages of 18-34 years provided informed consent and completed two experiments involving tests of attentional bias, mood, and memory before and after a cycling protocol or seated rest control condition. Participants were categorized into low-trait anxious ( $n=29$ ) or high-trait anxious ( $n=35$ ) groups, and randomly allocated to experimental conditions. For both experiments, participants completed the assessments before and following 20 min of moderate intensity exercise or seated rest. Experiment 1 examined word-based attentional bias, while Experiment 2 examined picture-based attentional bias. **RESULTS:** Acute moderate exercise did not alter word-based attentional bias scores,  $F(1, 60) = 0.82$ ,  $p = .37$ ,  $\eta_p^2 = .01$ , nor incongruent response times,  $F(1, 60) = 0.97$ ,  $p = .33$ ,  $\eta_p^2 = .02$ . Exercise decreased picture-based attentional bias, but failed to reach statistical significance for bias scores,  $F(1, 59) = 3.03$ ,  $p = .087$ ,  $\eta_p^2 = .05$ , and incongruent response times,  $F(1, 59) = 3.45$ ,  $p = .07$ ,  $\eta_p^2 = .06$ . Trait anxiety levels did not impact exercise-induced changes in attentional bias. Enhancements in participants' mood post-exercise were observed in both experiments,  $F(1, 60) = 14.92$ ,  $p < .001$ ,  $\eta_p^2 = .20$  and  $F(1, 59) = 16.35$ ,  $p < .001$ ,  $\eta_p^2 = .23$ , respectively. The effects of exercise on memory were inconsistent.

**CONCLUSION:** The effects of acute exercise on attentional bias seem to depend on stimulus type. Results suggest that exercise has a greater impact on picture-based attentional bias pre- to post-exercise (Experiment 2) compared to word-based attentional bias (Experiment 1). Moderate intensity exercise improves measures of total mood disturbance, anger, confusion, state anxiety, vigor, and tension. This suggests that exercise may have a greater impact on subjective mood measures compared to the attentional processes associated with anxiety.

1107 Board #286 May 31 2:00 PM - 3:30 PM

### Exercise Intensity and Creativity

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(No relationships reported)

It has been shown that poor mental cognition is a risk factor for mortality at all stages in life. Studies have demonstrated that participants who report low levels of weekly physical activity consistently score lower in short-term memory, inductive reasoning, and verbal fluency tests. Intensity of exercise appears to be a critical component in the effectiveness of an exercise program on cognitive function, but little research on exercise's effect on creativity has been conducted. Further research is needed in the areas of both exercise's effect on creativity, and more specifically, various exercise intensity levels on creative function. **Purpose:** The purpose of this study was to investigate the relationship between exercise intensity levels in older adults and the creative component of mental cognition. **Methods:** Participants included 14 females and 10 males aged 55-75 years. Each participant completed three creative functioning assessment tests including the Remote Associations Task (RAT), the Creative Uses Test, and the Torrance Test. Height and weight were measured and BMI was calculated. Each participant wore a physical activity monitor that recorded physical activity for one week. Participants were instructed to go about their daily routine as usual. Data were analyzed by linear regression. **Results:** Average daily steps walked and RAT score were significantly associated ( $p<0.05$ ). There was no statistical relationship between amount of moderate intensity or vigorous intensity physical activity and scores on any creativity test. Those categorized as obese (BMI > 30) scored significantly lower on the RAT test but higher on the Creative Uses Test for both fluency and flexibility measures. **Conclusion:** Amount, but not intensity, of regular exercise had an influence on creative abilities. Additionally, there was a relationship between fitness and creativity. Obese individuals showed decreased convergent creativity abilities and increased divergent creative abilities. Further research is needed to support and explain this finding.

1108 Board #287 May 31 2:00 PM - 3:30 PM

### Using Elisa to Enhance The Biochemistry Laboratory Experience For Exercise Science Students

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**Background:** Researching the effects of exercise on many health conditions requires the use of biochemistry laboratory techniques such as Enzyme Linked Immunosorbent Assay (ELISA). However, undergraduate Exercise Science programs often do not provide experiences in these kinds of biochemistry laboratory techniques. **Purpose:** This project evaluated undergraduate students' knowledge of, experience with, and confidence in using biochemistry laboratory techniques before and after a laboratory exercise measuring salivary cortisol concentrations via ELISA. **Methods:** As part of the laboratory sessions in an undergraduate Exercise Physiology class the students ( $n=113$ ) provided saliva samples before and after 40 minutes of moderate intensity aerobic or resistance exercise. On another occasion, in groups of 2-4 students, the saliva samples were analyzed for cortisol concentrations using commercially available ELISA kits. Before and after the laboratory experience the students completed a survey regarding their knowledge of, experience with, and confidence in biochemistry laboratory techniques. **Results:** 58% of the students completed the survey before and after the biochemistry laboratory experience. None of the students indicated any previous experience with or knowledge of what ELISA was, how to perform an ELISA, or what could be measured using ELISA. 62% of the students had never used a precision single or multichannel pipette, and 50% had no confidence, 26% had very low confidence, and 24% had moderate confidence in their ability to do so correctly. After the laboratory experience 100% of the students had used a precision single channel and multichannel pipette, and 30% had moderate confidence and 70% had high confidence in their ability to do so correctly. As part of an open ended question the students indicated that they enjoyed the experience and frequently commented that they "felt like a real scientist" as while performing the ELISA. **Conclusion:** While many exercise science students in an undergraduate exercise physiology class had no prior laboratory experiences using precision pipettes or other biochemistry techniques,

a single laboratory exercise enhanced the students' confidence in their ability to correctly use precision pipettes and enhanced their self-identification as exercise scientists.

## B-74 Free Communication/Poster - Exercise Psychology - Neuroscience

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

### 1109 Board #288 May 31 2:00 PM - 3:30 PM ERP Evidence of Preparation Strategy Change in Table Tennis Players with Varying Level of Difficulty

Yingzhi Lu, Xiawen Li, Jiacheng Chen, Chun Xie, Chenglin Zhou. *Shanghai University of Sport, Shanghai, China.*  
(No relationships reported)

The task-preparation processes usually be affected by different factors, such as attentional demands, and skill levels. Researches in sport and motor field reported that skilled athletes are characterized by intense preparation of stimuli and employ highly developed strategies in the attention and motor domains, to respond to stimuli effectively.

**PURPOSE:** To investigate the effect of skilled level on the task-preparation strategy with varying level of attentional demands.

**METHODS:** 50 participants were grouped into Elites group (EG, n = 17), Amateur group (AG, n = 16) and Control group (CG, n = 17) based on the table tennis training years and skilled level. A modified cue-target paradigm was used in current study. It contains both cue stimuli (square means easy task, circle means hard task) and target stimuli (a ping-pang ball, may display on the left, right, up or down of the screen.). In the easy task, participants were asked to press the number key on corresponding position with the target, while in the hard task, the key on the opposite position needs to be pressed. Participants were asked to do a cognitive-motor task (release the "5" key, then press the target key and come back to hold the "5" key again.). Electroencephalograph was recorded during the task.

**RESULTS:** The accurate result showed the EG (0.99±0.01) performed better than CG (0.97±0.03,  $p = .046$ ), and in both reaction time (ms) and choice time, the EG (RT: 336.22±39.05; CT: 470.01±48.27) was faster than both AG (RT: 391.83±58.71; CT: 543.45±66.17) ( $ps < .01$ ) and CG (RT: 426.47±56.18; CT: 582.85±77.08) ( $ps < .001$ ). In the the contingent negative variation (CNV)(1200-1500 ms, unit:µV), only the easy task elicited larger CNV amplitude on the left hemisphere (1.95±1.67) than right hemisphere (0.59±1.36) ( $p < .001$ ) in the CG, while the AG showed such hemisphere differences on both easy (left: 1.39±1.48; right: 0.05±1.17) ( $p = .001$ ) and hard task (left: 1.26±1.61; right: -0.17±1.53) ( $p < .001$ ), and the EG didn't show any difference on hemisphere in neither of the tasks.

**CONCLUSIONS:** Different task-preparation strategies were moderated by both the skilled level and task difficulty. It is likely that successful athletes in reactive sports are characterized by employing similar spatial preparation in the motor regions to respond to visual stimulus effectively.

### 1110 Board #289 May 31 2:00 PM - 3:30 PM Exercise Training Rescues High Fat Diet-induced Neuronal Nitric Oxide Synthase Expression In Hippocampus And Cortex.

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(No relationships reported)

Western high-fat diet (HFD) consumption and being overweight induce hippocampal atrophy and deterioration of function. These alterations are associated with mental disorders, such as depression and anxiety. Exercise is an effective therapeutic treatment to combat obesity and enhance brain health. Numerous studies have demonstrated that neuronal nitric oxide synthase (nNOS) is a key regulator of affective behavior. Increased nNOS expression leads to anxiety, while reduced brain nNOS in an enriched environment that includes running exercise has anxiolytic effects. **PURPOSE:** We investigated whether HFD consumption and exercise training altered nNOS expression in the brain. **METHODS:** Twenty 4-week-old male C57BL/6J mice were used. After 2 weeks of acclimatization, mice were randomly assigned to a standard diet (SD; n = 5) or HFD group (n = 15). After 6 weeks, HFD-fed mice were further divided into either a non-exercise (HFD; n = 7) or a HFD (12 weeks) with exercise group (HFD+Ex; n = 8). The HFD+Ex group was allowed free access to a running wheel. Western blotting was performed to determine nNOS protein expression levels in the hippocampus (Hp), cortex (Cx) and cerebellum (Ce) from SD, HFD and HFD+Ex mice. **RESULTS:**

Body weights were significantly increased in HFD-fed mice (SD: 26.0 ± 0.4 g; HFD: 36.6 ± 1.5 g; HFD+Ex: 29.1 ± 0.5 g;  $p < 0.01$ ). Similarly, mesenteric fat weights were increased in the HFD group, while exercise training mitigated this effect (SD: 0.16 ± 0.04 g; HFD: 0.56 ± 0.10; HFD+Ex: 0.25 ± 0.03;  $p < 0.01$ ). Compared with that of SD mice, Hp and Cx nNOS expression levels increased significantly with HFD feeding (Hp: 1.90 ± 0.28 fold increase,  $p < 0.05$ ; Cx: 1.89 ± 0.49;  $p < 0.01$ ). HFD-induced Hp and Cx nNOS expression was reduced in HFD+Ex mice to levels comparable to those of the SD group, though the difference in the Cx was not significant (Hp: 0.86 ± 0.16 fold increase, Cx: 1.48 ± 0.22;  $p = 0.1003$ ). While Hp and Cx nNOS expression levels were susceptible to HFD consumption and exercise, those in the Ce were unchanged ( $p > 0.05$ ). **CONCLUSION:** We conclude that exercise training restores HFD-induced nNOS expression in the Hp and Cx. Our results indicate that HFD-induced brain dysfunction is regulated by nNOS in the Hp and Cx, and exercise has therapeutic potential for mitigating HFD-induced depression and anxiety via the nNOS/NO pathway.

### 1111 Board #290 May 31 2:00 PM - 3:30 PM Examining Fear Of Re-injury In High School Athletes With Concussion

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Recent concussion consensus statements advocate for research on emotional sequelae and associated risk factors following sport-related concussion (SRC). Fear of re-injury- a frequent emotional response following orthopedic injuries- is one factor that might influence emotional sequelae following SRC. Researchers report that athletes with SRC demonstrate elevated mood disturbances compared to athletes with musculoskeletal injuries. Maladaptive psychological responses, such as fear of re-injury, may influence the clinical presentation of SRC and associated recovery outcomes such as subjective symptom reporting. The relationship between fear of re-injury throughout SRC recovery and post-concussion symptom reporting are unknown. **PURPOSE:** To examine prospectively the relationship between fear of re-injury and symptom reporting in high school athletes with SRC.

**METHODS:** High school athletes (ages 14 - 18) with SRC were recruited for study and completed research measures at 3.40 days (SD = 1.60) following injury. Demographic data and total symptom severity scores were obtained from the Post-Concussion Symptom Scale (PCSS) and fear of re-injury was assessed via the Tampa Scale of Kinesiophobia (TSK). The TSK scores were categorized as sub-clinical, mild, moderate, and severe. Fear of re-injury categorizations were calculated for the sample and the relationship between TSK scores and symptom severity scores were examined with a Pearson's product-moment correlation. Statistical significance was set at ( $p < .05$ ).

**RESULTS:** Sixteen high school athletes ( $M = 15.75$ ,  $SD = 1.0$  years) participated in the study. The mean TSK score for the entire sample was 36.88 ( $SD = 5.96$ ), which reflects moderate fear of re-injury. Fear of re-injury scores were above clinical cutoffs for the entire sample. More than half of the sample (56%, 9/16) were moderately fearful of re-injury. Twenty-five percent (4/16) and 19% (3/16) of the sample exhibited mild and severe levels of fear, respectively. The mean total symptom score was 23.94 ( $SD = 27.13$ ). Total symptom scores and TSK scores were positively related ( $r = 0.67$ ,  $p \leq 0.05$ ).

**CONCLUSIONS:** Fear of re-injury is prevalent in high school athletes with SRC. Moreover, total symptom scores are positively correlated with fear and may influence management of SRC.

### 1112 Board #291 May 31 2:00 PM - 3:30 PM The Influence of Prior Concussion History and Gender on Post-Concussive Recovery in Young Athletes

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**PURPOSE:** To determine if female athletes with a prior history of concussion have a longer recovery period when compared with their male counterparts with a similar history of prior concussion. **METHODS:** We reviewed male and female youth, high school, collegiate and professional athletes (10-35 years old) seen by one provider for post-concussive symptoms at an outpatient sports medicine clinic.

**RESULTS:** When comparing males and females with a prior history of concussion, there were no differences found ( $p = 0.4006$ ) in recovery time following a concussion. Without regard to gender, those with no history of prior concussion are more likely to recover from post-concussive symptoms than those with a prior concussion history, although the difference was not statistically significant ( $p = 0.1027$ ). When assessing

whether gender alone influenced recovery rates, findings suggest that males are more likely to recover at any time point when compared to their female counterparts ( $p = 0.0019$ ).

**CONCLUSIONS:** History of at least one prior concussion in young athletes results in a higher initial symptom score and extended duration of post-concussive symptoms, thereby prolonging recovery time. According to our study, there are no gender-based differences in recovery time for those who sustain multiple concussions.

1113 Board #292 May 31 2:00 PM - 3:30 PM  
**Neurotransmitter Concentrations Do Not Predict TMS Measures of Excitability and Inhibition in the Motor Cortex**

Alia L. Yassen, Eli K. Edwards, Anita D. Christie. *University of Oregon, Eugene, OR.* (Sponsor: David Gabriel, FACSM)  
 (No relationships reported)

Transcranial magnetic stimulation (TMS) provides measures of motor cortex excitability and inhibition. Pharmacological studies suggest the involvement of the neurotransmitters glutamate and GABA in mediating TMS measures of excitability and inhibition, respectively. **PURPOSE:** The aim of this study was to determine the relationship between TMS measures of excitability and inhibition and proton magnetic resonance spectroscopy (1H-MRS) quantitation of excitatory and inhibitory neurotransmitter concentration in the primary motor cortex. **METHODS:** Thirteen (6 female, aged  $20.6 \pm 1.0$  years) healthy individuals were tested at three time points: Baseline, 2 Weeks, and 2 Months. Amplitude of the motor evoked potential (MEPamp) was calculated as a TMS measure of excitability, and the duration of the cortical silent period (CSP) was determined as a TMS measure of inhibition. Concentrations of glutamate and GABA were obtained at similar time points using 1H-MRS. **RESULTS:** MEPamp ( $p=0.30$ ) and glutamate concentration in the primary motor cortex ( $p=0.73$ ) were both similar across visits. However, glutamate concentration did not significantly predict MEPamp ( $R^2=0.0002$ ,  $p=0.93$ ). CSP duration ( $p=0.47$ ) and GABA concentration within the primary motor cortex ( $p=0.42$ ), were also similar across visits. However, GABA concentration did not predict CSP duration ( $R^2=0.0008$ ,  $p=0.87$ ). **CONCLUSION:** No relationship between TMS measures of cortical excitability or inhibition and 1H-MRS measures of glutamate and GABA were reported. These results suggest that additional factors may be responsible for excitability and inhibition, as assessed by TMS.

1114 Board #293 May 31 2:00 PM - 3:30 PM  
**The Effects Of An Eight Week Exercise Intervention On Brain Activity In Depressed And Non Depressed Individuals: A Fmri Pilot Study**

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 (No relationships reported)

**PURPOSE:** Memory deficits is the most frequently reported cognitive symptom in people suffering with Major Depressive Disorder (MDD). Supporting clinical findings, neuroimaging studies investigating memory impairment in people with MDD have identified brain areas such as the prefrontal cortex and medial temporal lobe to be dysregulated during both memory encoding and retrieval. Exercise for brain health has been a common research theme for the past several years. Research has found that exercise protects against the development of neurodegenerative diseases, reverses brain volume loss in the elderly, upregulates neurogenesis in rodents and improves learning and memory. The aim of this study is to investigate the effects of an eight week exercise program on brain function during a memory task in people suffering with MDD and young healthy individuals.

**METHODS:** Eight medicated patients with a clinical diagnosis of MDD based on DSM-IV criteria and eight healthy controls completed an eight week supervised exercise intervention. Participants performed an associative memory fMRI task matching names to faces pre and post the exercise intervention. Region of interest (ROI; anterior hippocampus) and whole-brain analyses were conducted to examine changes in brain function pre and post the exercise intervention.

**RESULTS:** Following the eight weeks of exercise our ROI analyses revealed no group x time interaction, no main effect of group and a marginal main effect of time that did not reach significance. When examining the whole sample, collapsing across groups, increases in activity were present following the intervention in several regions, such as the basal ganglia, medial frontal and parietal lobe, and posterior cingulate. A regression analysis was conducted to determine if the change in activity pre/post was related to improvement in depression scores. We found those who showed the greatest improvement in depression scores had a reduction in activity in the left occipital and right motor regions. This finding suggests an improvement in sensory and motor processing.

**CONCLUSIONS:** Our study shows that exercise can modulate brain activity during memory encoding in both healthy controls and those suffering from depression, which may be related to the reduction in symptoms shown in patients.

1115 Board #294 May 31 2:00 PM - 3:30 PM  
**Effects of the FITKids Randomized Controlled Trial on Cognitive Control and Conflict Monitoring in Children**

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**PURPOSE:** We investigated the influence of a 9-month physical activity intervention (FITKids: NCT01619826, NCT01334359) on cognitive control and conflict monitoring.

**METHODS:** Three hundred eight preadolescent children (8-9 years old) were randomized into an afterschool physical activity intervention ( $n=139$ ) or a wait-list control group ( $n=169$ ). The FITKids intervention occurred following every school day and provided a sum of 70-minutes of moderate-to-vigorous physical activity per session. All children completed a fitness assessment and a cognitive control task (i.e., flanker task) at pre- and post-test. Event-related brain potentials (ERPs) were recorded during flanker performance to determine neuroelectric underpinnings of frontally mediated changes in conflict monitoring (i.e., error-related negativity or ERN).

**RESULTS:** Results revealed greater improvements in fitness from pre- to post-test for the intervention group (1.8 mL/kg/min; 5.4% change) compared to the control group (0.6 mL/kg/min; 2.1% change) [ $t(306)=2.3$ ,  $p=0.02$ ]. Further, increased performance was observed for the flanker task, requiring variable amounts of cognitive control, with greater change for the intervention group (9.3% accuracy; -8.5 omission errors, -2.0 omission error runs) compared to the control group (6% accuracy; -4.1 omission errors, -0.7 omission error runs) [ $F's(1, 306) \geq 6.1$ ,  $p's \leq 0.02$ ]. Additionally, results revealed larger ERN amplitude at post-test (-6.3  $\mu V$ ) compared to pre-test (-5.0  $\mu V$ ), only for the wait-list group [ $F's(1, 306) \geq 9.6$ ,  $p's \leq 0.01$ ] with no such change observed for the intervention group (pre-test: -5.7  $\mu V$ ; post-test: -5.7  $\mu V$ ) [ $F's(1, 306) \leq 0.6$ ,  $p's \geq 0.46$ ], suggesting greater cognitive efficiency in that no additional adjustments in neural indices of performance monitoring were observed to underlie improved performance at post-test. Lastly, a dose-response relation was observed for children in the intervention such that greater improvements in cardiorespiratory fitness were related to greater reductions in ERN amplitude ( $r=.20$ ,  $p=0.02$ ).

**CONCLUSIONS:** These findings demonstrate that daily physical activity not only serves to improve fitness but also facilitates behavioral and functional neural processes associated with effective conflict monitoring in young children.

1116 Board #295 May 31 2:00 PM - 3:30 PM  
**Modifying Anterior Cruciate Ligament Injury Risk Factors in Female Athletes Through Real-Time Biofeedback**

Michael A. Riley<sup>1</sup>, Scott Bonnette<sup>1</sup>, Christopher DiCesare<sup>2</sup>, Adam Kiefer<sup>2</sup>, Kevin Shockley<sup>1</sup>, Michael Richardson<sup>1</sup>, Gregory Myer, FACSM<sup>2</sup>. <sup>1</sup>University of Cincinnati, Cincinnati, OH. <sup>2</sup>Cincinnati Children's Hospital Medical Center, Cincinnati, OH.  
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With a growing number of females participating in sport activities, the prevention of anterior cruciate ligament (ACL) injuries in female has become increasingly important. Overall, female athletes are more likely to injure the ACL than their male counterparts. Unfortunately, the majority of current preventative training programs face implementation challenges that reduce their widespread adoption as an ACL injury prevention program. The approach used in this study is an effort to overcome prior limitations using a real-time visual feedback training program to reduce biomechanical risk factors associated with ACL injuries.

**Purpose:** To develop and test effects of within activity response to real-time biofeedback method that targets and improves movement biomechanics associated with ACL injury risk in females.

**Methods:** Twenty female collegiate athletes [19.7 yrs. ( $SD = 1.34$ ), 1.74 m (0.09), and 72.16 kg (12.45)] participated. The study utilized a two-treatment crossover design. Participants were placed into either a real- or sham-first feedback group. The feedback focused on the technical performance of the unweighted back squat. After half the trials, participants were crossed over to receive the alternative treatment. Each

participant completed 110 squats—40 training squats for each feedback display and 10 squats during each test period. Participants' ability to control the feedback was evaluated by a heat map analysis which consisted of calculating a score that indicated the percentage of time the movement caused the stimulus to occupy a correct value. Heat maps were created for pre- and post-tests and each training set of squats.

**Results:** During training sets there was a significant difference in the heat map scores between the real and sham feedback sets,  $t(19) = 2.94, p < .01$ . The heat map score during the real feedback sets [ $M = 60.73\%$ , (6.47%)] was significantly greater than the score during the sham sets [ $M = 56.62\%$ , (8.42%)], indicating that the real-time biofeedback promoted the desired response during exercise performance.

**Conclusions:** The heat map scores of participants were higher during the real feedback training sets than the sham feedback training sets indicating real-time biofeedback as a potential training method for modification of risk factors linked to non-contact ACL injury prevention.

1117 Board #296 May 31 2:00 PM - 3:30 PM  
**Acute High-intensity Interval Training And Moderate-intensity Continuous Exercises Differentially Facilitate Cognitive Control**

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**PURPOSE:** The present study investigated the effects of a single bout of high-intensity interval training (HIIT) and continuous, moderate aerobic exercise (MAE) on inhibitory control. **METHODS:** The P3 component of an event-related brain potential was collected in 64 young adults during a modified flanker task following 20 minutes of seated rest, 20 minutes of MAE, and 9 minutes of HIIT on separate days in counterbalanced order. **RESULTS:** Shorter overall reaction time was observed following MAE (392.2ms) and HIIT (384.8ms) compared to seated rest (402.6ms),  $t_s(63) \geq 2.8, p_s \leq .007$ . Response accuracy selectively improved following HIIT (93.2%) in the task condition requiring greater inhibitory control compared to seated rest (91.1%) and MAE (91.3%),  $t_s(63) \geq 3.0, p_s \leq .004$ . P3 amplitude was larger following MAE (14.4µV) compared to seated rest (13.1µV) and HIIT (11.6µV),  $t_s(63) \geq 2.7, p_s \leq .007$ . Decreased P3 amplitude and shorter latency were observed following HIIT (11.6µV; 393.6ms) compared to seated rest (13.1µV; 405.4ms),  $t_s(63) \geq 2.6, p_s \leq .012$ . **CONCLUSION:** The current results indicated that MAE may facilitate cognitive control via increased neural resource allocation, whereas HIIT may have a larger facilitation on cognitive control beyond MAE via more efficient neural resource allocation. These findings demonstrate that both single bouts of MAE and HIIT may be feasible approaches to enhance cognitive performance, albeit via different mechanisms of neural activation.

1118 Board #297 May 31 2:00 PM - 3:30 PM  
**Comparing Before-and After-School Neurocognitive Performance in High School Athletes: Implications for Concussion Management**

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Sport-related concussion (SRC) requires a multifaceted assessment and management approach that relies on computerized neurocognitive testing (CNT) as an objective complement to subjective symptom reporting. Previous literature has identified several factors that negatively influence CNT performance and may complicate post-injury assessment. One factor that may negatively influence CNT performance is the cognitive fatigue associated with the academic school day. Concussed high school athletes may be required to complete an academic school day following their injury. Oftentimes, sports medicine professionals may have to administer CNT before and/or after school depending on the sports medicine, academic, and athletic schedules. However, administering CNT after an academic school day may not be the optimal time to evaluate neurocognitive performance due to several confounding factors such as cognitive fatigue. **PURPOSE:** To compare before-and after-school CNT performance in non-concussed high school athletes.

**METHODS:** A randomized crossover design was used for this study. After receiving University IRB approval, 29 high school athletes (15 males, 14 females) completed CNT before-and after-school on separate days. The mean age of the sample was 15.72 ± 1.25 years old. A series of paired samples t-tests were conducted for each CNT outcome score (verbal and visual memory, reaction time, processing speed) for both time points. Statistical significance was set at a Bonferroni-corrected ( $p < .01$ ). **RESULTS:** Significant differences for visual memory and reaction time were documented across both time points. Visual memory ( $p = .008$ ) was significantly better

before-school (86.14% ± 11.01) than after-school (81.57% ± 12.14) and reaction time ( $p = .001$ ) was significantly slower before-school (0.60 ± 0.07 sec.) than after-school (0.57 ± 0.06 sec.).

**CONCLUSIONS:** This study suggests that time of day and the demands of a school day should be considered when determining the optimal timing for CNT assessment. More research is needed to determine the mechanisms for which the time of day and cognitive fatigue may impact CNT assessment scores.

1119 Board #298 May 31 2:00 PM - 3:30 PM  
**Reliability And Validity Of The Japanese Version Of The Activities-specific Balance Confidence Scale After Stroke**

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 (No relationships reported)

**PURPOSE:** To investigate the reliability and validity of the Japanese version of the Activities-specific Balance Confidence Scale (ABC-J) among people > 6 month after stroke.

**METHODS:** ABC-J was translated with the step according to COSMIN'S CHECKLIST and Principals of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes Measures. In a cross-sectional study design, the sample size of this study was calculated according to psychometric recommendations described by Giraudeau and Mary, and calculated with G\*power. A convenience sample of 85 people was included (mean age 66.3 ± 9.5 years, between 0.5 and 20 years after stroke). The ABC-J was administered along with the Timed Up and Go test (TUG-T), the 10-meter walk test (10MWT), the Berg Balance Scale (BBS), the Geriatric Depression Scale (GDS), and the Fall Efficacy Scale-International (FESI). One or two weeks later, the ABC-J was again completed by 69 participants. Reliability was investigated in terms of reproducibility (the intra-class correlation coefficient: ICC, standard error and minimal detectable change) and internal consistency (Cronbach alpha), and one type of validity (criterion-related) were assessed with the Spearman correlation coefficients. **RESULTS:** The mean score for the ABC-J was 58.6±24.0. The ABC-J showed excellent internal consistency (Cronbach's alpha = .96) and substantial test-retest reliability (ICC=.96, 95% CI: .93, .97), with standard error and minimal detectable change values of 2.88 and 7.98, respectively. The ABC-J total score significantly correlated with TUG-T ( $r = -.53, 95\%CI: -.67, -.35$ ), 10MWT ( $r = -.53, 95\%CI: -.67, -.35$ ), BBS ( $r = .59, 95\%CI: .65, .72$ ), GDS ( $r = -.29, 95\%CI: -.47, -.08$ ), and FESI ( $r = .76, 95\%CI: .65, .84$ ) (all  $p < .001$ ).

**CONCLUSIONS:** ABC-J is a valid and reliable measure for investigating balance confidence among people >6 month after stroke.

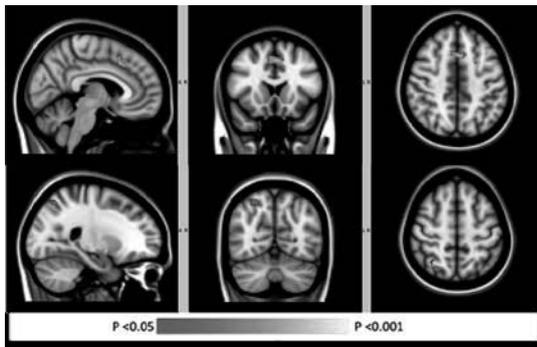
1120 Board #299 May 31 2:00 PM - 3:30 PM  
**Jugular Compression Ameliorates Alteration in fMRI of Working Memory in High School Female Soccer Athletes**

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**PURPOSE:** We aimed to investigate (1) whether repetitive head impact exposure during a soccer season induced significant functional changes in the brain in female athletes; and (2) whether a neck collar that applies mild jugular vein compression to engorge the cranial reserve volume (to reduce brain slosh during head impact exposure) can ameliorate resultant change in brain functional activation. **METHODS:** Neuroimaging data was acquired prospectively prior to and immediately following a high school soccer season in female athletes. These athletes were assigned to the non-collar group (n=12, age = 15.61±1.00 years) and the collar group (n=8, age = 15.30±1.19 years,  $p = 0.53$ ). Head impact exposures were recorded during all practices and games using X2's X-patch wearable sensor. A standard N-Back task was used to engage working memory during functional MRI at both pre- and post-season. **RESULTS:** On average, the athletes in the two groups experienced a similar number of impacts (145±91 vs. 143±23,  $p=0.95$ ). Increased brain activation of working memory was observed from pre-season to post-season in the non-collar group ( $p < .05$ , corrected) but not in the collar group. Compared to the non-collar group, significantly lower

alteration in fMRI brain activation ( $p < .05$ , corrected) was found in the collar group in the cingulate gyrus and the angular gyrus (Figure 1), both of which are known to be associated with memory functions.

**CONCLUSIONS:** The current study explored the alteration of brain activation in female athletes after experiencing repetitive head impact during a high school soccer season. The significantly increased brain activation from pre- to post-season in the non-collar group suggested that greater effort was required for task completion. The absence of alteration of brain activation in the collar group suggests a potential protective effect, supporting the growing literature of mild jugular compression in brain injury protection in sports.



## B-75 Free Communication/Poster - Instrumentation and Assessment Tools

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

### 1121 Board #300 May 31 3:30 PM - 5:00 PM Comparing Motion Capture Systems For Clinical Appropriateness In Lower Extremity Frontal Plane Measurements

Megan Philipp, Kenneth Jenkins, Connor Norman, Harrison Hall, Lauren Beres, Pat Sells, Kevin Robinson. *Belmont University, Nashville, TN.*  
(No relationships reported)

Motion capture systems are used with increasing frequency in clinical settings to form treatment and referral decisions. While the systems provide a distinct advantage over visual observations, they are limited by a variety of technological features. Additionally, the systems are not equivalent for all uses, and require further investigation to determine clinical appropriateness.

**PURPOSE:** The purpose of this study was to compare four independent motion analysis systems for capturing frontal plane hip motion during double limb squat (DLS) and single leg squat (SLS) movements. **METHODS:** 15 females with a mean age of  $24.2 \pm 1.27$  years provided consent and were screened before data collection. Each participant performed three trials of both DLS and SLS which were simultaneously captured on four motion analysis systems (Qualisys, Myomotion, Dartfish, Hudl). Following data collection, frontal plane hip angles were determined at the point of peak knee flexion. **RESULTS:** A one-way ANOVA of frontal plane hip angles between the four motion analysis systems demonstrated significant differences ( $p \leq 0.05$ ). Tukey post-hoc analyses were conducted to identify statistical significance. No significant difference was found between Qualisys and Myomotion or between Dartfish and Hudl for both right and left lower extremity during both DLS and SLS. A significant difference was found between Qualisys, Dartfish and Hudl during both DLS ( $7.62 \pm 21.71$ ,  $-37.57 \pm 17.05$ ,  $-29.46 \pm 15.56$ ) and SLS ( $-11.52 \pm 26.46$ ,  $12.7 \pm 6.75$ ,  $12.04 \pm 8.09$ ). A significant difference was found between Myomotion, Dartfish and Hudl during both DLS ( $7.09 \pm 8.83$ ,  $-37.57 \pm 17.05$ ,  $-29.46 \pm 15.56$ ) and SLS ( $-20.6 \pm 7.88$ ,  $12.7 \pm 6.75$ ,  $12.04 \pm 8.09$ ). **CONCLUSION:** 2-D and 3-D motion analysis systems demonstrated similarity within their specific domains but cannot be compared due to differences in measurement and calculation methods for hip abduction angles.

### 1122 Board #301 May 31 3:30 PM - 5:00 PM Relative Strengths and Efficacy of Commonly Used Clinical Motion Capture Systems for Lower Extremity Movements

Kenneth Jenkins, Megan Philipp, Lauren Beres, Connor Norman, Harrison Hall, Patrick Sells, Kevin Robinson. *Belmont University School of Physical Therapy, Nashville, TN.*  
(No relationships reported)

Motion capture systems are used with increasing frequency in clinical settings to form treatment and referral decisions. However, these systems offer varying levels of efficacy and comprehensiveness in data capture and clinical appropriateness.

**PURPOSE:** The purpose of this study was to expand on previous research for a more in-depth comparison between various motion analysis systems including Qualisys and Myomotion as well as Dartfish and Hudl for a variety of joint angles and rotations during functional movements. **METHODS:** 15 females with a mean age of  $24.2 \pm 1.27$  years provided consent and were screened before data collection. Each participant performed three trials of both double limb squat (DLS) and single leg squat (SLS) which were captured on four motion analysis systems simultaneously (Qualisys, Myomotion, Dartfish, Hudl). Multi-plane hip and knee angles were collected at peak knee flexion for each movement performed. **RESULTS:** The comparison between Qualisys and Myomotion demonstrated a significant difference in peak knee flexion ( $DLS: 96.83 \pm 12.77$ ,  $105.63 \pm 15.31$  SLS:  $73.68 \pm 16.91$ ,  $31.91 \pm 15.77$ ) and hip flexion ( $DLS: 79.26 \pm 11.39$ ,  $104.01 \pm 13.02$  SLS:  $61.99 \pm 18.71$ ,  $78.47 \pm 15.57$ ) in right lower extremity. Paired T-tests of the left leg showed no significant difference ( $p < 0.05$ ) between Qualisys and Myomotion for all hip and knee angles collected. Dartfish and Hudl showed no significant difference between knee angles and hip angles at peak knee flexion in the frontal plane bilaterally. **CONCLUSION:** Between the four motion capture systems investigated, comparison of multiple joint angles cannot be made between those using three dimensions (Qualisys and Myomotion) and those using two dimensions (Hudl and Dartfish) as they utilize divergent methods to capture and quantify data. Within their subgroups, Qualisys and Myomotion were found to have no mean differences between hip rotation and abduction, but to differ in peak hip and knee flexion. No significant differences were found between the data captured by Hudl and Dartfish which demonstrates that the two systems are comparable when used in the clinical setting. However, in terms of forming diagnoses, three dimensional systems offer a more complete picture.

### 1123 Board #302 May 31 3:30 PM - 5:00 PM Mobile, Low Profile, and Inexpensive Knee Joint Angle Sensor

Adin Martineau, James Tracy, Gavin Collins, Parker Rosquist, Dustin A. Bruening, Matthew K. Seeley, David T. Fullwood, Anton E. Bowden. *Brigham Young University, Provo, UT.*  
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(No relationships reported)

High-speed videography has been used to collect vast amounts of knee kinematic data, however, this method is generally restricted by a relatively small motion capture volume and is expensive. Consequently, alternative methods should be explored.

**PURPOSE:** To quantify sagittal-plane knee joint angles, using resistance changes from a high-deflection nanocomposite piezoresistive strain sensor.

**METHODS:** Nickel coated carbon fiber and nickel nanostrands were cured in a silicone matrix, to create a piezoresistive strain gauge. This gauge was adhered to athletic tape and applied over the patella. The gauge data were collected (1027 Hz), using an RFDuino microcontroller, on one male subject (age = 25 years; height 1.88m, weight 81.6 Kg), while he walked and ran at various speeds (3-7 MPH). Sagittal-plane knee angles were also measured using more traditional methods: VICON high speed cameras and Visual 3-D, and these angles were used to calibrate and evaluate the joint angles obtained from the strain sensor.

**RESULTS:** Output from the nanocomposite strain gauge appeared to show a one to one relationship between knee angle and change in resistance for angles 20 degrees or more during walking and running (Figure 1). Hysteresis was present in the sensor as it was being loaded and unloaded.

**CONCLUSIONS:** Through appropriate non-linear models, the strain sensor data could be used to predict knee angles during walking and running, which would facilitate the inexpensive measurement of knee kinematics outside of the traditional biomechanics laboratory setting. Supported by NSF Grant CMMI1538447

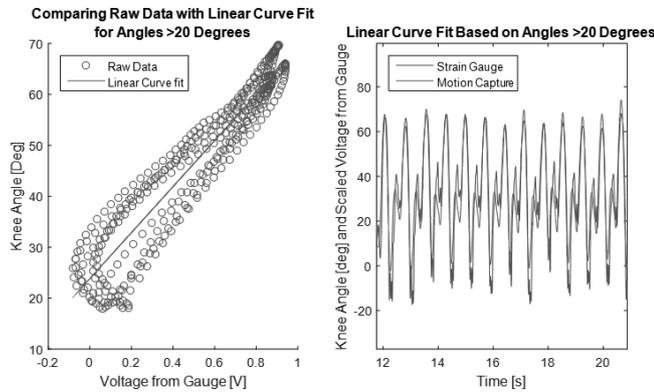


Figure 1. Strain gauge voltage scaled to motion capture angles during a 7MPH run

1124 Board #303 May 31 3:30 PM - 5:00 PM  
**Reliability Of A Smartphone Application Designed For Postural Control Assessment On Chronic Ankle Instability Subjects**

Yalan Chiu. *National Yang-Ming University, Taipei, Taiwan.*  
 (No relationships reported)

Ankle sprain is the most common sports-related injury. With high recurrence rate and residual symptoms, repeated ankle sprain may turn into chronic ankle instability (CAI), which affects sport efficacy and postural control ability. Recently, smartphones have become very popular and powerful devices, and been showed to have good validity and reliability on several clinical usages with built-in sensors. However, there is still not yet a smartphone application designed especially for subjects with CAI to assess their postural control ability.

**PURPOSE:** The purpose of this study is to evaluate the reliability of a smartphone-based postural control assessment application designed for subjects with CAI. **METHODS:** 10 healthy subjects (1 male, 9 females; age=21.8 ± 1.6 y/o) were recruited in the study. HTC 10 smartphone was used to conduct the assessment by recording the data of built-in accelerometer with an app developed using Android Studio. Subjects were asked to execute a 40-seconds single leg stance test. The smartphone was fixed on the middle of shin with an exercise armband, and the acceleration data was recorded with 50Hz sampling rate. Each subject performed 3 times of the same test (2 tests in day 1 and 1 test in day 2) to evaluate the within- and between-day reliability. Data was analyzed with intra-class correlation (ICC) with SPSS 20, and statistical significance was set as alpha < 0.05. **RESULTS:** ICC of within-day reliability was 0.899, p < 0.001 (acceleration data: test 0.941±1.445 vs retest 0.785±1.252, unit: m/s<sup>2</sup>). ICC of between-day reliability was 0.655, p = 0.025 (acceleration data: test 0.941±1.445 vs next-day test 1.041±1.513, unit: m/s<sup>2</sup>). The within-day reliability was good and the between-day reliability was acceptable. **CONCLUSIONS:** The study shows that the smartphone application has good reliability to be a convenient and easy-used tool for assessing postural control ability on CAI.

1125 Board #304 May 31 3:30 PM - 5:00 PM  
**Leg Power During Simulated Sit-to-Stand Fatigue: Smartphone Measures of Movement Speed**

Brian L. Tracy, FACSM, Amber R. Wright, Jungsoo Kang, Matthew J. Carnal. *Colorado State University, Fort Collins, CO.*  
 Email: brian.tracy@colostate.edu  
 (No relationships reported)

Smartphones are inexpensive, portable, user friendly, and contain sensitive gyroscopes. Apps can sample, store, and wirelessly transmit data. The 30s sit-to-stand (STS) is often used to measure leg power and fatigue resistance but provides only a relatively crude count of repetitions. Typically, expensive equipment is required to measure leg power (LP) and changes in LP that would indicate fatigue. **PURPOSE:** Determine the ability of an iPod to detect changes in chair rising speed, compared with an electrogoniometer (eGONI) and force platform. **METHODS:** Young adults (22.9±2.9 yrs, n = 42) performed a series of 20 STS repetitions starting with five at maximal speed, followed by progressive slowing of the remaining reps. Three trials of 20 reps were performed. A 5<sup>th</sup> generation iPod Touch was attached laterally on the lower thigh. An eGONI (Biometrics) was placed laterally across the knee joint. The feet were on a force platform (AMTI) in front of the chair. Concurrently, iPod gyroscope data (rad), knee joint angle (rad), and ground reaction force (GRF, N) were sampled at 100Hz. The peak slope (0.1s time constant) of the iPod pitch signal, eGONI signal, and GRF was calculated for the rising phase of each rep, in addition to the peak GRF. The instantaneous slope was normalized to body mass to provide an index of power

for each rep. For each device, the max, min, and max-min across the 20 reps were calculated. Correlations were computed between the devices for all subjects combined. **RESULTS:** Within individual subjects, across the range of speeds, the iPod values were highly correlated with the eGONI values (all R<sup>2</sup>>0.97), and the iPod vs. GRF R<sup>2</sup> values ranged between 0.82 and 0.95. For 3,148 trials pooled across all subjects, the R<sup>2</sup> was 0.91 for iPod vs. eGONI, 0.77 for iPod vs. GRF peak slope, and 0.72 for iPod vs. GRF peak. Across all subjects, the iPod vs. eGONI R<sup>2</sup> values ranged between 0.80 and 0.84 for max, min, and max-min. The iPod vs. GRF peak slope R<sup>2</sup> values ranged between 0.24 and 0.34, and between from 0.38 to 0.54 for iPod vs. GRF peak. **CONCLUSION:** A large range of chair rising speeds can be detected with the iPod. The iPod is an adequate substitute for an electronic goniometer or force platform to assess changes in leg power during an extended sit-to-stand task.

1126 Board #305 May 31 3:30 PM - 5:00 PM  
**Validation Of Smartphone-based Assessment Of Sit-to-stand Power**

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 Email: mcarnal@colostate.edu  
 (No relationships reported)

Modern smartphones are inexpensive, portable, user friendly, and contain sensitive gyroscopes. Apps can be used to sample, store, and wirelessly transmit data. Although easy to conduct, field tests of sit-to-stand (STS) power provide only a relatively crude (timed or counted) outcome measure of global performance. Expensive lab-based biomechanics equipment is required to obtain measures of leg power (LP) for individual repetitions during brief 5x STS tasks. **PURPOSE:** To determine the ability of the iPod to detect movement speed for each rep during a 5x STS test, and make comparisons with an electrogoniometer (eGONI) and force platform. **METHODS:** Young adults (22.9 ± 2.9yrs, 21 men, 21 women) performed a 5x STS task as rapidly as possible with strict form. Three trials were performed. A 5<sup>th</sup> generation iPod Touch was firmly attached (Velcro) to a strap around the lower thigh. An eGONI (Biometrics) was placed laterally across the knee joint. The feet were on a force platform (AMTI Accusway) in front of the chair. Concurrently, iPod gyroscope data (rad), knee joint angle (rad), and ground reaction force (GRF, N) were sampled at 100Hz. The peak slope (0.1s time constant) of the iPod pitch signal, eGONI signal, and GRF was calculated for the rising phase of each rep. The peak GRF was also measured. The instantaneous slope was normalized to body mass to provide an index of power for each rep. For each device, the mean power of 5 reps and the maximal single rep value was calculated for the three trials. Correlations were computed between the devices across all subjects. **RESULTS:** The mean (R<sup>2</sup>=0.85) and max (R<sup>2</sup>=0.86) iPod peak slope were highly correlated with the corresponding eGONI value. The mean (R<sup>2</sup>=0.47) and max (R<sup>2</sup>=0.44) iPod peak slope were moderately correlated with the corresponding GRF value. The mean and max values were highly correlated with each other for the iPod (R<sup>2</sup>=0.99), eGONI (R<sup>2</sup>=0.99), and GRF (R<sup>2</sup>=0.98). The greater rising power for men vs. women was detected similarly by the iPod (32.5%), eGONI (29.5%), and peak GRF (30.9%). **CONCLUSION:** As measured with the iPod, mean rising power from the 5x STS is very reflective of a single maximal rep. The iPod is sufficiently sensitive to detect differences in chair rising power between sexes and can replace an electronic goniometer for assessing chair rising power.

1127 Board #306 May 31 3:30 PM - 5:00 PM  
**Development of Smartphone-Based Balance Assessment System for Subjects with Chronic Stroke**

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 (No relationships reported)

Stroke is a cerebral artery disease that may lead to death and long-term disabilities; common clinical features include: hemiplegia, muscle weakness, numbness, sensory and motor deficits. These features may cause balance impairments, which will affect performance of ADLs and Quality of Life. In recent years, smartphones had become very popular and powerful. With the built-in sensors, smartphones had been shown to have good validity and potential to assess balance. Therefore, the purpose of this study is to evaluate the feasibility of smartphone-based balance assessment system for subjects with chronic stroke.

**Methods:** Ten subjects with chronic stroke (9 male, 1 female; age=57.7±13.3 y/o) and thirteen healthy adults (5 male, 8 female; age=45.6±11.7 y/o) were recruited in the study. HTC 10 smartphone was used to conduct the balance assessment, by recording its built-in accelerometer data with an application developed using Android Studio. Six postures were tested for thirty seconds each: shoulder-width stance (SWS) with eyes opened (E/O) and closed (E/C), feet-together stance (FTS) with E/O and E/C, semi-tandem stance (STS) with E/O and E/C. The smartphone was fixed on the back

on the S2 level. The summation of changed acceleration data was used to represent the balance performance, and the higher value indicated more instability. Data was analyzed with independent t-test with SPSS 20, and statistical significance was set as  $\alpha < 0.05$ .

**Results and discussions:** Significant difference was found between subjects with chronic stroke and healthy adults under four assessment postures: SWS with E/C (stroke  $0.040 \pm 0.013$  vs. healthy  $0.032 \pm 0.007$ ,  $p = 0.048$ , unit: g), FTS with E/O (stroke  $0.037 \pm 0.013$  vs. healthy  $0.032 \pm 0.006$ ,  $p = 0.027$ , unit: g), FTS with E/C (stroke  $0.050 \pm 0.023$  vs. healthy  $0.035 \pm 0.006$ ,  $p = 0.000$ , unit: g), STS with E/C (stroke  $0.099 \pm 0.075$  vs. healthy  $0.055 \pm 0.017$ ,  $p = 0.048$ , unit: g). The result demonstrates that a smartphone with built-in accelerometer can be used to discriminate the different balance performance between subjects with chronic stroke and healthy adults.

**Conclusion:** The study shows that smartphones may be a convenient, easy-to-use and valid tool for balance assessment on subjects with chronic stroke.

1128 Board #307 May 31 3:30 PM - 5:00 PM  
**Reliability of Foot Morphology Measurements From a Three-Dimensional Scanner**

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The relationship between structure and function of the foot may play a role in lower extremity injuries. Three-dimensional scanning techniques of foot structure have recently been developed to automate anatomical foot measurements.

**Purpose:** To assess the reliability of foot morphology measures from a commercially available three-dimensional scanner in a young, female population.

**Methods:**

15 females participated in this study (age:  $19.9 \pm 0.8$  yrs, height:  $1.7 \pm 0.1$  m, mass:  $66.3 \pm 13.8$  kg). A hand-held 3D white light scanner was used to obtain specific foot related measurements. Each subject had both feet scanned using a standardized foot position. Twelve measurements were calculated: foot length, foot width, heel width, arch height, arch length, toe height, ball circumference, waist circumference, instep circumference, heel circumference, ball height, and instep height for both feet. Inter-rater reliability was assessed between two different raters on the same test day. Between day test-retest reliability (intra-rater) was evaluated by a single rater on two separate days. Additionally, within day test-retest reliability was evaluated from three separate scans from the same rater. Intraclass correlation coefficients ICC (2,1) were computed for each measure. Standard error of measurement (SEM) was also calculated for each variable.

**Results:** Between day test-retest reliability was excellent (ICC range=0.91-0.98) for left and right length and width measures (SEM  $1.4 \pm 0.7$ mm). Between day height measures were lower with a range of 0.58-0.88 (SEM  $1.6 \pm 0.5$ mm), with toe height exhibiting the lowest reliability, whereas, circumference measures ranged from 0.89-0.96 (SEM  $2.7 \pm 0.4$ mm). Within day test-retest reliability was generally greater than between day reliability (range 0.75-0.99). Inter-rater reliability of height and width measures exhibited a range of 0.94-0.99 (SEM  $1.1 \pm 0.5$ mm). The range of inter-rater reliability for height measures was 0.63-0.89 (SEM  $1.7 \pm 0.5$ mm) and circumference measures were 0.90-0.97 (SEM  $2.6 \pm 0.3$ mm).

**Conclusion:** The results indicate that height, width and circumference reliability were excellent for inter-rater, intra-rater, and within day test-retest. While generally acceptable, future work should investigate the lower reliability for height measures.

1129 Board #308 May 31 3:30 PM - 5:00 PM  
**Reliability And Validity Of Hip Proprioceptive Scores In Older People: Testing In Weight-bearing Stance With The Hip Sway Ameda**

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To date, most hip proprioception tests have been conducted in lying position, which may be not relevant to functional performance. **PURPOSE:** To investigate the reliability of a novel hip proprioception test conducted in weight-bearing stance and its relevance to functional performance in older people.

**METHODS:** Twenty-one right-footed community-dwellings (8F, 13M, mean 72 years old, range 65-87), without neurological disorders or major lower limb injuries in the past 6 months volunteered. All participants could walk at least 100 meters independently without using a walking aid. Active Movement Extent Discrimination Apparatus (AMEDA) was purposely built for testing hip sway proprioception in the sagittal plane and the measure of proprioceptive sensitivity was obtained using Area Under the ROC Curve (AUC) analysis. The proprioceptive scores on the two occasions

were used to calculate a reliability ICC (3, 1). A paired-sample t-test was used to examine test-retest differences. To evaluate test validity, Pearson's correlations were calculated between scores of hip AMEDA and Step Test (ST) and 10 Meter Walk Test (10MWT).

**RESULTS:** The ICC (3,1) was 0.61 and there was no significant difference between the two occasions of testing ( $p = 0.18$ ). Both the left and right hip proprioceptive scores were significantly correlated with ST results ( $r = 0.52$  and  $0.45$ , both  $p < 0.05$ ). Only right hip proprioceptive scores were correlated significantly with the Comfortable and Fast forms of the 10MWT ( $r = -0.46$  and  $-0.44$ , both  $p < 0.05$ ). Proprioceptive scores for the right and left hips were significantly correlated ( $r = 0.73$ ,  $p < 0.001$ ).

**CONCLUSIONS:** The novel hip sway AMEDA test showed an acceptable reliability for the measurement of hip proprioception in older people. The hip proprioceptive scores obtained showed a significant relationship with functional performance. These findings have implications for rehabilitation intervention during aging.

1130 Board #309 May 31 3:30 PM - 5:00 PM  
**Pilot Study For The Reliability Of The 10-second Foot Tapping Test (FTT)**

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(No relationships reported)

The ability to produce and sustain rapid and repetitive movements is a vital aspect of almost any act of daily living (ADL). Without such ability, seemingly simple tasks such as walking would be all but impossible. Though commonly overlooked, the ability to rapidly and repetitively dorsiflex and plantar flex the foot is a crucial constituent of proper gait. So to that end, researchers have identified a means of assessing a person's ability to rapidly and repetitively dorsiflex and plantar flex the foot known as the 10-second foot-tapping test (FTT). Using the FTT, researchers have demonstrated that there is a marked decrease in foot tapping speed in clinical populations; e.g. stroke, multiple sclerosis, amyotrophic lateral sclerosis, cervical myelopathy, and Parkinson's disease; as well as degradations with age regardless of disease. It is hypothesized that this decline in foot tapping speed is attributed to changes taking place in the motor neurons responsible for the contraction of the muscles of the lower limbs. Despite showing a diminished foot tapping speed with disease and age, very little is known about the reliability of the FTT. **Purpose:** Therefore, the purpose of this study was to evaluate the test-retest reliability and inter rater reliability measures of the FTT using video playback of the test. **Methods:** Nine subjects were recruited for this study. Over the course of two visits, foot-tapping speed for each leg was measured using the FTT. During each visit the number of foot taps performed in 10 seconds was tested twice for each leg, yielding 4 tests per leg per subject over the course of two days. Each trial was video recorded and slowed down at varying speeds so as to allow each of the three raters to easily distinguish and count the individual foot taps, creating a total of 216 individual leg-test counts for analysis. **Results:** The FTT was found to have high interrater reliability (Cronbach's Alpha: 0.971) and immediate test-retest reliability (Pearson R Correlation: 0.918). **Discussion:** This study indicates that the FTT exhibits high test-retest and interrater reliability using video analysis. However, going forward, more research must be done on the reliability of the FTT using "live" counting, across the many apparent variations in test administration methods, and of course within a larger and more diverse group of subjects.

1131 Board #310 May 31 3:30 PM - 5:00 PM  
**Assessing the Reliability and Validity of an Objective Method of Measuring Postural Stability: Preliminary Data**

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**Reported Relationships:** S.E. Scarneo: Contracted Research - Including Principle Investigator; BrainScope Company, Inc.

**PURPOSE:** Postural stability is frequently used in the evaluation of mild traumatic brain injury (mTBI) and can be measured in a variety of different ways. Although Balance Error Scoring System (BESS) is a supported tool for assessing postural stability assessment after mTBI, other clinical tools are available, such as body sensors such as APDM Opal body sensor). The purpose of this investigation was to assess the validity and relationship of the APDM Opal body sensor compared to the modified BESS (mBESS) in individuals after an mTBI. **METHODS:** Injured subjects were defined as those diagnosed by an appropriate health care professional with an mTBI and compared to healthy controls. Postural Stability was examined using both the mBESS and APDM Opal sensor during the same testing session with the three traditional stances. mBESS was scored according to the conventional grading system. APDM was used in conjunction with a tablet and mobility lab software to collect postural stability data. Root mean square values were calculated for anterior-posterior (AP) and medial-lateral (ML) acceleration. Pearson product-moment correlations were calculated to assess the relationship between average mBESS score and average

RMS value, between average mBESS score and diagnosis with a concussion, and between average RMS value and diagnosis with a concussion. **RESULTS:** The overall mean RMS value was  $1.92 \pm 1.20 \text{ m}(s^2)^{-1}$  while subjects ( $n=43$ ) committed a mean of  $1.20 \pm 0.88$  balance errors during BESS testing on a firm surface. The coefficient of determination between calculated means of RMS and total mBESS score for the subject pool was modest, however trended towards significant ( $R^2=0.08, p>.05$ ). The coefficient of determination between mean total BESS score and a positive concussion diagnosis was insignificant ( $R^2=0.002, p>.05$ ). A weak and inverse relationship was found between calculated mean RMS and positive diagnosis with a concussion compared to healthy controls ( $R^2=0.009, p>.05$ ). **CONCLUSION:** While our results did not show a strong correlation between mBESS score and the Opal's measurement of postural stability, there was a trend toward statistical significance that may be influenced by sample size. This is promising given previously established validity and reliability values of the APDM, especially when using only a single sensor.

that allows for forefoot on rearfoot motion. **Data analysis** consisted of creating torque - angle curves using the FTS data and fitting the curves using a 2-degree polynomial of the form  $c1X^2+c2X+b$ . For each subject, a mean  $c1$  and  $c2$  coefficient and DAHI were obtained for the day 1 and day 2 measurement sessions. Intraclass correlations were used to assess the reliability of the coefficients across the three trials on the same day and Pearson correlations were used to assess test-retest reliability of the mean  $c1$  and  $c2$ , and DAHI across days. **RESULTS:** The correlation between the day 1 and 2 DAHI measurements for the right and left feet were  $r = .842$  ( $p = 0.002$ ) and  $r = -0.101$  ( $p = 0.8$ ). The intraclass correlation coefficients for the  $c1$  and  $c2$  coefficients for the right and left feet were  $0.887$  and  $0.927$  and  $.813$  and  $.738$ , respectively. The correlation between the day 1 and day 2 mean  $c1$  and  $c2$  coefficients were  $r = .493$  ( $p=0.027$ ) and  $r = .695$  ( $p=.001$ ), respectively. **CONCLUSIONS:** The FTMD appears to be a more reliable method of assessing foot flexibility than DAHI regardless of extremity that can be used by novice clinicians.

1132 Board #311 May 31 3:30 PM - 5:00 PM  
**Test-Retest Reliability of Multiple Postural Control Assessment Measures**  
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Multiple assessment methods exist to identify postural control deficits in both healthy and pathological populations. Though force platform technology is frequently used and validated in quiet stance conditions, few studies have explored the reliability of dual task assessments. Additionally, few studies have utilized non-linear metrics derived from ground reaction forces to determine differences in dual task conditions. **PURPOSE:** The purpose of this study was to determine test-retest reliability of three different postural control assessments using both linear and nonlinear methodology. **METHODS:** 24 healthy participants (3 male, 21 female, age  $20.38 \pm 1.46$ ) attended a single testing session once a week for four weeks. Participants completed three trials of eyes open (EO) and eyes closed quiet standing (EO) and a sport-like postural task, the Wii Fit Soccer Heading Game (WFS). Raw Center of Pressure (CoP) was collected using a force platform (1000Hz) and further analyzed. 95% Confidence Ellipse (CE), along with Peak Excursion Velocity (PEV), and Sample Entropy (SampEn) in anteroposterior (AP) and mediolateral (ML) directions was calculated from the data. Test-retest reliability was assessed using multiple repeated-measures ANOVA for each CoP variable across each time point (Time 1, Time 2, Time 3, Time 4). **RESULTS:** Significant differences were observed in 95% CE in EO ( $p = .016$ ) and EC ( $p = .032$ ) conditions. However, post hoc assessments determined no significant differences between time points 1, 2, 3, or 4. No significant differences were observed for EC PEV in the AP ( $p = .211$ ) and ML ( $p = .403$ ) directions, EO in the AP ( $p = .340$ ) and ML ( $p = .239$ ) directions, or WFS in the AP ( $p = .065$ ) and ML ( $p = .122$ ) directions across time. No significant differences were observed for EC SampEn in the AP ( $p = .961$ ) and ML ( $p = .030$ ) directions or EO in the AP ( $p = .434$ ) and ML ( $p = .150$ ) directions. **CONCLUSIONS:** Results indicate that the postural assessment metrics used for EO, EC, and the WFS conditions are a reliable measure across multiple weeks and do not indicate significant variability or a learning effect over time. Use of both linear and non-linear CoP measurements such as SampEn, PEV, and 95% CE show to be reliable over multiple time points, and thus should be taken into consideration for future studies utilizing postural control assessment.

1133 Board #312 May 31 3:30 PM - 5:00 PM  
**The Reliability of Foot Torsional Stiffness Measurements in Asymptomatic Recreational Runners**  
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Excessive foot mobility has been identified as a risk factor for overuse injuries in runners. Existing tools used to assess foot mobility either lack reliability, correlation with dynamic foot function, or require a significant amount of experience to use reliably. **PURPOSE:** To develop a clinical tool that can be used by novice clinicians to assess foot flexibility by measuring the torsional stiffness of the foot and evaluate its reliability. **METHODS:** A novice clinician (less than one year of experience) performed a structural foot assessment on 10 asymptomatic recreational runners. The assessment consisted of dorsal arch height index (DAHI) and foot torsional stiffness (FTS) measurements using a ForeFoot Torsion Measurement Device (FTMD). The same clinician repeated the measurements of DAHI and FTS at a second day approximately one week later. The FTMD provides measurements of angular displacement and torque at a sampling rate of 50 Hz and consists of a split platform controlled by a stepper motor with a torque sensor located in series with the motor

1134 Board #313 May 31 3:30 PM - 5:00 PM  
**The Development of a Seated Clinical Trunk Test to Assess Lower Extremity Injury Risk**  
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 (No relationships reported)

Poor neuromuscular control of the trunk is associated with numerous injuries, including anterior cruciate ligament tears. Currently, few reliable methods exist to clinically assess trunk neuromuscular control. The development of such a test could be used to screen individuals who require trunk neuromuscular control training for injury prevention and rehabilitation. **PURPOSE:** The objective of this study was to assess the between and within session reliability of a new seated clinical trunk control test. **METHODS:** 10 healthy subjects (10 F, ages  $21 \pm 1.83$ , BMI  $21.78 \pm 3.01$ ) with no prior lower extremity injuries were asked to sit on a wobble board placed on a solid surface on a plinth with their feet approximately 4 inches off the ground. Test length was 30 seconds and subjects had three practice trials followed by 2 test trials with their eyes closed. Performance on the test was measured as the time to the first predefined error and how many errors occurred in 30 seconds for each trial. An error occurred if the subject uncrossed their arms, opened their eyes, or if an edge of the wobble board touched the plinth. Reliability with and between days was assessed with an Intraclass Correlation Coefficient (ICC). **RESULTS:** Between day reliability for the time to error was good (ICC=0.77) and the reliability for the number of errors was excellent (ICC=0.93). Both the time to error and number of errors had excellent within session rater reliability (ICC <0.99). The average time to error was (day 1:  $17.3 \pm 9.2$  seconds, day 2:  $21.5 \pm 8.6$  seconds), and the average number of errors was (day 1:  $1.4 \pm 1.8$  errors, day 2:  $1.2 \pm 1.4$  errors). The average difference for time to error within the same session was  $0.1 \pm 0.1$  seconds, and there were no differences in the number of errors. **CONCLUSION:** The seated trunk control test shows good to excellent within and between day reliability for both the number of errors and time to the first error. Furthermore, there were minimal differences between trials, indicating that after the practice trials, there was no additional learning, yielding stable consistent results. These results indicate that the test is a reliable assessment of trunk neuromuscular control. Having established the tests reliability, subsequent studies should assess its ability to differentiate injured versus non-injured individuals.

1135 Board #314 May 31 3:30 PM - 5:00 PM  
**Comparison of Stability Scores on Adult Participants Using Commercial Balance Methods**  
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 (No relationships reported)

**Methods.** Currently, many commercial products or methods are being marketed for being the best way to improve overall balance and stability. Several of these products have not been tested or compared to see if stability range limits can be improved within a five week session by using these devices. **Purpose:** The purpose of this study was to compare if commercial balance methods can improve Limit of Stability (LoS) scores in healthy adult participants? **Methods:** A 4 group pre-test/post-test non-equivalent control group design was selected for the protocol. Subjects were grouped into 4 categories, Bosu Balance Trainer (BBT), Slack-line Device (SLD), Vinyasa Yoga (VG) and Control Group (CG). All subjects ( $n = 148$ ) were assessed pre and post via computerized posturography (Bertec, Inc. Columbus, OH) to determine (LoS) stability scores through sagittal and anterior/posterior planes. The experimental groups (BBT, SLD, VY) practiced their skills twice a week for at least 30 minutes for 5 straight weeks. A 4 x 2 multivariate MANOVA was used to determine any significance ( $p < 0.05$ ) within subjects and between groups.

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**Results:** Significance was observed in the frontal ( $p = .036$ ) and right sagittal planes ( $p = .034$ ) within the experimental groups. VY was significantly higher in the frontal plane ( $SD = 3.07 + 1.09$ ) than BBT ( $SD = 3.64 + .82$ ) or SLD ( $SD = 3.97 + .73$ ). However, SLD was significantly higher in the right sagittal plane ( $SD = 4.16 + .72$ ) compared to VY ( $SD = 3.67 + .54$ ) and BBT ( $SD = 3.31 + .46$ ). Post-hoc power scores demonstrated a value of 1.0 with regards to effect between subjects (group) and within subjects (time/time \* group).

**Conclusion:** Commercial balance methods can contribute to increasing Limit of Stability (LoS) scores in healthy adults. However, there is not a definitive program or device that increases LoS in all planes, based upon the results of this study.

1136 Board #315 May 31 3:30 PM - 5:00 PM

### Balance Assessment using Microsoft Xbox Kinect

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(No relationships reported)

Reduction in balance has been identified as an indicator of risk of fall, and thus, an accurate and cost effective balance assessment tool is essential for prescribing effective postural control strategies. **PURPOSE:** To establish the validity of the Microsoft Xbox Kinect (Kinect v2) in assessing the whole body center of mass (CoM) excursion and velocity during single leg balance and voluntary ankle sway tasks among young and elderly subjects. **METHODS:** Twenty subjects (10 young: age = 20.5±2.3 years, Height = 171.8±7.2 cm, Weight = 70.7±11.6 kg; 10 elderly: age = 70.6±9.5 years, Height = 169.1±8.7 cm, Weight = 74.0±17.8 kg), with no history of lower extremity injury, participated in this study. Subjects performed a total of six randomized trials; four single leg stand (SLS) and two ankle sway trials. A comparison between the balance outcome measures (anteroposterior (AP) and mediolateral (ML) CoM excursion and velocity and average sway length) from the Kinect v2 and a traditional three-dimensional motion analysis (3DMA) system was performed. **RESULTS:** Results from the SLS and voluntary ankle sway trials showed that consistency, agreement, and correlation between systems was excellent ( $ICC > 0.75$ ) for all CoM related variables when all subjects were considered a single group as well as when the elderly and young groups were analyzed. Concordance between systems ranged from poor to almost perfect depending on the group, task, and variable assessed.

**CONCLUSION:** This new technique, using a low cost motion analysis technology, may enable real time, objective assessments of balance parameters in the clinical and research environments, which represents a clear advancement in clinical balance assessment and home-based rehabilitation programs.

1137 Board #316 May 31 3:30 PM - 5:00 PM

### Validation of the Kinect-based Star Excursion Balance Test

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The Star Excursion Balance Test (SEBT) is a simple clinical assessment of dynamic balance that is commonly used as a measure of performance and injury risk among healthy and injured populations. Continued efforts to improve the sensitivity and repeatability of the SEBT, while maintaining the relative ease with which the SEBT can be implemented, may aid clinicians in utilizing the SEBT as an evaluative tool in patients with suspected balance deficits. To date, there is no study examining the use of the Microsoft Kinect on assessing the SEBT reach distance measures. **Purpose:** To establish the validity and reliability of the Xbox One Kinect (Kinect v2) to automatically assess the SEBT reach data in all eight directions. **Methods:** A total of ten healthy subjects (5 males and 5 females, age: 26.8±5.7 years, height: 174.2±8.3 cm, weight: 73.5±10.8 kg) participated in this single session observational research study. The reach distances in the eight different directions of the SEBT were measured concurrently from the Kinect v2 and a traditional three-dimensional motion analysis (3DMA) system. **Results:** The maximum SEBT reach distance difference between the Kinect and a traditional motion analysis system (BTS) was 2.01cm, while the minimum difference obtained was 0.86cm. The maximum ICC difference between the two systems was 0.01 and the maximum difference in CV was 1.7%, indicating that the Kinect is able to provide similar absolute and relative reliability compared to the BTS. Additionally, Pearson's correlation coefficient showed high agreements between the Kinect and the BTS ( $r > 0.97$ ) in all directions of the SEBT. **Conclusion:** The performance of the Kinect was comparable to that of the BTS in determining the trajectories of the subject's landmarks and thus the reach distance values during complex dynamic tests such as the SEBT.

1138 Board #317 May 31 3:30 PM - 5:00 PM

### Inter-day Consistency Of The Regional Analysis Of Discomfort Survey

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Cleated footwear designs often differ in terms of stud configuration, stiffness, and other structural variables. Although these design differences have the potential to affect an athlete's performance, they may also directly influence the athlete's perceived comfort of the cleat. Established footwear comfort surveys are generally non-specific in identifying anatomic locations of discomfort. Thus, there is a need to develop more specific and reliable assessments of footwear comfort. **PURPOSE:** To identify the day-to-day reliability and consistency of the electronic Regional Analysis of Discomfort Survey (RADS). **METHODS:** Fifteen healthy female athletes (age= 19.9±0.8 yrs, height= 1.7±0.1 m, mass= 66.3±13.8 kg) completed a series of movement screening and physical performance tasks on an artificial turf surface in standard soccer cleats on two separate days. After finishing these tasks, participants completed the RADS, which provided them the opportunity to identify locations of regional discomfort on an illustration that included the lateral, posterior, medial, plantar, and dorsal areas of each foot on a computer screen. The day-to-day consistency of identifying discomfort in each of 16-regions of the foot were analyzed using the coefficients of agreement (number of exact agreements / number of possible agreements). **RESULTS:** Fourteen of the fifteen participants identified an area of discomfort on at least one of the two days (mean= 4.4±5.7 locations, range= 0-20). Overall, the coefficients of agreement indicated good-to-excellent day-to-day consistency, with values ranging from 0.73-1.00. The lowest consistency was found in the distal (0.73) and proximal (0.73) aspect of the lateral side of the right foot, and distal (0.73) and proximal (0.73) aspect of the medial side of the left foot. The RADS exhibited perfect day-to-day consistency (1.00) in the bilateral plantar hallux, bilateral central plantar forefoot, and left plantar midfoot regions. **CONCLUSIONS:** Preliminary analysis indicates that the RADS may provide consistent day-to-day measures of perceived footwear discomfort in an athletic female population. Further investigations using a larger sample size and broader range of cleated athletes are warranted to validate the RADS using plantar foot pressure and anthropometric foot structure data.

1139 Board #318 May 31 3:30 PM - 5:00 PM

### Validation of Single Sensor Wireless In-shoe Force Insoles during Running

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Assessment of lower extremity loading during running is often completed either overground or on an instrumented treadmill in a biomechanics lab. A new product has been developed to allow for the acquisition of plantar loading on an iPod using Bluetooth, which could allow for the assessment of running in an outdoor setting. **PURPOSE:** To validate a single sensor in-shoe force insole (pedoped, Novel Electronics, St. Paul, MN) against a force plate during various running conditions. **METHODS:** The study included 12 subjects (age 25.3±4.2, height 68.7±4.1 cm, weight 758.9±173.9 N) each fitted with a pair of pedoped insoles (100Hz) and a pair of New Balance shoes. Each subject completed a 20 second running trial for 6 different conditions on an instrumented treadmill (1200 Hz). These conditions include running at a 9, 10 and 11 min/mi pace, running uphill at 10 min/mi, running with an exaggerated heel strike and a wide gait pattern at 11 min/mi (R9, R10, R11, RU, RHS, and RW respectively). A Matlab program was created to calculate peak vertical ground reaction forces (vGRF), loading rate (LR), and impulse (I) for each step. The interclass correlation ( $ICC_{3,k}$ ) comparing the pedoped insoles with the force plate was calculated in SPSS. The ranges used for the ICC are: fair 0.40-0.59, good 0.6-0.74, and excellent 0.75-1.00. **RESULTS:** The average peak vGRF, LR and I are presented in Table 1 along with the specific ICC values. For the vGRF the ICC values are considered excellent (0.81-0.91), LR ICC values are good to excellent (0.74-0.95), and I ICC values are excellent (0.84-0.91). **CONCLUSIONS:** Loading differences between the pedoped and force plate could result from differences in measurement location. These results indicate that these single sensor wireless insoles (pedoped) are a valid alternative to assessing lower extremity loading parameters during running allowing researchers to expand testing to a variety of settings outside of the lab.

**Table 1: Comparisons between pedoped and force plate loading parameters.**

	vGRF (BW)			LR (BW/s)			I (BW*s)		
	pedoped	Force Plate	ICC (SEM)	pedoped	Force Plate	ICC (SEM)	pedoped	Force Plate	ICC (SEM)
R9	2.15±0.17	2.40±0.20	0.88 (0.05)	16.72±3.23	21.64±4.38	0.76 (0.92)	0.34±0.030	0.36±0.021	0.84 (0.01)
R10	2.140±0.17	2.38±0.21	0.89 (0.05)	16.43±3.50	20.48±4.07	0.78 (0.87)	0.34±0.026	0.37±0.022	0.91 (0.01)
R11	2.08±0.15	2.29±0.15	0.83 (0.04)	15.51±3.49	18.93±3.68	0.90 (0.80)	0.35±0.023	0.38±0.025	0.95 (0.01)
RHS	2.04±0.18	2.28±0.15	0.91 (0.04)	15.06±2.71	17.92±2.05	0.95 (0.56)	0.34±0.024	0.38±0.023	0.87 (0.01)
RW	2.02±0.17	2.27±0.15	0.88 (0.04)	15.53±3.36	20.53±6.95	0.74 (1.21)	0.34±0.030	0.37±0.028	0.90 (0.01)
RU	2.09±0.12	2.30±0.15	0.81 (0.04)	14.93±2.21	18.17±3.14	0.93 (0.64)	0.34±0.029	0.36±0.028	0.89 (0.01)

\*SEM = standard error of the measurement.

**B-76 Free Communication/Poster - Medical Issues**

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

1140 Board #319 May 31 3:30 PM - 5:00 PM

**Disturbed Shear Rate Patterns And Endothelial Dysfunction In Young Men On Anabolic Androgenic Steroid Abuse**

Francis Souza, Allan Sales, Rafael Porello, Ana Luiza Sayegh, Marcelo Santos, Mauricio Yonamine, Carlos Negrão, Maria Janieire Alves. *Heart Institute, Sao Paulo, Brazil.*  
(No relationships reported)

Previous studies showed that disturbed in the shear rate (SR) patterns, characterized by high retrograde and oscillatory SR on conduit artery, are associated with pro-atherogenic phenotype. This phenomenon seems to be caused by increased sympathetic nervous activity and reduced bioavailability of nitric oxide. Considering the anabolic androgenic steroids (AAS) abuse induces autonomic dysfunction, it is possible to speculate that AAS users present alterations in the SR on conduit artery. **Purpose:** The aim of this study was to evaluate the shear rate patterns in young men under AAS abuse. **Methods:** 18 volunteers were divided into 2 groups: self-reported Anabolic Androgenic Steroid Users (AASU, n=10), Anabolic Androgenic Steroid Non-Users (AASNU, n=8), both group were bodybuilder (strength exercise training). The patients were submitted to evaluate SR patterns and flow-mediated dilation (FMD) both in the brachial artery. Furthermore, carotid artery intima-media thickness (IMT) was evaluated. All vascular variables were obtained by Doppler ultrasound and the images were analyzed by brachial analyzer. **Results:** Age was similar among AASU and AASNU (27±1 vs. 27±1 years, p=0.87). Anterograde SR (118.0±11.0 s<sup>-1</sup> vs. 117.0±17.0s<sup>-1</sup>, p=0.9) and mean SR (78.0±12.0 s<sup>-1</sup> vs. 98.0±21.0 s<sup>-1</sup>, p=0.3), were similar between groups. AASU showed higher retrograde SR (-42.0±6.0s<sup>-1</sup> vs. -19.0±5.0 s<sup>-1</sup>, p=0.01) and oscillatory SR (0.30±0.03 uu vs. 0.16±0.04 uu, p=0.03) compared to AASNU. AASU showed lower FMD compared to AASNU (7.2 ± 0.7% vs. 9.6 ± 0.7%, p=0.04). In addition, AASU showed higher carotid artery IMT compared to AASNU (0.62±0.02 mm vs. 0.49±0.02, p=0.005). **Conclusion:** Our results suggest that AAS abuse induces disturbed in the SR patterns in the brachial artery and endothelial dysfunction. These alterations could increase the risk of developing atherosclerosis in young men under AAS abuse.

1141 Board #320 May 31 3:30 PM - 5:00 PM

**Long Compared To Short Haul Travel Effects On Wheelchair Basketball Player'S Preparation For The World Championships**

Peter M. Fowler<sup>1</sup>, Jo Miller<sup>2</sup>, Charli Sargent<sup>3</sup>, Michele Lastella<sup>3</sup>, Heidi Thornton<sup>4</sup>, Lee Taylor<sup>1</sup>. <sup>1</sup>Aspetar Orthopaedic and Sports Medicine Hospital, Doha, Qatar. <sup>2</sup>Australian Institute of Sport, Canberra, Australia. <sup>3</sup>Central Queensland University, Adelaide, Australia. <sup>4</sup>La Trobe University, Melbourne, Australia.  
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Transmeridian travel often results in sleep disruption and increased daytime fatigue, both of which could negatively affect performance if travel is undertaken in close proximity to competition. Preliminary evidence from elite able-bodied athletes

regarding the impact of travel prior to competition is available to inform medical staff practice, however such data has not been collected from elite Paralympic athletes. This seems a considerable oversight given the unique challenges these athletes face with respect to travel and sleep.

**PURPOSE:** To investigate the impact of long compared to short haul travel on sleep, jet-lag, mood and performance in a group of elite Paralympic athletes prior to and during competition.

**METHODS:** For 19 consecutive days, including baseline (12 days), travel (1 day) and competition (6 days), objective measures of sleep and subjective measures of jet-lag, vigour, fatigue, and performance were assessed in 11 elite wheelchair basketball players using wrist actigraphy and self-report questionnaires, respectively. International travel to the World Championships (Manchester, United Kingdom [4 games over 6 days, commencing 2 days post arrival]) from various destinations was categorized into either LONG (n=6; 8-11 h time-zone change) and SHORT (n=5; less than 2 h time-zone change). Linear mixed models, standardised effect sizes (ES) and magnitude-based inferences were used to analyse the data.

**RESULTS:** There was no substantial influence of travel group (LONG vs. SHORT) on sleep quantity and quality, or subjective responses. However, for all players combined the mean sleep duration during baseline was below National Sleep Foundation guidelines, with a further likely small (ES = 0.36 ± 0.25) reduction during competition (6.7 ± 1.4 h vs. 6.3 ± 1.6 h, p=0.02). Increased vigour was associated with a likely moderate increase in subjective performance rating during competition (ES = 0.33 ± 0.26).

**CONCLUSIONS:** This group of Paralympic athletes did not obtain sufficient habitual sleep at home, with travel, regardless of the number of time-zones crossed, and/or competition further reducing sleep quantity. Individualised strategies to increase sleep quantity prior to and particularly following travel would therefore be recommended for this specific group of athletes.

1142 Board #321 May 31 3:30 PM - 5:00 PM

**Exercise-Induced Asthma Knowledge among Coaches of the Special Olympics National Team**

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(No relationships reported)

Evidence suggests that adults with an intellectual disability (ID) who have asthma worry about side-effects of using medications and do not like using their inhalers in public due to stigma. This is problematic, particularly for athletes, as medication needs to be taken 10-15 minutes prior to exercise. Further, research indicates that adults with ID may not be using their inhalers properly. Thus, coaches may need to assist with ensuring appropriate use of inhalers. **PURPOSE:** The purpose of this study was to determine whether Special Olympics coaches know how to manage their athlete's asthma effectively. **METHODS:** Coaches were asked to complete a short survey anonymously while attending training camp with their athletes. The survey consisted of 11 true or false statements regarding asthma, three questions on symptoms, triggers, and preventive techniques, and six yes/no questions on their athletes asthma status, their comfort and confidence in dealing with an athlete having an attack, and their emergency action plan (related to asthma). Twenty seven coaches completed the questionnaire. **RESULTS:** On average, coaches got 3.9 ± 1.6 of the true/false statements incorrect. However, they generally identified correct triggers, symptoms and preventive techniques. Less than half of the coaches felt confident dealing with an asthma attack if their athlete had one while playing their sport. Only 5 coaches had received training to prepare them for working with an athlete with asthma and only 9 coaches had an emergency action plan to deal with an asthma attack. **CONCLUSION:** These results demonstrate a need for asthma related training for Special Olympics coaches.

1143 Board #322 May 31 3:30 PM - 5:00 PM

**The Effect Of Resistance Training On Strength, Balance, And Coordination In Elderly Women**

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**Purpose:** Analyze the effect of 12 weeks of resistance training on strength, coordination, and balance performance in elderly women. **Methods:** The effect of resistance training on strength, coordination, and balance performance was assessed in a total of 39 postmenopausal elderly women (age 71 ± 9 yrs) who were selected to participate in a protocol of 12 weeks of resistance training. The sample was separated into two groups, the intervention group (IG) with 29 women and the control

group (CG) with 10 women. The resistance training protocol was applied three times a week engaging muscle groups between superior and inferior muscles. The exercises performed to superior muscles were the Pulley, Peck-Deck, Triceps Pulley, Hammer and Side Lateral Raise and the exercises to the inferior muscles were the Abductor, Adductor, Extension Chair, Flexor Bench, and Leg press 90°. Flexibility was tested using a Well's Bench where the participant performed 3 attempts and the best score was recorded. The dynamic balance was analyzed using a circuit that was performed before the intervention beginning and at the end of 12 weeks. Following the prescriptions proposed by Rikli & Jones, the coordination test was performed using a complex task mixed with a circuit. **Results:** The strength in superior limbs statistically improved between CG and IG (11.40 ± 2.87 vs 19.50 ± 1.52) with similar results with the inferior limbs strength (14.90 ± 3.10 vs 26.56 ± 3.17, p=0.001). Regarding dynamic balance, the IG presents a decrease in the time to complete to task compared to the CG (14.62s ± 1.83s vs 12.71s ± 0.62s, p<0.05). There are no differences in the coordination between GC and IG. **Conclusion:** The main conclusion of this manuscript brings a new paradigm to the training methods used in elderly populations. The benefits related to the strength development using resistance training are in accordance with the present literature, however, in opposition to the present literature, we found that resistance training is effective in developing dynamic balance. Dynamic balance is fundamental in avoiding falls, which are one of the most common injuries in the elderly population. Therefore, it is fundamental that elderly people work to develop health and wellness by incorporating resistance training as a strategy to develop strength and balance.

1144 Board #323 May 31 3:30 PM - 5:00 PM  
**Maximizing Respiratory Health In Elite Swimmers - A Systematic Approach To Optimize Total Airway Health**  
 James H. Hull<sup>1</sup>, Anna R. Jackson<sup>2</sup>, James G. Hopker<sup>2</sup>, Jon Greenwell<sup>3</sup>, John W. Dickinson<sup>2</sup>. <sup>1</sup>Royal Brompton Hospital, London, United Kingdom. <sup>2</sup>University of Kent, Chatham, United Kingdom. <sup>3</sup>British Swimming, Loughborough, United Kingdom.  
 (No relationships reported)

Elite Swimmers are known to have high prevalence of exercise induced bronchoconstriction (EIB), nasal and sinus disorders. There is however limited data available regarding the impact of a systematic assessment, addressing all aspects of airway health in this cohort.

**PURPOSE:** To report the findings of a systematic approach to evaluating total airway health in elite swimmers with EIB, prior to the 2016 Olympics.

**METHODS:** 15 elite swimmers (9 males, 6 females), age 22.2 ± 2.9 yrs underwent a systematic assessment of total airway health three months prior to the Olympics. All swimmers had a prior diagnosis of EIB, confirmed by indirect bronchoprovocation challenge and measurement of exhaled nitric oxide (FeNO). All were prescribed appropriate inhaler therapy and educated on inhaler technique. At the systematic assessment spirometry, FeNO, inhaler flow-rate, nasal flow was measured and they also underwent an assessment with a pulmonologist. Results were analysed using paired *t*-tests and are presented as mean ± SD.

**RESULTS:** All swimmers had at least one co-existing condition in addition to EIB including nasal disease, reflux, sensations of laryngeal closure, recurrent respiratory tract infection and abnormal breathing sensations. One-third reported side effects from inhaler use. All swimmers demonstrated sub-optimal inhaler technique based on an inhalation rate of 348 ± 49.4 L.min<sup>-1</sup>. Despite being prescribed treatment for EIB, three swimmers had on-going airflow obstruction with bronchodilator reversibility of FEV<sub>1</sub> by 12.9 ± 7.7 % above baseline. At the review FeNO was reduced (pre: 27.7 ± 15.1, post: 16.3 ± 6.5 ppb (p = 0.006) from first consult.

**CONCLUSION:** Despite being prescribed EIB treatment over half of an elite cohort of swimmers reported troublesome respiratory and allied symptoms. Moreover, inhaler technique was sub-optimal with frequent report of side-effects. Respiratory health in elite swimmers can be optimized through systematic assessment of airway health.

1145 Board #324 May 31 3:30 PM - 5:00 PM  
**Venous Thromboemboli Associated with Acute Aerobic Exercise: A Review of Case-Report Commonalities**  
 Paul M. Parducci<sup>1</sup>, Amanda L. Zaleski<sup>1</sup>, Gregory A. Panza<sup>1</sup>, Linda S. Pescatello, FACSM<sup>1</sup>, Paul D. Thompson, FACSM<sup>2</sup>, Beth A. Taylor<sup>1</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>Hartford Hospital, Hartford, CT. (Sponsor: Linda Pescatello, FACSM)  
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 (No relationships reported)

Venous thromboembolic (VTE) events (deep vein thrombosis (DVT) and pulmonary embolism (PE)), have been reported in otherwise healthy athletes following acute bouts of aerobic exercise. **PURPOSE:** To review case reports and assess the commonalities of athletic individuals diagnosed with VTE, as well as the return-to-play recommendations prescribed by their physicians. **METHODS:** We reviewed reports (n=14) of trained individuals (mean±sd; age 30.9 ± 15.3; F/M = 8/6) who were

diagnosed with DVT and/or PE following a bout of aerobic exercise. We assessed frequency of VTE risk factors, symptoms with which patients presented, and return-to-play recommendations presented by clinicians. Age comparisons between the female and male groups were assessed by a one-way ANOVA. **RESULTS:** Of the 14 cases of diagnosed VTE reported in healthy trained athletes, seven patients (50%) were diagnosed with PE, four (28.6%) with DVT, and three (21.4%) with both DVT and PE after a bout of vigorous exercise (11.7±3.0 METs). Female patients were on average younger than males (22.6±5.9 vs. 41.8±17.7; p=0.014). The most frequently reported commonality was the presentation of symptoms after a period of prolonged inactivity (> 1 hour) following an aerobic exercise bout, seen in nine (64.3%) individuals. Additionally, seven (87.5%) of the eight women were oral contraceptive (OC) users. Only two (12.3%) individuals were diagnosed with an inherited clotting disorder. Five cases (35.7%) did not report return-to-play recommendations, and those who did varied widely, with six (42.9%) clinicians recommending a range of physical activity restrictions, and three (21.5%) clinicians advising use of compression garments. **CONCLUSIONS:** Female athletes presenting with VTE were significantly younger than male athletes, and most were using OCS, suggesting that the mechanisms underlying VTE may differ in men vs. women. Moreover, the frequency with which a period of inactivity preceded VTE also supports the possibility that aerobic exercise in combination with other risk factors can exacerbate VTE independent of underlying preexistent coagulopathy disease. This information may help clinicians better prevent, diagnose and treat VTE in athletic patients and also highlights the need for better defined return-to-play guidelines for athletes following VTE.

1146 Board #325 May 31 3:30 PM - 5:00 PM  
**L-glutamine Enhances Plasma Glutamine And Maintains Concentrations Of Alanine And Arginine Following High Intensity Cycling**  
 Zachary S. Clayton<sup>1</sup>, Ari Hozman<sup>2</sup>, Brittany Braden<sup>2</sup>, Mark Kern<sup>2</sup>. <sup>1</sup>University of Oregon, Eugene, OR. <sup>2</sup>San Diego State University, San Diego, CA.  
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Glutamine is a naturally occurring nonessential, gluconeogenic amino acid. Prolonged exercise is associated with a decrease in intramuscular and plasma concentrations of glutamine, which may be linked to performance decrements. Thus, we hypothesized that exogenous glutamine supplementation would preserve the plasma glutamine pool following high intensity cycling, as well as improve performance in a repeated bout of cycling. Two solutions [61 g glucose polymer (PLC); 61 g glucose polymer and 0.3 g·kg<sup>-1</sup>·bodyweight L-glutamine (GLN)] were tested using a double-blind, randomized, cross-over design. During each trial, ten cyclists ingested one liter of test solution immediately following an initial exercise bout (30 min at 70% VO<sub>2</sub> max, 6 x 1 min sprints at 140% VO<sub>2</sub> max, 45 min at 70% VO<sub>2</sub> max) and recovered for two hours in a seated position. Immediately following the recovery period, subjects completed a time to exhaustion (cycle at 80% VO<sub>2</sub> max until no longer maintaining 100 RPM) test. Blood was collected immediately following the initial exercise bout, after 2 h recovery, and immediately following the time to exhaustion test. Glutamine concentration was increased (p < 0.05) by approximately twofold (676±126 to 1410±636 μmol/L) from baseline to the completion of recovery for GLN, while no difference was detected in the PLC trial. At the end of recovery, GLN maintained alanine and arginine concentrations, while these amino acids significantly decreased in the PLC trial. However, the increased concentration of plasma glutamine and maintained concentrations of alanine and arginine did not influence performance (GLN: 20.98±10.35; PLC: 21.5±8.53 min).

1147 Board #326 May 31 3:30 PM - 5:00 PM  
**The Influence of Exercise Volume on Cardiorespiratory Fitness and Cardiovascular Disease Risk Factors**  
 Thomas Burke, Kelsie Ostojic, Nicole Koontz, Leonard A. Kaminsky, FACSM, Matthew Harber, FACSM. Ball State University, Muncie, IN. (Sponsor: Dr. Matthew Harber, FACSM)  
 (No relationships reported)

**Purpose:** To investigate the relationship of total exercise volume in relation to the American College of Sports Medicine (ACSM) aerobic exercise guidelines on improving cardiovascular disease (CVD) risk factors and cardiorespiratory fitness (CRF). **Methods:** Ninety-two individuals (57.0±11.1 (28-79) years; 41% male, 59% female) in a self-referred exercise program completed a CVD risk factor assessment, body composition (iDXA), and maximal exercise testing pre- and post- 6 months of participation. All were provided an individualized exercise prescription based on ACSM aerobic exercise guidelines. Exercise volume (frequency, intensity, and duration) was recorded daily and subjects were stratified into three groups (HIGH, MODERATE, LOW) based on the total volume performed. A two factor (group x time) ANOVA with repeated measures on time was performed to assess differences between groups for resting hemodynamics, blood lipids, body composition, and CRF. Correlation analyses were used to examine the relationship between exercise volume,

CVD risk factors, and CRF. **Results:** Exercise volume was higher ( $p<0.05$ ) in HIGH compared to MODERATE and LOW, and MODERATE was higher ( $p<0.05$ ) than LOW. A main effect for time ( $p<0.05$ ) was present for resting heart rate, systolic/diastolic blood pressure, total cholesterol, triglycerides, LDL, body weight, waist circumference, BMI, CRF, body fat composition, and lean mass, independent of group. Exercise volume was correlated ( $p<0.05$ ) with markers of aerobic fitness; resting heart rate ( $r=-0.236$ ) and CRF ( $r=0.286$ ). Improved plasma lipid profile was ( $p<0.05$ ) correlated with exercise volume; total cholesterol ( $r=-0.287$ ), LDL ( $r=-0.222$ ), glucose ( $r=-0.247$ ). Additionally, exercise volume was significantly correlated with markers of body composition, mainly fat distribution; body weight ( $r=-0.369$ ), body mass index ( $r=-0.356$ ), fat mass ( $r=-0.417$ ). **Conclusion:** Participation in a self-referred exercise program improves CRF and CVD risk factors regardless of exercise volume. Correlations between exercise volume and CVD risk factors (e.g. blood lipids, body composition) suggest a dose response relationship. Randomized control trials are warranted to assess the impact of exercise volume on CVD risk factors.

## B-77 Free Communication/Poster - Nutrition and Health

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

1148 Board #327 May 31 2:00 PM - 3:30 PM

### Assessing Urine Concentration in Children by Combining Urine Color and Void Number

Lisa T. Jansen<sup>1</sup>, Giannis Arnaoutis<sup>2</sup>, Dimitris Bougatsas<sup>2</sup>, J.D. Adams<sup>1</sup>, Jeanne H. Bottin<sup>3</sup>, Erica T. Perrier<sup>3</sup>, Andy Mauromoustkos<sup>1</sup>, Stavros A. Kavouras, FACSM<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Harokopio University, Athens, Greece. <sup>3</sup>Danone Research, Palaiseau, France. (Sponsor: Stavros A. Kavouras, FACSM)  
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**Reported Relationships:** L.T. Jansen: Consulting Fee; S.A. Kavouras - Scientific Consultant for Quest Diagnostics. Contracted Research - Including Principle Investigator; S.A. Kavouras - Active Grants with Danone Research.

**Purpose:** To evaluate the diagnostic ability of two combined practical markers for high urine concentration in children. **Methods:** Twenty-four hour urine samples from 210 Greek children (age: 8-14 y, body mass:  $43.4 \pm 12.6$  kg, height:  $1.49 \pm 0.13$  m, girls: 105) were collected and analyzed for urine osmolality (UOsm), color (UC), while the number of voids (Void) was recorded. Receiver Operating Characteristic (ROC) analysis was performed for UC, Void, and combination of UC and Void to determine markers' diagnostic ability for detecting high urine osmolality ( $UOsm > 800$  mmol $\times$ kg<sup>-1</sup>). **Results:** Sixty-four out of the 210 children (30%) had UOsm greater than 800 mmol $\times$ kg<sup>-1</sup>, with mean UOsm, UC, and Void of  $686 \pm 223$  mmol $\times$ kg<sup>-1</sup>,  $3 \pm 1$ , and  $6 \pm 2$ , respectively. UC displayed an overall diagnostic accuracy (area under the curve, AUC) of 90% (adjusted for gender, age and body mass index) with 98.4% sensitivity, 59.6% specificity, and threshold of  $>3$ . The overall accuracy for Void was 73.7% (adjusted for age and gender) with 63.1% sensitivity, 64.1% specificity, and threshold of  $>5$  times per day. When combined ROC analysis performed for UC & Void presented an AUC of 91% with 100% sensitivity and 62.6% specificity. **Conclusion:** Both urine color alone and the combination of urine color assessment and void count can be used as valid and simple diagnostic measures to detect high urine concentration. **Grant Funding Info:** Funding provided by Danone Research

1149 Board #328 May 31 2:00 PM - 3:30 PM

### A First Morning Spot Sample Overestimates 24-Hour Urine Osmolality in Children and Adults

Adam D. Seal<sup>1</sup>, Dimitris Bougatsas<sup>2</sup>, Giannis Arnaoutis<sup>2</sup>, Jeanne H. Bottin<sup>3</sup>, Erica T. Perrier<sup>3</sup>, Spiridoula Tsiouridi<sup>2</sup>, Stavros Kavouras, FACSM<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Harokopio University, Athens, Greece. <sup>3</sup>Danone Research, Palaiseau, France.

**Reported Relationships:** A.D. Seal: Consulting Fee; Quest Diagnostics. Contracted Research - Including Principle Investigator; Danone Research.

Hydration is frequently assessed using the concentration of single spot urine samples collected from first morning urine. However, circadian variations and overnight fasting (i.e., during sleep) likely affect morning urine concentration. Twenty-four-hour urine samples provide a more complete view of daily hydration, but collection is time-consuming and is difficult to manage, particularly in studies involving children. The degree to which first morning urine overestimates 24-h urine concentration has been characterized in adults, but less in children. **Purpose:** To evaluate the diagnostic

accuracy of first morning urine concentration to accurately identify children and adults with high 24-h urine concentration ( $>800$  mmol $\times$ kg<sup>-1</sup>). **Methods:** Hydration was assessed via urine osmolality ( $U_{Osm}$ ) in a total of 210 children (age: 8-14 years, body mass:  $43.4 \pm 12.6$  kg, height:  $1.49 \pm 0.13$  m, girls: 105) and 82 adults (age:  $23.6 \pm 2.9$ , body mass:  $65.8 \pm 8.1$  kg, height:  $1.72 \pm 0.76$  m, women: 41). Data collection included both a full 24-h collection ( $U_{Osm-24}$ ) as well as the associated first morning spot urine sample ( $U_{Osm-AM}$ ). The diagnostic accuracy of  $U_{Osm-AM}$  to identify  $U_{Osm-24} > 800$  was evaluated using receiver operating characteristic (ROC) analysis in children and adults separately. **Results:** Mean  $U_{Osm}$  in children and adults, respectively, were as follows:  $U_{Osm-AM}$ :  $780 \pm 235$  and  $782 \pm 244$  mmol $\times$ kg<sup>-1</sup>;  $U_{Osm-24}$ :  $686 \pm 223$  and  $567 \pm 214$  mmol $\times$ kg<sup>-1</sup>. ROC analysis for  $U_{Osm-AM}$  for detecting  $U_{Osm-24} > 800$  in children yielded an area under the curve (AUC) of 82.3% with sensitivity, specificity, and threshold values of 53.1%, 95.2%, and 1009 mmol $\times$ kg<sup>-1</sup>, respectively. In adults, the AUC was 89.0%, with sensitivity, specificity, and threshold values of 91.7%, 87.1%, and 969 mmol $\times$ kg<sup>-1</sup>, respectively. **Conclusions:** Urine osmolality measured with a first morning spot sample overestimates 24-h urine osmolality in both children and adults. This is in line with previous research in adults suggesting that spot urine samples only reach equivalence with 24-h urine osmolality in the early to late afternoon. Similar research needs to be performed in children. Funding provided by Danone Research.

1150 Board #329 May 31 2:00 PM - 3:30 PM

### Effects of Vitamin D3 Supplementation on Lean Mass, Muscular Strength, and Cardiorespiratory Fitness: A Double-Blind Randomized Controlled Trial

Zhen-Bo Cao<sup>1</sup>, Xiaomin Sun<sup>2</sup>, Kumpei Tanisawa<sup>3</sup>, Satomi Oshima<sup>3</sup>, Mitsuru Higuchi, FACSM<sup>3</sup>. <sup>1</sup>Shanghai University of Sport, Shanghai, China. <sup>2</sup>Xian Jiaotong University, Xian, China. <sup>3</sup>Waseda University, Tokyo, Japan. (Sponsor: Mitsuru Higuchi, FACSM)  
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Low levels of serum 25-hydroxyvitamin D [25(OH)D] are associated with low lean mass, decreased muscle strength, and poor cardiorespiratory fitness. However, the evidence in support of the effect of vitamin D supplementation on lean mass and physical fitness is inconsistent. **Purpose:** To clarify whether there is a direct effect of a 1-year vitamin D<sub>3</sub> supplementation on lean mass, muscular strength and cardiorespiratory fitness in healthy adults. **Methods:** Ninety-five participants (34 men) randomly received either 420 IU vitamin D<sub>3</sub> per day or placebo in a double-blind manner for 1-year. Lean body mass and fat mass were determined by dual energy X-ray absorptiometry (DXA). Hand grip strength (HGS) was measured using a hand grip dynamometer and leg extension power (LEP) was measured using a leg extension power measurement system. Cardiorespiratory fitness (CRF) was assessed by measuring peak oxygen uptake ( $VO_{2peak}$ ) using bicycle ergometer. Physical activity (PA) was assessed using uniaxial accelerometer and quantified as time spent in moderate- and vigorous physical activity (MVPA). Serum 25(OH)D and 1,25-dihydroxyvitamin D [ $1,25(OH)_2D$ ] concentrations were assessed using commercial ELISA kits. **Results:** Serum 25(OH)D and  $1,25(OH)_2D$  concentrations were significantly increased by approximately 29.5nmol/L and 7.0 pg/mL, respectively, after 1-year vitamin D<sub>3</sub> supplementation. After vitamin D<sub>3</sub> supplementation, lean body mass was significantly increased from 43.8 kg to 44.3 kg ( $P<0.05$ ), while the muscle strength and cardiorespiratory fitness were not changed. **Conclusion:** The present study indicates that vitamin D<sub>3</sub> supplementation for one year effectively improves lean mass, but not muscle strength and cardiorespiratory fitness in healthy adults. Supported by a Grant-in-Aid for Scientific Research (C), National Natural Science Foundation of China (No. 31571226), and Program for Professors of Special Appointment (Eastern Scholar) at Shanghai Institutions of Higher Learning (No. TP2014057) to ZBC.

1151 Board #330 May 31 2:00 PM - 3:30 PM

### The Prevalence Of Vitamin D Deficiency In Elite Winter Sport Athletes

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**Purpose:** In recent years, vitamin D's role in health and athletic performance has become evident. As a result, research on the prevalence of vitamin D insufficiency has been a topic of growing interest. The current literature assessing vitamin D status in the athletic population is limited. Therefore, the purpose of this study is to determine the prevalence of vitamin D insufficiency in elite winter sport athletes. **Methods:** A retrospective analysis was performed on data from various elite winter sport types throughout 2015 ( $n=91$ ,  $24.9 \pm 4.2$  yrs). Multiple serum 25-hydroxyvitamin D (25(OH)D) lab values were collected and athletes answered a questionnaire with information on sport type, geographical training/living locations, vitamin D

supplementation, and sun exposure. Descriptive statistics, student and paired t-tests, repeated measures, one- and two- way ANOVAs were used to detect differences in vitamin D levels across time, within and between groups. SPSS v 23 was used. Significance was set at  $p < 0.05$ .

**RESULTS** Prevalence of vitamin D insufficiency across all winter sports was highest at the beginning of the year and during the winter season (27.3% and 24.3%, respectively). There were no significant changes in 25(OH)D levels observed over time, however, indoor winter athletes (IWAs) had consistently lower 25(OH)D levels when compared to outdoor winter athletes (OWAs) across the entire year. Supplementation during winter season increased 25(OH)D levels in IWAs by 11.5 ng/ml when compared to non-supplementing IWAs ( $p < 0.05$ ); 25(OH)D levels in OWAs were not affected by supplementation. During the summer season athletes of lighter skin pigmentation had 7.5 ng/ml higher 25(OH)D levels than athletes of darker skin pigmentation ( $p < 0.05$ ).

**CONCLUSION** The findings of this study demonstrate vitamin D insufficiency is prevalent in elite winter sport athletes with an increased risk for IWAs. With negative effects associated with inadequate vitamin D, it is recommended for sports dietitians to increase the frequency of vitamin D testing throughout the year and consider supplementation in athletes during winter seasons.

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### Can Increased Sodium Intake Reduce Exercise-associated Hyponatremia?

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The primary risk factor for exercise-associated hyponatremia is overhydration, but other factors can play a role, including Na<sup>+</sup> losses and intakes. **PURPOSE:** To test the efficacy of a CHO-containing (6%) beverage with 60 vs. 21 mmol/L on plasma [Na<sup>+</sup>] when consumed to nearly match mass loss, while cycling in the heat.

**METHODS:** In a randomized, crossover study, 10 males ( $VO_{2max}$   $60 \pm 3$  mL/min/kg,  $75 \pm 5$  kg, 20-50 y) cycled (55%  $VO_{2max}$ ) in the heat (34 °C) for 3 h while consuming a beverage containing either 21 mmol/L Na<sup>+</sup> (L) or 60 mmol/L Na<sup>+</sup> (H). Beverage volume was based on body mass changes in 1 h pre-trials under similar conditions. Blood was sampled every 30 min. Tc, HR, and body mass were monitored. Linear mixed effects model analysis of variance was conducted with Subject as a random effect, and Diet and Time as fixed effects. T-tests were conducted on single measures. **RESULTS:** Not all subjects completed 3 h of exercise, with mean exercise time being 175 min on both L and H. Mean fluid intake was ( $3.3 \pm 0.6$  L,  $3.4 \pm 0.7$  L, resp.;  $p = 0.45$ ). Body mass change was ( $-0.39 \pm 0.31$ ,  $-0.20 \pm 0.36$  kg, resp.;  $p = 0.09$ ). Plasma sodium decreased over time on L, whereas increased slightly on H ( $p < 0.001$ ), with mean rate of change being ( $-0.6 \pm 0.6$  mmol/L/h,  $0.6 \pm 0.6$  mmol/L/h, resp.;  $p = 0.057$ ). At ride completion, four subjects were hyponatremic (plasma [Na<sup>+</sup>]  $< 135$  mmol/L) on L, and only one on H. No differences in end Tc ( $38.6 \pm 0.8$ ,  $38.6 \pm 0.8$  °C, resp.;  $p = 0.90$ ) or end HR ( $147 \pm 31$ ,  $157 \pm 24$  bpm, resp.;  $p = 0.39$ ) were observed.

**CONCLUSION:** Consumption of a beverage with sodium concentration of 60 mmol/L has advantage over one with a concentration typically found in sports drinks (21 mmol/L), preventing plasma sodium reduction during long-lasting exercise in the heat.

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### Iron Supplementation During 3 Consecutive Days Of Endurance Training Augmented Hepcidin Concentration

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**PURPOSE:** Several physiological mechanisms have been proposed to explain impaired iron status, such as gastrointestinal bleeding, hemolysis, lack of iron in dietary diet and losses in sweat. However, detailed mechanisms underlying exercise-induced iron deficiency among athletes remain unclear. Hepcidin, the 25-amino acid peptide hormone, is a key mediator of iron homeostasis and it may represent another mechanism for iron deficiency in response to exercise training. The present study was designed to investigate impact of consecutive days of strenuous endurance training on hepcidin concentration. The influence of iron supplementation during training period was also determined. **METHODS:** Fourteen male endurance athletes (long distance runners, triathletes) participated (mean  $\pm$  standard error, age: 19-22 yrs; height:  $1.68 \pm 0.01$  m; body mass:  $57.3 \pm 1.6$  kg; maximal oxygen uptake ( $VO_{2max}$ ):  $59.6 \pm 0.8$  ml/kg/min). Subjects were randomly assigned to either an iron treatment group (Fe group,  $n = 7$ ) or a placebo group (CON group,  $n = 7$ ). All subjects completed 3 consecutive days of endurance training, consisting of two bouts of 75 min of treadmill running at

75 % of  $VO_{2max}$ , separated with 3h of rest between bouts. In the Fe group, 12 mg of iron was provided using flavor drink twice a day (24 mg/day), whereas the subjects in the CON group took the same flavor drink without iron. Venous blood samples were collected in early morning on days 1-4 and 3h after second bout of exercise on day 1. Serum hepcidin, ferritin, iron, myoglobin and plasma IL-6 concentrations were evaluated. **RESULTS:** The Fe and CON groups showed acute elevations of serum hepcidin, myoglobin and plasma IL-6 concentrations 3h after exercise ( $P < 0.05$  vs. baseline). After 3 days of training period (day 4), serum hepcidin concentration was significantly higher in Fe group than in CON group ( $11.0 \pm 2.5$  ng/mL vs.  $5.9 \pm 1.6$  ng/mL,  $P < 0.05$ ). Moreover, serum iron concentration was decreased only in Fe group on day 4 ( $91.3 \pm 13.5$  in the Fe group vs.  $129.7 \pm 7.4$   $\mu$ g/dL in the CON group). **CONCLUSIONS:** Three consecutive days of endurance training increased hepcidin concentration at baseline when the iron was supplemented.

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### Lower Choline Intake is Associated with Diminished Strength and Lean Mass Gains in Older Adults

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(No relationships reported)

**PURPOSE:** Choline is an essential micronutrient involved in many physiological processes including membrane integrity/signaling, lipid transport, methylation reactions, neurotransmission, and muscle contraction. We examined the relationship between habitual, food-based choline consumption and muscle responses to resistance exercise training (RET).

**METHODS:** Forty-six, 60-69-year-old men and women underwent 12 weeks of whole body RET (3x/week, 3 sets, 8-12 reps, 75% of maximum strength [1RM]). Body composition (DEXA) and 1RM tests were performed before and after training. After analyzing 1,656 dietary logs (3x/week for 12 weeks with 46 participants), participants' mean choline intakes were categorized into three groups: Low (2.9-5.5 mg/kg lean/d), Med-Low (5.6-8.0 mg/kg lean/d), or Adequate (8.1-10.6 mg/kg lean/d). This corresponds to <50%, ~63%, and ~85% of Adequate Intake (AI), respectively. ANOVA/ANCOVA were performed to compare changes in composite strength (leg press + chest press 1RM) and lean mass between groups controlling for the effects of other nutrients.

**RESULTS:** Gains in composite strength were significantly less in the Low group compared with the other groups (Low:  $30.9 \pm 15.1\%$ , Med-Low:  $70.3 \pm 48.5\%$ , Adequate:  $81.9 \pm 68.4\%$ ;  $p = 0.004$ ). ANCOVA with cholesterol, protein, or other nutrients did not alter this result. Reduced gains in lean mass were also observed in the Low group, compared with the higher choline intake of 5.6-10.6 mg/kg lean/d ( $1.3 \pm 0.6\%$  vs.  $3.2 \pm 0.6\%$ ,  $p < 0.05$ ) with folate as a covariate.

**CONCLUSION:** These data suggest lower choline intake is negatively and independently associated with muscle responses to RET in older adults.

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### Dietary Guidelines For Americans: Comparing Menus To What Is Served And Consumed In Preschool Children

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Preschool menus must meet the Dietary Guidelines for Americans however, what is actually served and consumed by children is not restricted, potentially affecting consumption of a balanced diet. **PURPOSE:** Compare preschool menus that meet dietary guidelines to what is actually served and consumed. **METHODS:** Fifty-two preschool children (mean  $\pm$  SD, age 3y and 10m  $\pm$  8m) from a university early childhood center participated in the 10-week study. Each day, 15 children were randomly selected for nutritional analysis of their lunch. Prior to and immediately after consumption, a picture of the child's tray was taken using digital photography. If a child had additional food (second serving), additional pictures were taken. Analysis of energy and nutrient content for menus, food served, and food consumed was completed using Food Processor Nutrition Analysis by ESHA. Food color (white, brown, orange, yellow, red, green, other) was determined by observation during analysis. A food preference survey was administered orally to children immediately after each meal. **RESULTS:** There was a significant ( $p < 0.05$ ) difference for total kilocalories (kcal) between menu ( $448 \pm 130$ ), served ( $523 \pm 148$ ) and consumed ( $361 \pm 178$ ). There was a significant ( $p < 0.05$ ) difference for grams of carbohydrate between menu ( $55.3 \pm 18.9$ g) and served ( $56.5 \pm 20.5$ g) compared to what was consumed ( $38.5 \pm 21.7$ g). There was a significant ( $p < 0.05$ ) difference for grams of fat between menu ( $16.0 \pm$

8.7g), served (21.2 ± 9.7g) and consumed (14.5 ± 10.0g). There was a significant (p<0.05) difference for protein between menu (21.7 ± 5.7g), served (27.9 ± 10.6g) and consumed (19.5 ± 11.8g). The majority of food served was white (38.1%), brown (20.4%), or yellow (14.2%) with minimal green (10.7%), orange (10.2%), or red (6.1%) foods. Children described food as yummy (75.2%), okay (7.6%), and yucky (17.2%). Consumption of vegetables (46.9%) was significantly (p<0.05) lower than dairy (88.9%), fruits (82%), grains (81.8%), and meats (72.8%). Children consumed a high percentage (77.9%) of fats/sweets. **CONCLUSION:** The amount of food consumed was significantly less than the menu and served amounts, indicating that children were not meeting the dietary recommendations as intended, potentially contributing to long-term health consequences.

1156 Board #335 May 31 2:00 PM - 3:30 PM  
**Characterization of Nutritional Intake and Distribution in Pediatric Burn Patients**

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**PURPOSE:** The hypermetabolic response after a severe burn results in whole body catabolism and calorie deficits leading to malnutrition and losses in lean body mass (LBM). Thus, proper nutrition after a severe burn is essential to recovery. Current practice is to increase nutritional intake by (1.2-1.5 kcal x resting energy expenditure (REE)) and protein (1.5-2.5 g protein/kg/day) to increase LBM. Research in non-burn populations suggests an ideal protein intake of 25-30 g per meal for optimal protein synthesis. However, outpatient nutritional monitoring is currently not well documented; the amount and distribution of protein among meals is unknown. Therefore, we examined the nutritional profile and distribution of substrates in severely burned pediatric outpatients in comparison to non-burned children to further direct recovery efforts to mitigate catabolism and increase LBM.  
**METHODS:** Caregivers of 23 burned children (>30% total body surface area burned) and 7 non-burned children (NB) (21 male, 9 female; 13 ± 4 years; mean ± SD) completed 24-hour dietary recalls for 3 consecutive days to obtain a detailed report of foods consumed. Unpaired t-tests with Welch's correction were performed between burned and NB children. Alpha was set at p<0.05.  
**RESULTS:** Burned children consumed significantly more kcal (3032 ± 888 kcal) than NB children (2147 ± 551 kcal, p=0.006) and averaged 1.6 x REE kcal per day. Burned patients consumed similar amounts of protein/kg body weight (2.9 ± 0.9 g) as NB children (2.0 ± 1 g/kg/day, p>0.05) and had similar distributions of protein at each meal (p>0.05). Burn patients consumed 40-52% carbohydrates, 30-37% fat and 17-18% protein in main meals; protein intake significantly differed at breakfast (p=0.007) and lunch (p=0.041) between burned and NB children.  
**CONCLUSIONS:** The data showed burned children consume more kcal than the recommended amount established for the burn population and consume roughly the same amount of total protein as NB. The protein distribution among each main meal is adequate in burned children. If further studies show that catabolism is not curbed and losses in LBM still persist in spite of adequate nutrition, other interventions such as drug therapy and exercise programs should be considered to increase LBM in severely burned children.

1157 Board #336 May 31 2:00 PM - 3:30 PM  
**Consumption Of Sugar-sweetened Beverages By Sex And Weight Status In Children From The Mexico-US Border**

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It has been studied that school-age children have access to a diet with a high caloric content and low nutritional value, in addition, these population similarly consumes sugar sweetened beverages. The consumption of these beverages is associated with the development of obesity, cardiovascular disease, diabetes, cancer and metabolic syndrome. **PURPOSE:** To identify the frequency of consumption of sugar sweetened beverages by sex and weight status in children from the Mexico-US border.  
**METHODS:** A total of 453 students (235 girls and 218 boys) from 4<sup>th</sup> to 6<sup>th</sup> grade of five elementary schools in the city of Tijuana, Baja California, Mexico were measured. Height, weight and BMI was obtained by anthropometry. The questionnaire of beverage consumption (Hedrick et al 2010) was administered, to calculate the caloric and sugar content the Nutritionist Pro (v 5.2) program was used. **RESULTS:** The prevalence of overweight and obesity was 45%. Thirty two per cent of boys and 22%

of girls consumed more than 50 grams per day of sugar from drinks. As revealed by the Mann-Whitney Test, significant differences by sex were observed in the consumption of grams of sugar per day (p = 0.001) and total calories from beverages (p = 0.002). Also, the boys reported a higher consumption of kilocalories from sugar sweetened beverages (p = 0.001) and milliliters per day (p = 0.001) than girls. No significant differences of sugar and kilocalories consumption from sugar sweetened beverages among children with normal weight and those who were overweight and obese were found. **CONCLUSIONS:** The results of this study indicates a high intake of sugar from drinks, which is higher than recommended by WHO. The boys reported a higher consumption of sugar sweetened beverages and kilocalories than girls. The study shows no significant differences in the sugar and kilocalories consumption by weight status.

1158 Board #337 May 31 2:00 PM - 3:30 PM  
**Weight Loss Knowledge Among Current And Future Health Professionals In Exercise Science And Nutrition**

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Knowledge among current and future health professionals of the most recent literature pertaining to applicability of the 3500 calorie rule for predicting weight loss is unknown. **PURPOSE:** To assess levels of knowledge, among those in the fields of exercise science and nutrition, of the applicability of the 3500 calorie rule for predicting weight loss (WL) over time and whether knowledge differed with a person's training level and their perceived WL knowledge.  
**METHODS:** Students (S), faculty (F), and professionals (P) [n = 352, 68% female, 31 ± 13.5 years] responded to an anonymous online survey sent via email lists and social media platforms. Level of WL knowledge was assessed using a list of 9 statements pertaining to the 3500 calorie rule and its ability to accurately predict WL over time. Respondents were asked to identify which statements were true and were scored (0-100%) based on their correct responses. Participants also reported current exercise and nutrition certifications. They reported level of WL knowledge on a 5 point Likert scale and were divided into 2 groups: very good or excellent (EX) knowledge vs good, fair and poor (Poor) knowledge. Respondents were grouped as certified or not certified. A one-way ANOVA was used to test for differences in scores on WL facts between S, F, and P. Independent t tests were used to detect differences in scores on WL facts between certified and not certified and between EX knowledge and Poor knowledge.  
**RESULTS:** Scores on WL facts were not different between S, F, and P [64.1 ± 18.9% (n=217); 70.1 ± 19.9% (n=39); 63.5 ± 21.2% (n=96), respectively; p = 0.176]. Certified S had higher scores on WL facts than S without certifications [72.8 ± 17.9% vs 62.6 ± 18.7%, respectively; p = 0.005] while no differences in scores on WL facts existed between those with and without certifications for F [67.2 ± 19.7% vs 73.5 ± 20.2%, p = 0.335] and P [64.0 ± 20.8% vs 62.4 ± 22.7%, p = 0.748]. Those who rated themselves as having EX knowledge did not score differently than those who rated themselves as having Poor knowledge [69.8 ± 16.0% vs 69.3 ± 16.8%, respectively; p = 0.789].  
**CONCLUSIONS:** Knowledge of WL concepts is similar among S, F, and P. Certification may enhance students' knowledge of WL facts but does not influence knowledge for F or P. High levels of perceived knowledge may not reflect better actual knowledge of WL facts.

1159 Board #338 May 31 2:00 PM - 3:30 PM  
**The Acute Effects of Nutrition Labels on Beverage Consumption in a College Cafeteria**

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Previous research is inconsistent in determining if nutrition labels on food and beverages influence consumer behavior. **PURPOSE:** To determine the acute effect of nutrition labels on consumer beverage consumption in a college cafeteria setting.  
**METHODS:** Consumption for 13 beverages in a university cafeteria was recorded over a two-week period. Week one acted as a control week (CW) and week two as an experimental week (EW). Nutrition labels were placed above beverage dispensers after the CW. Beverages included five enhanced water, five milk, and three juice options. Daily consumption was measured by tracking the total amount of beverage restocked divided by the number of cafeteria patrons (mL/number of patrons). In addition, to better understand the effect of the nutrition labels a three question follow up survey was administered at the end of the two weeks in the cafeteria during dining hours (N=150). One-way ANOVAs were employed for significance testing. **RESULTS:** Passion orange guava (POG) was the only beverage to have a significant difference in consumption between the CW (3.73±1.21) and EW (2.11±1.44), p=0.041. No other enhanced water flavor, type of milk, or juice significantly differed in consumption, p>0.05. Overall, total beverage consumption did not significantly differ between the CW (19.57±4.76) and EW (16.80±9.43), p=0.502. The results of the survey indicated

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95% of cafeteria patrons noticed the nutrition labels, but 71% responded the nutrition labels did not influence their behavior towards selecting a particular beverage or the quantity of the beverage consumed. However, 61% of all the respondents preferred having nutrition labels available. **CONCLUSION:** Nutrition labels appear to have an acute influence to decrease beverage consumption of POG, but not beverages such as milk, enhanced water, or other juices. Further research is needed to determine why nutrition labels may influence the consumption of some products, but not others.

1160 Board #339 May 31 2:00 PM - 3:30 PM  
**The Relationship between Social Jetlag and Cardiorespiratory Fitness in New Zealand Adolescents**

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Social jetlag occurs when there is a mismatch between an individual's circadian clock and their sleep schedule. Recent research has shown that social jetlag is associated with many health related factors, particularly with overweight and obesity. However, the relationship between social jetlag and cardiorespiratory fitness has not yet been studied, including in adolescents. **PURPOSE:** To investigate the relationship between social jetlag, measured as the difference in hours between the midpoint of sleep on school and non-school days, and cardiorespiratory fitness. **METHODS:** Cardiorespiratory fitness, anthropometric, demographic and dietary data were collected from students aged 15 to 18 years attending secondary schools in Otago, New Zealand. Students completed an online lifestyle survey in one class period. Food choice was assessed using the validated New Zealand Adolescent FFQ and three dietary patterns ('Treat Foods', 'Fruits and Vegetables' and 'Basic Foods') were generated using principal components analyses. A subset of participants also undertook fitness testing measurements. The primary outcome, cardiorespiratory fitness, was expressed as maximal oxygen uptake (VO<sub>2</sub>max) values, estimated from a multi-stage 20-metre shuttle run test. Multivariate linear regression analyses were undertaken with VO<sub>2</sub>max as the primary outcome. Analyses were adjusted for dietary pattern scores, Body Mass Index (BMI) Z scores, sex, age, socio-economic status and ethnicity. An interaction between sex and social jetlag was also tested for.

**RESULTS:** Questionnaire, BMI and cardiorespiratory fitness data were available for 279 participants, with a mean (SD) age of 15.7 (0.9) years. Mean (SD) VO<sub>2</sub>max was 43.3 (5.6) ml/kg per min for girls and 48.5 (7.1) ml/kg per min for boys. Mean (SD) social jetlag was 1 hour 53 minutes (1 hour 17 minutes). A one-hour increase in social jetlag was associated with a 0.78 ml/kg per min decrease in VO<sub>2</sub>max (CI: -1.39, -0.18). There was no significant interaction between sex and social jetlag.

**CONCLUSIONS:** Social jetlag is a significant correlate of cardiorespiratory fitness in adolescents. Minimising social jetlag may be beneficial to improve physical fitness of adolescents and has the potential to be a simple and measurable goal in lifestyle interventions.

1161 Board #340 May 31 2:00 PM - 3:30 PM  
**Differential Relationship between Habitual Physical Activity and Consumption of Key Dietary Factors**

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Previous research indicates that energy intake is lower in moderately active when compared to sedentary and highly active individuals. However, relationships between choices of foods varying in energy density and physical activity (PA) remain largely unexplored.

**PURPOSE:** To determine the relationship between habitual PA and dietary factor consumption with high/low energy density in a nationally representative sample. **METHODS:** Data from the National Health and Nutrition Examination Survey 2009-2010 Dietary Screener Questionnaire were utilized to estimate key dietary factor intake. Participants (n=5,302; age range: 18-69) were divided into quartiles based on PA behavior, defined as moderate- or high-intensity activities for work, recreation and walking/biking. Data were adjusted for age, body mass index, and sex. **RESULTS:** Added sugar intake was highest among very high (25.9±0.9 tsp) and low activity (25.7±1.0 tsp), and was significantly (p<0.001) lower with moderate (23.9±0.9 tsp) and high activity (22.8±0.9 tsp). Added sugar intake from sugar-sweetened

beverages was lower (p<0.001) in moderate (18.4±1.1 tsp) and high activity (17.0±1.1 tsp) when compared to low (20.8±1.2 tsp) and very high activity (20.6±1.1 tsp). Fruit and vegetable intake increased gradually from low (2.32±0.10 cup eq) to high activity (2.70±0.10 cup eq), but did not increase further with very high activity (2.64±0.10 cup eq). Whole grain and fiber intake increased gradually from low (0.93±0.19 oz eq; 14.4±0.7 g) to high activity (1.30±0.18 oz eq; 16.1±0.6 g) but plateaued at very high activity levels (1.13±0.18 oz eq; 16.0±0.6 g).

**CONCLUSIONS:** Our results suggest differential associations between PA and food choices: Moderate to high PA was associated with healthier food choices, indicated by lower intake of energy-dense, nutrient-poor foods and higher consumption of fruits, vegetables, and whole grains. However, the increase in added sugar consumption and stagnating intakes of healthier foods among very high activity suggest the beneficial effect of PA on dietary patterns is inhibited at this upper end, possibly due to compensatory mechanisms to meet increased energy needs. Future research is needed to determine physiologic and behavioral mechanisms underlying this differential relationship between PA and dietary patterns.

1162 Board #341 May 31 2:00 PM - 3:30 PM  
**Association of Fruit and Vegetable Intake with Cardiorespiratory Fitness in Adolescents**

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 (No relationships reported)

An association has been established between total energy intake and cardiorespiratory fitness (CRF) in adolescents; however, there is little research examining dietary components. **PURPOSE:** To determine if an association exists between F/V intake and CRF in adolescents. **METHODS:** A sample of 424 adolescents (234 males and 190 females) age 10-18 years completed the Dietary Behavior section of the Youth Risk Behavior Survey (YRBS) and the FITNESSGRAM 20 meter Pacer test (PACER). This section of the YRBS assesses F/V intake based on intake frequency over a one week period. Peak oxygen consumption (VO<sub>2</sub>peak) was calculated from the PACER results and categorized based on the FITNESSGRAM aerobic standards, placing individuals into one of three categories: Healthy Fitness Zone (HFZ), Needs Improvement (NI), and Needs Improvement - Health Risk (NI-HR). Mean differences in total F/V intake for participants in each of the CRF categories were assessed using a one way ANOVA. **RESULTS:** The mean total F/V intake values (times per week) showed slight differences between each of the categories. For male participants the F/V intake values in the HFZ, NI, and NI-HR categories were 19.9 (SD 15.2), 15.8 (SD 19.2), and 19.1 (SD 13.8) respectively. The mean F/V intake for female participants in the HFZ, NI, and NI-HR categories were 20.9 (SD 16.2), 20.3 (SD 19.6), and 15.9 (SD 9.6) respectively. However, none of these differences were statistically significant (all p>0.05). Average fruit and vegetable intakes were also individually analyzed, but with similar results (all p>0.05).

**CONCLUSION:** F/V intake does not have a significant association with CRF in adolescents.

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**Metabolome Analysis Of Sex Differences In Plasma Metabolite Profiles Caused By Acute Resistance Exercise**

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**PURPOSE:** The present study used metabolome analysis to determine sex differences in plasma metabolite profiles cause by acute resistance exercise.

**METHODS:** Six healthy men and six eumenorrheic women (age, 25.7±4.5 and 20.7±1.1 years; height, 169.3±2.0 and 162.9±4.5 cm; weight, 66.6±6.0 and 56.9±6.1 kg, respectively) volunteered to participate in this study. All of them performed three sets of leg extensions at 70% of one repetition maximum (RM) until failure for each set. Blood samples were collected at rest and immediately after exercise from the women in the luteal phase of the menstrual cycle. Blood concentrations of progesterone and 17-β-estradiol in the samples were determined by ELISA, and endogenous metabolites in plasma were estimated using capillary electrophoresis time-of-flight mass spectrometry.

**RESULTS:** Blood concentrations of estradiol and progesterone were significantly lower in men than in women at rest (30.8±9.8 vs. 242.8±95.4 pg/mL, p<0.01 and 0.7±0.2 vs. 11.5±10.3 ng/mL, p<0.05, respectively). Metabolomics analysis indicated that values for amino acids and a glycosylated pyrimidine analog were significantly greater in men than in women at rest (valine: 232±2 vs. 188±20 μM, p<0.01; leucine: 135±18 vs. 100±9.6 μM, p<0.01; lysine: 235±33 vs. 183±23 μM, p<0.01; uridine: 15±2.2 vs. 10±1.1 μM, p<0.01; methionine: 23±2.4 vs. 19±4.1 μM, p<0.05;

tryptophan:  $61 \pm 5.9$  vs.  $52 \pm 6.1$   $\mu\text{M}$ ,  $p < 0.05$ ). Rates of change in metabolites increased significantly more in men than in women after exercise (lactic acid:  $1231.1 \pm 263.8\%$  vs.  $672.5 \pm 521.9\%$ ,  $p < 0.05$ ; malic acid:  $320.1 \pm 136.4\%$  vs.  $168.5 \pm 92.2\%$ ,  $p < 0.05$ ; glycerol 3-phosphate:  $37.5 \pm 11.0\%$  vs.  $-3.8 \pm 25.8\%$ ,  $p < 0.01$ ; creatine:  $26.8 \pm 16.2\%$  vs.  $3.7 \pm 9.0\%$ ,  $p < 0.05$ ; citrulline:  $1.8 \pm 6.2\%$  vs.  $-8.5 \pm 8.4\%$ ,  $p < 0.05$ ).

**CONCLUSIONS:** Metabolite profiles and values for sex hormones changed in a sex-dependent manner after acute resistance exercise. Therefore, sex hormone concentrations might influence energy utilization during resistance exercise.

1164 Board #343 May 31 2:00 PM - 3:30 PM

### Aerobic Exercise Protects Against Intestinal Villus Damage Induced by Inflammation in Rats

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(No relationships reported)

Intestinal villi are modified under the action of inflammation and aerobic exercise protects against this damage, but the mechanisms of action of cell proliferation or apoptosis have not been elucidated. **Purpose:** Evaluate the effect of aerobic exercise on the intestinal morphology of Wistar rats with lipopolysaccharide (LPS) challenge. **Methods:** Twenty rats (200-300g) randomized into two experimental groups matched for body mass: training group ( $n=10$ ) and sedentary group ( $n=10$ ). Training group was submitted to moderate intensity aerobic training on a motorised treadmill at 65% of maximal speed for 60 min, 5 days/week during 8 weeks. Forty-eight hours following the last exercise training session, the animals were randomly allocated to four groups: sedentary group-S ( $n=5$ ), sedentary with LPS-S+LPS ( $n=5$ ), Training group-T ( $n=5$ ) and training with LPS-T+LPS ( $n=5$ ). LPS groups received one dose of LPS intraperitoneally during three days to stimulate chronic inflammation; S and T groups received saline. Water and food was ingested ad libitum. Euthanasia was performed 24h after the last dose of LPS and the middle jejunum was harvested and stored for histological analysis with hematoxylin and eosin. Villous height was evaluated under light microscopy (Image-Pro Plus 6.0, Media Cybernetics). For each intestinal sample, at least 10 well-oriented villi were measured and the mean value was calculated. Data were analysed using two-way ANOVA with Tukey's post-hoc test; statistical significance was accepted at  $p < 0.05$ . **Results:** Villus height ( $\mu\text{m}$ ) was significantly higher for T+LPS than S+LPS ( $340.8 \pm 11.8$  vs.  $237.6 \pm 24.2$ ), and for T compared to TLPS ( $418.2 \pm 11.7$  vs.  $340.8 \pm 11.8$ ), but was lower for S+LPS compared to S ( $237.6 \pm 24.2$  vs.  $368.3 \pm 23.5$ ). Interestingly, T+LPS was not significantly different from S ( $340.8 \pm 11.8$  vs.  $368.3 \pm 23.5$ ). **Conclusion:** Eight weeks of aerobic exercise training appears to be capable of improving intestinal villi and protect against inflammatory damage. Supported by: CAPES

## B-78 Free Communication/Poster - Obesity

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM  
Room: Hall F

1165 Board #344 May 31 2:00 PM - 3:30 PM

### An 8-month Small-group Circuit Functional Training Program Improves Body Composition And Performance Of Overweight/obese Women.

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The body weight training, high-intensity interval training (HIIT), functional fitness, group personal training, and circuit training are currently some of the top worldwide trends in the commercial, corporate, clinical, and community landscapes within the health and fitness industry. Additionally, adult obesity and physical inactivity are considered as the top global public health problems nowadays.

#### PURPOSE:

This study aimed to evaluate the effects of a circuit functional training program on body composition and performance in sedentary overweight or obese women.

#### METHODS:

Twenty-eight premenopausal overweight or obese women ( $n=28$ ;  $36.8 \pm 4.6$  years;  $166.0 \pm 0.1$  cm;  $79.7 \pm 9.1$  kg;  $28.8 \pm 2.8$  kg/m<sup>2</sup>) volunteered to participate and were randomly assigned to either a control (C,  $n=14$ ) or an experimental group (E,  $n=14$ ). Exercise consisted of a low volume circuit functional training program (~30 min) and

3 sessions per week in nonconsecutive days for 32 weeks. Both groups were tested pre- and post-intervention in body mass index (BMI), waist-to-hip ratio (WHR), body composition (DXA), resting metabolic rate (RMR), upper and lower body muscular strength (1RM) and endurance (curl up and push up), cardiovascular endurance (VO<sub>2peak</sub>), flexibility (sit and reach test), static balance (Sharpened Romberg test), and subjective vitality. Comparisons were made using two-way ANOVA with repeated measures.

#### RESULTS:

Significant improvements were observed between pre- and post-testing measures in E. Body fat, BMI, and WHR declined ( $p < 0.001$ ) by 11.4%, 6%, and 4.6% while fat-free mass ( $p < 0.05$ ), upper and lower body muscular strength, trunk and upper body muscular endurance, VO<sub>2peak</sub>, flexibility, static balance, and subjective vitality increased ( $p < 0.001$ ) by 1.9%, 30.9% and 27.2%, 91.6% and 238.5%, 26.8%, 34.5%, ~254%, and 131.8%, respectively.

#### CONCLUSION:

These results suggest that a time-effective exercise modality that combines the circuit training, HIIT, and functional fitness using body weight exercises may improve all components of physical fitness in premenopausal, inactive overweight or obese women. These findings may be attributed to the hybrid nature of this exercise regimen for small groups applying full-body movements and high-intensity routines according to HIIT principles adapted to sedentary individuals.

1166 Board #345 May 31 2:00 PM - 3:30 PM

### Effects Of Exercise Intervention On Visceral Fat In Obese Youth: Meta-analysis

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(No relationships reported)

Childhood obesity is associated with a higher chance of the development of several diseases, premature death, and disability in adulthood. Previous studies have examined the effects of exercise on visceral fat; however, many of these studies applied different methodologies and showed different results. **PURPOSE:** To assess the effects of different exercise types on visceral fat in obese youth and to suggest the most effective way to reduce visceral fat using a meta-analysis. **METHODS:** Electronic database searches were performed in Pubmed, MEDLINE, Academic Search Complete, SportDiscus, and CINAHL from the earliest record to May 2016. Key words included 'exercise or training', 'visceral fat', and 'child or adolescent or youth'. The inclusion criteria for eligible studies were as follows: 1) subjects were obese at baseline, 2) subjects aged 6-18 years, 3) body weight was reported at baseline and after intervention, and 4) studies were published in peer-reviewed journals written in English. Two authors independently selected trials, assessed trial quality and extracted data. Comprehensive Meta-Analysis version 3 software was used to compute effect size (ES) and the 95% confidence intervals (CI) using a random effects model. Heterogeneity was assessed using the Cochran's Q statistic. Four moderator variables (gender, types of exercise, treatment periods, and disease conditions) were analyzed. **RESULTS:** Of the 177 studies from the initial search, 61 ESs were derived from the 30 selected studies. The overall treatment effect was large (Cohen's d (ES) = 1.05, 95% CI = 0.94, 1.16). Subgroup analyses showed that exercise type ( $Q_b = 10.84$ ,  $df = 2$ ,  $p = 0.004$ ) and treatment length ( $Q_b = 23.76$ ,  $df = 1$ ,  $p < 0.001$ ) influenced the overall ES. The combined exercise program (Aerobic + Resistance training; ES = 1.19, 95% CI = 1.06, 1.35) and treatment periods longer than 6 months (ES = 1.23, 95% CI = 1.10, 1.35) appeared to be the most effective in reducing visceral fat. However, ESs were similar among gender and disease conditions. **CONCLUSIONS:** There was a large overall effect for exercise intervention on visceral fat in obese youth. Findings from this meta-analysis can help in designing an effective exercise intervention to reduce visceral fat in obese youth.

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### Hemodynamic Response to Acute and Chronic Exercise in Obese and Lean Prehypertensive Men

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**PURPOSE:** Approximately 7.1 million deaths worldwide are ascribed to hypertension (HTN). Those with HTN who fit the lean body phenotype are characterized by mechanistically different HTN compared to an obese HTN phenotype. The purpose of this study was to assess whether body phenotype influences blood pressure (BP)

response following both acute and chronic exercise. **METHODS:** Obese (body mass index (BMI) $>30$  kg/m<sup>2</sup>) and normal weight (BMI $<25$  kg/m<sup>2</sup>) men with pre-hypertension (PHTN) (systolic BP (SBP) 120-139 or diastolic BP (DBP) 80-89 mmHg) were asked to participate in a two phase trial. Phase 1 assessed differences in post-exercise hypotension between groups in response to an acute exercise bout. Phase 2 consisted of a two-week aerobic exercise intervention at 65-70% of heart rate (HR) max on a cycle ergometer. Primary outcome measures were; brachial BP, central BP, cardiac output (CO), and systemic vascular resistance (SVR) measured acutely after one exercise session and following two-weeks of training. **RESULTS:** There were no baseline resting brachial BP ( $126 \pm 7$  mmHg vs.  $126 \pm 5$  mmHg,  $P=0.976$ ), central BP ( $110 \pm 5$  mmHg vs.  $113 \pm 6$ ,  $P=0.123$ ), age ( $24 \pm 4$  yr vs.  $25 \pm 4$  yr,  $P=0.547$ ), or  $\text{VO}_2$  peak ( $2.9 \pm .4$  l.min<sup>-1</sup> vs.  $3.2 \pm .7$  l.min<sup>-1</sup>,  $P=0.248$ ) differences between Lean and Obese. At rest, obese PHTN had greater CO compared to lean PHTN ( $6.3 \pm 1$  vs.  $4.7 \pm 1$  L/min,  $P = 0.005$ ) and decreased SVR compared to lean PHTN ( $1218 \pm 263$  vs.  $1606 \pm 444$  Dyn.s/cm<sup>2</sup>,  $P = 0.003$ ). Lean PHTN saw a 3 mmHg reduction on both brachial and central SBP ( $P < 0.05$ ) in response to acute exercise, while obese PHTN witnessed a significant 4 mmHg increased brachial and 3 mmHg increased central SBP ( $P < 0.05$ ). SVR decreased greater following acute exercise in lean PHTN compared to obese PHTN ( $224$  dyn.s/cm<sup>2</sup> vs.  $75$  dyn.s/cm<sup>2</sup>,  $P < 0.001$ ). Chronic training evoked a 4 mmHg reduction in brachial SBP and 3 mmHg reduction for central SBP for lean PHTN with no change in obese PHTN. Lean BP reduction in response to training was accompanied by a significant SVR reduction of  $169$  dyn.s/cm<sup>2</sup> ( $P < 0.05$ ), while obese experienced a significant increased SVR following training ( $95$  dyn.s/cm<sup>2</sup>  $P < 0.05$ ). **CONCLUSION:** Body phenotype may play a significant role in relation to the efficacy of aerobic exercise on BP reduction.

1168 Board #347 May 31 2:00 PM - 3:30 PM  
**Dyspnea on Exertion in Nonobese and Obese Patients**  
 Vipa Bernhardt<sup>1</sup>, Rubria Marines-Price<sup>2</sup>, Kyle Weinstein<sup>2</sup>, Simba Walker-Williams<sup>2</sup>, Andrew R. Tomlinson<sup>2</sup>, Tony G. Babb, FACSM<sup>2</sup>. <sup>1</sup>Texas A&M University Commerce, Commerce, TX. <sup>2</sup>Texas Health Presbyterian Hospital Dallas and University of Texas Southwestern Medical Center, Dallas, TX. (Sponsor: Tony G Babb, FACSM)  
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 (No relationships reported)

**PURPOSE:** Dyspnea on exertion (DOE) is a common symptom in otherwise healthy obese individuals and in patients with serious illness. Whether obese patients have an exaggerated rating of breathlessness (RPB) as compared with nonobese patients is unknown. In a retrospective analysis, we investigated RPB in nonobese and obese patients who were referred for clinical cardiopulmonary exercise testing (CPET) due to unexplained DOE.

**METHODS:** Data from 112 patients were separated into nonobese (BMI  $< 30$ ; n = 28; 20 F) and obese (BMI  $\geq 30$ ; n = 47; 24 F) groups. All patients cycled at two individualized constant load work rates (one easy & one harder) for 4-6 mins, followed by a peak exercise test. Constant load work rates were set based on the patient's symptoms and physical activity habits. During the last minute of each constant load exercise bout, patients' RPBs were obtained (Borg scale 0-10). Groups were compared by independent *t* test and relationships between variables were examined by regression analysis.

**RESULTS:** BMI was  $22 \pm 2$  kg/m<sup>2</sup> in the nonobese ( $62 \pm 9$  kg) and  $36 \pm 4$  kg/m<sup>2</sup> in the obese ( $103 \pm 16$  kg) patients (mean  $\pm$  SD;  $p < 0.001$ ). Age was not different between groups ( $50 \pm 20$  yr vs  $57 \pm 12$  yr). Work rates were not significantly different between the nonobese and obese patients at the lower ( $29 \pm 19$  W vs  $24 \pm 14$  W) or higher constant load work rates ( $59 \pm 35$  W vs  $49 \pm 27$  W). Exercise intensity was also not different between groups at the lower ( $53 \pm 11$  vs  $56 \pm 13\%$  of peak  $\text{O}_2$  uptake) or higher work rates ( $74 \pm 11$  vs  $72 \pm 11\%$ ). RPB was significantly ( $p = 0.05$ ) greater in the obese patients ( $2.3 \pm 1.4$  vs  $3.3 \pm 2.2$ ) at the lower work rate, but not at the higher work rate ( $4.4 \pm 1.8$  vs  $4.9 \pm 2.2$ ). Maximal exercise capacity was higher in the nonobese patients ( $77 \pm 24$  vs  $58 \pm 21\%$  predicted). There was no significant relationship between RPB and BMI within either group. However, there was a significant ( $p < 0.001$ ) association between RPB and ratings of perceived exertion (RPE) in the nonobese ( $r = 0.68$  &  $0.82$  for lower & higher constant work rates) and the obese ( $r = 0.87$  &  $0.81$ ) patients.

**CONCLUSIONS:** Obesity appears to have a significant effect on breathlessness at lower work rates in this mixed patient population, and should be considered when assessing breathlessness in patients. Supported by NIH R01 HL096782, King Charitable Foundation Trust, and Texas Health Presbyterian Hospital Dallas

1169 Board #348 May 31 2:00 PM - 3:30 PM  
**Improvements in Endothelial Function Following Whole-Body Vibration Training in Overweight and Obese Young Women**  
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Brachial artery flow-mediated dilation (FMD) is a significant predictor of future cardiovascular disease and preferred non-invasive marker for endothelial vasodilatory function. Importantly, central/abdominal obesity and physical inactivity are associated with endothelial dysfunction. Whole-body vibration training (WBVT) has been shown to improve overall arterial function in sedentary obese pre- and post- menopausal women. Yet, the impact of WBVT on endothelium-mediated vasodilation has not been examined. **PURPOSE:** To determine whether WBVT would induce greater benefits than a non-exercising control (CON) on endothelial function in young overweight/obese women. **METHODS:** Thirty-seven young overweight/obese women (age:  $21 \pm 2$  years; body mass index:  $31.4 \pm 3.4$  kg/m<sup>2</sup>) were randomized into WBVT (n=24), or CON (n=13) for 6 weeks (3 days/week). Brachial artery diameter was measured using Doppler ultrasound before and after 5 min of forearm ischemia. FMD was measured before and after the 6-week period. **RESULTS:** There were no between-group differences at baseline in any of the variables. Following 6 weeks, brachial artery FMD increased ( $\Delta 3.80 \pm 1.03\%$ ,  $P < 0.01$ ) in the WBVT when compared to CON. No significant differences were observed in resting brachial artery diameter after WBVT. **CONCLUSIONS:** Six weeks of WBVT elicited a significant improvement in brachial artery vasodilatory function in young sedentary overweight/obese women. Collectively, WBVT may be considered an effective alternate exercise modality for the prevention and treatment of arterial dysfunction in young overweight/obese women.

1170 Board #349 May 31 2:00 PM - 3:30 PM  
**Irisin Is Associated With Insulin Sensitivity Improvement Following An Exercise Training In Obese Youth**  
 Martin Sénéchal<sup>1</sup>, Brittany V. Rioux<sup>1</sup>, Pelech Cody<sup>2</sup>, Dustin Kimberley<sup>3</sup>, Teri L. Moffatt<sup>3</sup>, Todd H. Duhamel<sup>3</sup>, Vernon W. Dolinsky<sup>2</sup>, Johnathan M. McGavock<sup>2</sup>. <sup>1</sup>University of New Brunswick, Fredericton, NB, Canada. <sup>2</sup>University of Manitoba, Winnipeg, MB, Canada. <sup>3</sup>University of Manitoba, Winnipeg, MB, Canada.  
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**PURPOSE:** The purpose of this prospective study is to determine if a change in circulating irisin during an acute bout of exercise was associated with insulin sensitivity after a 6-week exercise training in obese youth. **METHODS:** A total of 11 obese youth aged between 12 and 18 years completed a 45-minute acute bout of exercise. Irisin, the primary exposure variable, was measured using an immunoassay Elisa from blood draws taken before and during exercise at 15, 30, and 45 minutes. Then participants underwent a 6-week strength training intervention performed at 65% of their one repetition maximal. The primary outcome measure was changes in insulin sensitivity, measured using the Matsuda index. To investigate the metabolic response, participants were categorized as either responder or non-responder according to the median change on the Matsuda index. **RESULTS:** The proportion of irisin increased significantly during the acute bout of exercise ( $56.3 \pm 63.3\%$ ;  $p=0.028$ ). Overall, the average relative insulin sensitivity did not improve following 6-week of strength training ( $+18.5 \pm 43.1\%$ ;  $p = 0.860$ ). Absolute change in irisin during the acute bout of exercise was associated with absolute change in Matsuda index ( $r=0.68$ ;  $p=0.022$ ). A similar association was observed between the relative change in irisin and the relative change in Matsuda index ( $r=0.73$ ;  $p=0.010$ ). Participants above the median of change in the Matsuda index, significantly increased irisin ( $90.0 \pm 28.0\%$ ;  $p=0.020$ ), while individuals below the median did not ( $22.8 \pm 18.7\%$ ;  $p > 0.05$ ). **CONCLUSIONS:** An acute bout of exercise increases plasma irisin in obese youth and is associated with a greater insulin sensitivity despite a large variability in response. More studies are needed to better understand the impact of irisin on other metabolic parameters.

1171 Board #350 May 31 2:00 PM - 3:30 PM  
**Effects of Different Exercises Training associated with Phototherapy on Cardiometabolic Risk in Obese Women**  
 Raquel Munhoz da Silveira Campos<sup>1</sup>, Ana R. Dâmaso<sup>2</sup>, Deborah Cristaina Landi Masquio<sup>2</sup>, Marcela Sene-Fiorese<sup>3</sup>, Fernanda Oliveira Duarte<sup>1</sup>, Antonio Eduardo Aquino Junior<sup>3</sup>, Lian Tock<sup>4</sup>, Vanderlei Salvador Bagnato<sup>3</sup>, Nivaldo Antonio Parizotto<sup>1</sup>.  
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In the past, exercise in obesity control, mostly weight loss programs are associated with aerobic training. However, aerobic *plus* resistance training (ART) can promote weight loss and positively affect some metabolic parameters. Recently, it has demonstrated the benefits to use the phototherapy associate to physical exercise practice in obese women. **PURPOSE:** Investigate the effects of different exercises training associated with phototherapy on cardiometabolic risk in obesity women. **METHODS:** It was involved 33 obese women with age of 20-40 years in a weight loss therapy during 4 months. Inclusion criteria were primary obesity, body mass index greater than 30 kg/m<sup>2</sup> and less than 40 kg/m<sup>2</sup>. The volunteers were assigned in two different groups: Aerobic Training (AT) and Aerobic *plus* Resistance Training (ART) groups. The interventions consisted on physical exercise training and application of phototherapy (830nm), immediately after the physical exercise. Metabolic parameters were evaluated. **RESULTS:** It were showed reduction in body mass (ART: 93±11 vs 89±11, p 0.001; AT: 94±16 vs 89±16kg, p 0.001), body mass index (ART: 35±4 vs 31±4, p 0.001; AT: 35±4 vs 33±4kg/m<sup>2</sup>, p 0.001), fat mass (ART: 40±3 vs 37±4, p 0.001; AT: 47±3 vs 44±4%, p 0.001), visceral fat (ART: 153±19 vs 135±17, p 0.004 AT: 160±34 vs 150±36cm<sup>3</sup>, p 0.003), total cholesterol (ART: 205±24 vs 180±22, p 0.002; AT: 183±43 vs 163±51mg/dl, p 0.04), neck (ART: 38±3 vs 35±2, p 0.001; AT: 38±2 vs 37±2cm, p 0.04) and waist (ART: 108±11 vs 105±10, p 0.002; AT: 99±8 vs 92±7cm, p 0.001) circumferences in both groups. Only ART group demonstrated increase in lean mass (60±3 vs 66±7%, p 0.001) and adiponectin (7.5±3.4 vs 10.17±4.1ng/l, p 0.001). In addition, reduction in triglycerides (133±38 vs 108±42mg/dl, p 0.01) was noted only in ART group. Two-way ANOVA with repeated measures was applied. **CONCLUSIONS:** It was showed that ART associated with phototherapy applied in obese women was more effective than AT to improve health status in obese woman, reducing the cardiometabolic risk in this population. Supported by FAPESP (2013/041364; 2013/19046-0; 2013/08522-6; 2015/14309-9), CNPq (573587/2008-6; 300654/2013-8; 150177/2014-3) and CAPES.

1172 Board #351 May 31 2:00 PM - 3:30 PM  
**Obesity Moderates the Effects of Motivational Interviewing Treatment Outcomes in Fibromyalgia**  
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**PURPOSE:** Obesity is a common comorbid condition among patients with fibromyalgia (FM). The purpose of this study was to assess if obesity moderates the treatment benefits of exercise-based motivational interviewing (MI) for FM. **METHODS:** This is a secondary data analysis of a completed clinical trial of 198 FM patients who were randomized to receive either MI or attention control (AC). Using body mass index (BMI) to divide participants into obese (BMI > 30 kg/m<sup>2</sup>) and non-obese (BMI < 30 kg/m<sup>2</sup>) groups, mixed linear models were used to determine interaction between treatment arms and obesity status with regards to the primary outcome of global FM symptom severity (Fibromyalgia Impact Questionnaire, FIQ). Secondary measures included pain intensity (Brief Pain Inventory, BPI), 6-minute walk test, and self-reported physical activity (Community Health Activities Model Program for Seniors). **RESULTS:** Of the 198 participants, 91 (46%) were non-obese and 107 (54%) were obese. On global FM symptom severity (FIQ), the interaction between treatment arms and obesity status was significant (p=0.02). In the non-obese group, MI was associated with a greater improvement in FIQ than AC. In the obese group, MI participants reported less improvement in FIQ compared to AC. The interaction analysis was also significant for BPI pain intensity (p=0.01), but not for the walk test and self-reported physical activity. **CONCLUSIONS:** This is the first study to show that obesity negatively affects the treatment efficacy of MI in patients with FM. Our findings suggest that exercise-based MI may be more effective if initiated after weight loss is achieved.

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**High Intensity Interval Training Changes Skeletal Muscle Insulin Signalling Pathway Of Obese Individuals**  
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**PURPOSE:** Obesity, characterized as excess of body fat (BMI ≥ 30 kg•m<sup>-2</sup>), is related to the development of various metabolic disorders, including insulin resistance. Exercise is known to serve as a non-pharmacological approach to increase skeletal muscle insulin sensitivity, although the mechanisms have not been fully elucidated. Additionally, the molecular underpinnings of the effects of high intensity interval training (HIIT) on insulin resistance are less understood. This study evaluated the effects of HIIT on biochemical and molecular markers related to insulin resistance in physically inactive obese individuals. **METHODS:** 9 obese insulin sensitive (OB; 32 ± 10 y; 92.4 ± 12.9 kg; 35.1 ± 3.8 kg•m<sup>-2</sup>) and 8 obese insulin resistant (OBR; 30 ± 11 y; 106.0 ± 19.6 kg; 37.8 ± 4.6 kg•m<sup>-2</sup>) volunteers were subjected to 8 weeks of HIIT using a cycle ergometer. Insulin resistance was defined as homeostasis model assessment index (HOMA-IR) equal or greater than 2.71. Before and after the training, a maximal ramp test was performed to measure maximal cycling power output. HIIT was performed 3 times a week with progressively increasing intensity and volume (8 to 12 bouts of 1 min duration at 80 to 110% of the maximum power output separated by 1 min active recovery at 30 W). A muscle biopsy and venous blood were performed 72 hours before and after HIIT to allow HOMA-IR calculation. Skeletal muscle samples were analyzed by Western Blot. **RESULTS:** HIIT increased insulin sensitivity evaluated by HOMA-IR in OBR (4.4 ± 1.4 versus 4.1 ± 2.2, p=0.02) but not in OB (1.8 ± 0.5 versus 2.3 ± 1.0) volunteers. In skeletal muscle, HIIT increased phosphorylation of the insulin receptor substrate (Tyr612), Protein kinase B (AKT Ser473) and protein kinase dependent calcium/calmodulin (CaMKII) (Thr286), and increased expression of β-hydroxyacyl-CoA dehydrogenase (β-HAD), and cytochrome C oxidase (COX-IV). There was also a reduction of phosphorylation of extracellular signal regulated kinase (ERK1/2) in OBR. **CONCLUSIONS:** 8 weeks of HIIT promoted improvements in insulin sensitivity, modified components of insulin signaling pathway, and improved oxidative metabolism in skeletal muscle. These changes were independent of changes in body fat. This work was supported by CAPES (PNPD-2455/2011), FAPEMIG (CDS APQ01621-10), and CNPq (477154/2011-5) grants.

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**Effects of Underwater Treadmill Training on Health-Related Fitness and Daily Caloric Expenditure in Adults with Type 2 Diabetes**  
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**PURPOSE:** To document the influence of underwater treadmill training (UTT) on components of health-related fitness and daily energy expenditure in middle-aged adults with type 2 diabetes. **METHODS:** Using a randomized, controlled, single-blind, crossover design, 26 adults with type 2 diabetes (age = 58.3 ± 4.5 yrs; 16 females, 10 males) were randomly assigned to complete a 12-week control period followed by 12 weeks of UTT (Group 1; G1; n = 13) or 12 weeks of UTT (3d-wk<sup>-1</sup>) followed by a 12-week period of no UTT (Group 2; G2; n = 13). During UTT, water height was maintained at 10 cm below the xiphoid process, walking speed was set to elicit a relative intensity of 40-50% of heart rate reserve (HRR) and gradually raised to 50-70% HRR by week 12, and the duration of walking sessions was increased from 30 to 60 minutes over the course of UTT. Primary outcome measures included cardiovascular fitness [resting heart rate (RHR), resting systolic and diastolic blood pressure (RSBP; RDBP), 6-min walk distance (6MWD)]; body composition [body mass (BM), body fat percentage (BF%), waist circumference (WC)]; leg strength [hamstring and quadriceps isokinetic peak torque at 30°•sec<sup>-1</sup> and 60°•sec<sup>-1</sup>], and daily average caloric expenditure (DACE). Using 1-way repeated-measures analysis of variance, post-treatment scores were compared to pre-treatment scores across G1 and G2 participants. **RESULTS:** Compared to pre-treatment scores, significant (p < .05)

improvements in cardiovascular fitness (decreased RHR, RSBP, and RDBP; increased 6MWD), body composition (decreased BM, BF%, and WC), and leg strength (greater peak hamstrings torque at 30°·sec<sup>-1</sup>, 60°·sec<sup>-1</sup>, and peak quadriceps torque at 30°·sec<sup>-1</sup> and 60°·sec<sup>-1</sup>), along with an increase ( $p < .05$ ) in DACE, were observed following UTT. **CONCLUSIONS:** Our findings demonstrate that an underwater treadmill walking program featuring a gradual and progressive increase in walking speed and duration can enhance health-related fitness and raise daily caloric expenditure in middle-aged adults with type 2 diabetes.

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### Insulin Therapy is Associated With Increased Sedentary Behaviour and Weight Gain in T2DM Patients

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**PURPOSE** Start of insulin treatment in type 2 diabetes mellitus (T2DM) is associated with weight gain, which further increases cardiovascular and metabolic risk. Changes in moderate-to-vigorous physical activity (MVPA), light physical activity (LPA) and/or sedentary behaviour (SB) may contribute to weight gain. Here, we compared physical activity patterns in T2DM and controls and studied the effects of initiation of insulin therapy.

**METHODS** First, we objectively assessed free-living MVPA, LPA and SB in patients with T2DM without (n=40) and with prolonged insulin therapy (T2DM-I, n=42), as well as weight matched (n=38) and lean controls (n=35). Secondly, 40 T2DM patients were followed prospectively across 12-months after initiation of insulin therapy. Weight, MVPA, LPA and SB were measured at baseline, 6 months and 12 months after start of therapy.

**RESULTS** Weight matched controls, T2DM and T2DM-I spent less time in MVPA than lean controls (1.6±1.4h, 1.1±0.8h, 1.5±1.1h and 2.7±1.5h, respectively,  $P<0.001$ ). T2DM-I, but not T2DM and weight matched controls, spent less time in LPA ( $P=0.045$ ). Sitting time was higher in T2DM and T2DM-I compared to lean controls ( $P=0.003$ ), but not compared to weight matched.

Prospectively, body weight increased 2.9±4.5kg over 12 months ( $P<0.05$ ). We found no changes in MVPA, whilst LPA declined from 2.0±1.1 to 1.6±0.9h ( $P=0.027$ ) and sitting time increased (11.7±1.7 to 12.3±1.9h,  $P=0.028$ ). Non-obese (BMI<30kg/m<sup>2</sup>) T2DM patients who started insulin therapy showed a positive correlation between the increase in sitting time vs weight gain ( $r=0.446$ ,  $P=0.037$ ) and vs waist circumference ( $r=0.446$ ,  $P=0.033$ ). These relations were not present in obese T2DM patients, who started with more sitting time and higher waist circumference (both  $P<0.05$ ).

**CONCLUSION** T2DM patients, especially those on insulin therapy, show lower levels of MVPA and LPA, but more sitting time, compared to lean controls. Start of insulin therapy is associated with an increase in sitting time. This increase in sitting time was associated with weight gain in non-obese subjects, but not in obese subjects. This suggests that increased SB, rather than decreased MVPA, may contribute to weight gain associated with insulin therapy in T2DM.

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### Validation Of A System-specific Dual-energy X-ray Absorptiometry-derived Body Volume Equation For 4-compartment Body Composition Calculations

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A dual-energy x-ray absorptiometry (DEXA)-derived estimation of body volume (BV) has been shown to be a valid alternative to air displacement plethysmography (BodPod) in the calculation of body composition using a traditional 4-compartment (4C) model. Previously established equations have been derived using a Hologic DEXA model, but validation of the equation with other DEXA models is needed.

**Purpose:** To determine the validity of DEXA-derived BV and 4C body composition (DEXA-4C) calculations using a GE iDXA system compared to the traditional 4C criterion method. **Methods:** Forty-six overweight and obese adults (Mean ± SD; Age=35.3 ± 9.0 yrs; Body mass index=33.2 ± 4.7 kg·m<sup>-2</sup>) underwent a traditional 4C body composition assessment. Fat mass (FM), lean mass (LM), and bone mineral content (BMC) were measured using a GE Lunar iDXA system; variables were used to calculate BV using a previously established Hologic-derived equation (DEXA BV = [FM/0.84] + [LM/1.03] + [BMC/11.63]) and compared to BV values obtained from BodPod. Body composition variables (FM, percent body fat [%FAT], LM) calculated from a DEXA-derived BV 4C model were compared to body composition variables

calculated from a traditional 4C criterion model. **Results:** When compared to BodPod BV, DEXA-derived BV was significantly higher (Mean ± SD; 96.3 ± 18.1 L vs. 95.4 ± 17.6 L;  $p<0.001$ ) with a total error (TE)=1.121 L and standard error of the estimate (SEE)=0.015 L. DEXA-4C FM (38.1 ± 11.4 kg vs. 35.6 ± 10.2 kg;  $p<0.001$ ) and %FAT (39.3 ± 7.9 % vs. 36.9 ± 7.5 %;  $p<0.001$ ) were significantly greater than the 4C criterion; LM was significantly lower than the criterion (58.4 ± 11.8 kg vs. 60.9 ± 12.7 kg;  $p<0.001$ ). For DEXA-4C body composition values, TE values were 3.082 kg for FM, 2.922% for %FAT, and 3.082 kg for LM. SEE values were 0.218 kg for FM, 0.326 % for %FAT, and 0.220 kg for LM. **Conclusions:** Although DEXA-derived calculations of BV and body composition were significantly different from 4C criterion measures, results demonstrated TE and SEE values that are considered acceptable, especially compared to other common composition methods. Utilizing DEXA-derived equations, irrespective of the model available, to determine BV may allow for accurate 4C composition assessments without use of BodPod. Supported by Scivation Inc.