Cardiac Denervation Affects Exercise Training-Induced Improvements in Cardiorespiratory Fitness of Heart Transplant Patients

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PURPOSE: Heart transplantation-induced cardiac denervation results in impaired heart rate control during exercise, and has been associated with a reduced cardiorespiratory fitness even years after surgery. Although there is some degree of cardiac reinnervation over time, it does not occur in all patients. Thus, our purpose was to analyze the effects of exercise training on the cardiorespiratory fitness of heart transplant patients with (CR) and without (NOCR) evidence of cardiac reinnervation.

METHODS: 33 sedentary heart transplant patients (age = 45.5 ± 2.2 years; time since surgery = 6.7 ± 0.7 years), divided into CR (N = 16) and NOCR (N = 17) group, were submitted to a thrice-weekly aerobic (30 min) and resistance training program (5 exercises) for 12 weeks. Symptom limited cardiopulmonary exercise testing (CPX) was performed before and after exercise intervention to assess cardiorespiratory fitness and hemodynamic response to exercise.

RESULTS: Heart rate response to exercise (resting, submaximal, maximal and recovery heart rate during CPX) did not change in both groups after intervention. CR patients improved cardiorespiratory fitness (VO2MAX) and exercise tolerance improved (P < 0.001) 10.8 ± 1.8 % (VO2 increase = 2.8 ± 0.5 ml/kg/min) and (13.4 ± 4.4%, Figure 1) after training, respectively. Although there was an increase in exercise tolerance (9.9 ± 3.5%, P = 0.02), cardiorespiratory fitness did not improve in NOCR patients after training (Figure 1).

CONCLUSIONS: Cardiorespiratory fitness improved in CR, but not in NOCR, after 12 weeks of exercise training. This result suggests that cardiac denervation affects exercise training-induced improvements in cardiorespiratory fitness of heart transplant patients.

Superior peak VO2 values have been noted in pre-pubertal soccer players compared to their recreationally active peers. It is unclear, what the underlying cardiovascular mechanisms are that give rise to this high level of aerobic fitness. PURPOSE: The aim of the study was to evaluate global markers of systolic and diastolic function in a group of highly-trained, pre-pubertal soccer players during an incremental exercise test.

METHODS: Twenty-two, highly-trained male soccer players (SP) from two professional soccer clubs (age: 12.0 ± 0.3 years) volunteered for the study. Fifteen recreationally active boys (CON), of similar age (age: 11.7 ± 0.2 years) were also recruited. All boys underwent an incremental cycle ergometer test to exhaustion. Cardiac dimensions were determined using M-mode echocardiography. Doppler ultrasound techniques were used to derive SV. Tissue-Doppler imaging was used to quantify systolic (TDI-Sadj) and diastolic function (TDI-E, E/E'adj and E/E'adj) at rest and maximal exercise intensities.

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SP demonstrated significantly (p = 0.05) greater peak VO2 values than CON (SP: 48.0 ± 5.0 vs CON: 40.1 ± 7.5 ml·kg-1 ·min-1). Some evidence of LV structural remodeling was seen in the SP; allometrically-scaled to body surface area left ventricular end-diastolic volume was larger (p = 0.05) in the SP (51.3 ± 9.0) compared to CON (44.6 ± 5.8 ml·BSA1.5). CONCLUSION: Factors that augment LV volume appear to be a contributory factor for the superior aerobic fitness of the soccer players. There appears to be no systematic evidence to support functional improvements in cardiac systolic and diastolic function in pre-pubertal soccer players.

Effects of Endurance Exercise Training on Cardiac Autophagy Relationship Proteins in STZ-induced DM Rats

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Many studies have demonstrated that diabetes mellitus (DM) is associated with muscle autophagy. Exercise training may affect muscle autophagy. The aim of the present study was to evaluated effects of endurance exercise training (EX) on cardiac autophagy-related protein in DM rats. We also evaluated the levels of apoptosis proteins of the heart. Experimental methods: the Sprague-Dawley (SD) male rats were divided into 3 groups as two experimental groups and one control group. The first groups as a control group received adjuvant. The second and third groups were the DM groups, received 150 mg/kg STZ by intraperitoneal injection. After one week, EX
was carried out in the third group (DM-EX group) for four weeks. The animals were sacrificed; the blood were collected; the blood glucose was measured; the autophagy related proteins (i.e., Atg5, LC3-I, LC3-II, Atg12) and apoptosis proteins (i.e., Beclin1, caspase3, cleaved caspase3), Bcl2, P-Bcl2) were analysis by western blot. The results show that the level of blood glucose was higher in DM group than in control group (p < 0.05). The Atg5, Atg12 and Bcl2 were highest in DM-EX group than in other group (p < 0.05). The Atg5, Atg12 and Be2 were highest in DM-EX group than in others (p < 0.05). The Beclin1 and P-Bcl2 were higher in DM-EX group than in control group (p < 0.05). Those results suggested that EX may affect muscle autophagy from DM damage through Bcl2, Atg5, and Atg12 increasing.

**PURPOSE:** Heart failure is often associated with abnormal pulmonary hemodynamics. Pulmonary arterial capacitance (PAC) is a measure of the distensibility of the pulmonary vasculature and is a determinant of pulmonary vascular afterload. Previously it has been shown that, at rest, PAC demonstrates a hyperbolic relationship with pulmonary vascular resistance (PVR) in heart failure (HF) patients and is an independent predictor of mortality. Our aim was to determine how exercise affects PAC and its relationship with exercise capacity and indices of respiratory gas exchange.

**METHODS:** 39 HF patients undergoing right heart catheterization performed incremental exercise to exhaustion. Pulmonary arterial systolic pressure (PAPs), pulmonary arterial diastolic pressure (PADs), mean pulmonary artery pressure (PAPm), and mean pulmonary wedge pressure (PWm) were measured invasively at rest and at peak exercise. Ventilation (Ve), oxygen consumption (VO2), carbon dioxide production (VCO2), and heart rate (HR) were continuously collected at rest and during exercise. Arterial and mixed venous blood samples were collected for determination of cardiac output (Q) via direct Fick. The following variables were then calculated: stroke volume (SV)=Q/HR; PAC=SV/(PAPs-PAPd); PVR=(PAPm-PWm)/Q.

**RESULTS:** PAC significantly decreased from rest to peak exercise (2.6 ± 0.6 ml/min/mmHg at rest vs. 2.0 ± 0.3 ml/min/mmHg at peak exercise). PAC was negatively correlated to PVR at rest (R=-0.74) and during exercise (R=-0.82) according to a hyperbolic fit. PAC was negatively correlated to VE/VCO2 at rest (R=-0.53) and during exercise (R=-0.52) according to a hyperbolic fit.

**CONCLUSIONS:** In patients with classic systolic HF, PAC is reduced and falls further with exercise. In addition, subjects with the greatest capacitance to accept increases in pulmonary blood volume have a better exercise capacity. This increased pulmonary vascular distensibility during exercise yields lower resistance to forward flow. The gas exchange measure ventilatory efficiency, a marker of disease severity and prognosis in HF patients, is also related to reduced PAC. Supported by NIH grant HL71478.

**Board #5**

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

**Differential Effects of Sarcopenic Obesity on Markers of Protein Synthesis in Hearts of C57BL/6J Mice**


(No relationships reported)

In 1990, 23.6% of the elderly population (60+ years old) was obese (≥30 BMI). By 2010, it increased to 39.5%. Pathological, cardiac hypertrophy is highly associated with both age and obesity. As the prevalence of obesity in the elderly population continues to rise, a firmer understanding of how age and obesity interact to affect cardiac function is needed. PURPOSE: To examine how sarcopenic obesity affects markers of protein synthesis. METHODS: Twenty-four C57BL/6J mice were evenly distributed into either a normal chow (17% kcals from fat) or high-fat (60% kcals from fat) diet after weaning. Six mice from each diet were euthanized at 3-4 months of age (young) or 22-24 months of age (aged). The classification of the 4 groups is as follows: Young Lean (YL), Young Obese (YO), Aged Lean (AL), Aged Obese (AO). Hearts were excised, snap-frozen, and processed for protein expression via western blot. All protein targets are reported as a ratio of phosphorylated to total protein.

**RESULTS:** There was an interaction of age and obesity on heart mass:tibia length. Heart mass:tibia length was 11% higher in YO compared to YL and 37% greater in AO compared to AL (p < 0.05). Also, AO heart mass:tibia length was 40% greater compared to YO (p < 0.05). There was a main effect of age to increase both pAkt/Akt (p < 0.05) and pmTOR/mTOR (p < 0.05). There was an interaction of age and obesity on p4EBP1/4EBP1 expression, p4EBP1/4EBP1 was lower in YO compared to YL, AL, and AO (p < 0.05). We detected an interaction of age and obesity on p70S6K expression, p70S6K was 47% higher in YO compared to YL (p < 0.05); however, p70S6K was not different between AL and AO mice. We observed an interaction of age and obesity on pAMPK/AMPK expression, pAMPK/AMPK expression was 329% higher (p < 0.05) in YL compared to YO but 46% lower (p < 0.05) in AO compared to AL (p < 0.05). The ratio of LC3-II to LC3-I was highest in DM group than in other group (p < 0.05). The Atg5, Atg12 and Bcl2 were highest in DM-EX group than in others (p < 0.05). The Beclin1 and P-Bcl2 were higher in DM-EX group than in control group (p < 0.05). Those results suggested that EX may affect muscle autophagy from DM damage through Bcl2, Atg5, and Atg12 increasing.

**Board #4**

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

**Effect of Exercise on Pulmonary Arterial Capacitance in Heart Failure**

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(No relationships reported)

Left ventricular (LV) twist and untwisting rate (“LV twist mechanics”) are indicative of the degree of left ventricular systolic and diastolic myocardial deformation. Exercise training has been suggested to impact on resting LV twist mechanics, however, whether LV twist mechanics respond differently during exercise in trained and untrained individuals is currently not known. PURPOSE: To compare the response of LV twist and untwisting rate to exercise in endurance trained and untrained men. Methods: Nine endurance runners (25 ± 6 yrs; 77 ± 12 kg) and thirteen untrained men (22 ± 3 yrs; 76 ± 10 kg) were examined at rest and during supine cycling exercise at 30%, 40% and 50% of their peak power output. LV twist mechanics were assessed using speckle tracking echocardiography. Blood pressure and heart rate were determined from continuous photoplethysmography. Statistical difference were determined using 2-way RM ANOVA (alpha ≤ 0.05), data are presented as mean and SD. Results: There were no significant differences between endurance trained and untrained men in blood pressure, heart rate or twist and untwisting rate (All P > 0.05). However, the ratio of untwisting rate per twist (UTtwist/twist) was significantly lower in untrained men at rest (-7.2 ± 3.0 vs. -10.1 ± 4.1 ms, P < 0.05), but similar UTtwist/twist during exercise (P > 0.05). Conclusion: In endurance runners and untrained individuals, LV twist mechanics change similarly from rest to moderate exercise. However, the lower UTtwist/twist in untrained individuals at rest may suggest a reduced reliance on diastolic mechanics when the cardiovascular system is not challenged, possibly relating to smaller hearts.

**Fig. 1.** LV twist mechanics in trained and untrained men. *: P < 0.05.
syndrome which can be quantified through the use of 12-lead electrocardiography (ECG). The identification and investigation of the prevalence of these AF associated ECG markers, which include the continuous dependent variables of PRI duration, heart rate (HR), and P-wave height and the categorical dependent variables of bradycardia, left atrial enlargement (LAE), and P-wave peaking, in CCCS as compared with a matched inactive collegiate population (IC). METHODS: Supine resting 12-lead ECGs of ten Division I CCCS and ten IC were taken and subsequently analyzed. Subject height, weight, and blood pressure were recorded. Independent T-tests and Chi-square tests were used respectively to analyze continuous and categorical dependent variables. RESULTS: No significant differences in PRI duration or prevalence of LAE were found between the two groups, but CCCS had a greater prevalence of bradycardia than IC (HR: 52 ± 7 bpm vs. 66 ± 7 bpm) (P<0.05). The CCCS had a 58% taller mean P-wave height and a greater prevalence of P-wave peaking than the IC (60% vs. 0%) (P<0.05). CONCLUSION: The identification and prevalence of AF associated ECG markers in cross-country skiers is difficult to determine in CCCS; suggesting that it is affected by other factors such as cumulative training time or age. However, as the increases in vagal tone and atrial chamber modifications characteristic of the endurance athletic heart syndrome accumulate over a lifetime of endurance training, they may result in a higher prevalence of AF among cross-country skier athletes. Therefore, further research involving the potential progression of these ECG changes in the lifespan of the cross-country skier is warranted.

### D-14 Thematic Poster - Military Physiology

**Chair:** Bradley Nindi, FACSM, University of Pittsburgh, Pittsburgh, PA.

**Board #1**

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

**Room:** 104

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**1773**

**Reliability of Simulations of Common Soldiering Tasks**

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(No relationships reported)

Understanding the physical demands of Soldiers is difficult. Many Soldiering tasks involve multiple people, require expensive equipment, or are difficult to carefully control. Simulations of these tasks may aid in answering specific research questions; however, the simulations must provide reliable results in order to be useful.

**PURPOSE:** To determine the reliability of 5 simulations of common Soldiering tasks.

**METHODS:** Three groups of ~50 Soldiers repeated simulations 4 times over 2 weeks. Group 1 (25 Male, 25 Female) performed 3 separate tasks: carrying 16 sandbags for 10m as fast as possible (SC), dragging a simulated 270-lb casualty 15m (CD), and completing an incremental heavy lift to simulate evacuating a casualty from a vehicle turret (CE). Group 2 (25 M, 25 F) completed 15 6.6m simulated combat rushes (CR), and Group 3 (29 M, 20 F) completed a simulated 4-mile foot march (FM). Repeated measures ANOVAs were used to test for improvements across consecutive trials. When there were no additional improvements between trials, relative reliability was assessed using Intraclass correlation (ICC). Absolute reliability was assessed with standard error of the measurement (SEM) and 95% limits of agreement (95% LOA) or 95% ratio LOA, as appropriate. RESULTS: The FM and CD did not improve across trials (p>0.10). Performance on the SC, CR, and CE improved between the first and second trials (p<0.05), but no improvements was seen on the third. Reliability estimates are shown below. CONCLUSIONS: These 5 simulations show high reliability and are suitable for studying the physical abilities of Soldiers. A practice session should be provided prior to testing the SC, CR, or CE.

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**1774**

**Board #2**

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

**The Physiological Demands Of A Task Simulation**

**Varies Between Independent Groups Of Subject Matter Experts**

Adam Hayes1, Kent Delbridge1, Jace Drain2, Herbert Groeller1, Joanne Caldwell1.

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(No relationships reported)

Task simulations are commonly developed by subject matter experts to enable quantification of the critical occupational physiological demands. However, it is unknown if the age, rank and experience of subject matter experts have an impact on the resultant physiological demands of a task simulation.

**PURPOSE:** To compare the physiological demands of a task simulation developed by two independent groups of subject matter experts. **METHODS:** Two groups of Royal Australian Air Force personnel each designed a simulation for establishing a security control point (Group 1: 12 males, 3 females, age 32.8 SD 9.7 y, experience 8.2 SD 6.2 y; Group 2: 9 males, 1 female, age 26.4 SD 7.3 y, experience 5.2 SD 3.9 y). The task required a team of five personnel to construct a military tent (11 x 11 ft.) and insert star pickets to establish a perimeter around the tent. The specific task requirements, such as number of pickets, distance, individual job roles, and an acceptable work rate, were determined independently by each group of experts. Oxygen consumption (VO2, Metamax) and heart rate (Polar HR monitor) were measured to evaluate the physiological demands of the simulation task. An independent t test was used to determine significant differences (P<0.05). Similarly, there was no difference between Group 1 and Group 2 for average heart rate (125 SD 8.5 beats.min-1 and 133 SD 16.4 beats.min-1, respectively; P>0.05) of the task simulation. However, there was a significant difference in the mean duration of the task simulation Group 1 (34 mins 26 s 10.01) and Group 2 (15 mins 30 s 3.41), and the % of maximal acceptable work duration (Group 1: 12.2 %, Group 2: 5.3 %, P=0.05). CONCLUSION: The physiological demands of a task are significantly influenced by the group of subject matter experts used to develop the simulation. This effect primarily influenced task duration rather than the intensity of the simulation. These results indicate that physical employment standards should be developed with input from multiple groups of subject matter experts.

Supported by a UOW/DST Group masters scholarship.
The ability to perform high intensity intermittent exercise whilst carrying load is an important component of dismounted military assault tasks. The Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of one key component of dismounted military assault tasks. The Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the metabolic demands and assess relationships with field approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of the Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013).
Nonalcoholic fatty liver disease (NAFLD) is a progressive disorder ranging from simple steatosis to nonalcoholic steatohepatitis (NASH), fibrosis, and cirrhosis. Exercise training is recommended to patients with NAFLD, yet it is unclear if exercise can effectively treat advanced liver disease, including fibrosis. PURPOSE: To determine whether 12 weeks of exercise training can attenuate the NASH+ fibrosis phenotype induced by a western diet (WD) high in fat, sucrose, and cholesterol in Otsuka Long-Evans Tokushima Otsuka (OLETF) rats. METHODS: Eight week old Long-Evans Tokushima Otsuka rats (L) and hyperphagic OLETF (O) rats were fed a 60% fat diet. The incidence of non-alcoholic steatohepatitis (NASH) has increased and becomes more commonly observed in patients with metabolic syndrome. NASH is characterized by increased hepatic lipid storage and chronic low-grade inflammation resulting from physical inactivity and overnutrition of diets high in both fat and fructose. Weight loss is a common therapeutic strategy; however, the continued high consumption of fructose may attenuate the beneficial effects of weight loss on NASH.

METHODS: To induce obesity, male C57BL/6 mice were fed a 60% fat diet with a 20% fructose solution (HF+Fr) for 8 wks. At-matched lean mice were fed a 10% fat diet (LF). To produce weight loss, HF+Fr mice were randomly assigned to a LF diet either with (WL+Fr) or without (WL- Fr) access to a 20% fructose solution for 6 wks. Significant differences (P<0.05) were identified by one-way ANOVA.

RESULTS: Following 6 wks of weight loss, WL-Fr remained 12.7% and 17.6% heavier than LF and WL+ Fr, respectively. Despite the lower body mass, WL-Fr showed greater hepatic triglyceride than LF (10.5 ± 30.9 mg/g tissue), but lower HF+Fr (30.9 ± 69.4 mg/g tissue). The elevated hepatic lipid in WL+ Fr when compared to LF was associated with increased expression of lipogenic genes Fasn and Acc1 by 1.5 and 1.1 fold, respectively. The increased expression of these genes in WL+Fr may be due to a 2.9 fold increased expression of the regulatory transcription factor Chrebp compared to LF. Despite weight loss, the continued fructose consumption was associated with a 1.5-2.0 fold increased expression of pro-inflammatory Tnfα and Ifng when compared to both LF and WL-Fr. Conversely, WL+Fr demonstrated an increased expression of the immunoregulatory Il10 (1.3 fold) and Il1b (2.8 fold) when compared to LF.

CONCLUSIONS: These data suggest that the continued consumption of high-fructose during weight loss reversely increased hepatic lipid storage and mRNA markers of de novo lipogenesis, as well as mRNA markers of inflammation. Overall, delayed clearance of hepatic lipids by fructose consumption during weight loss may promote early signs of NASH.
Introduction: We recently demonstrated that 7 days of increased sedentary time significantly increases post-meal insulin concentrations in healthy adults (Lyden et al. Med Sci Sport Exerc. 2015). It is unclear whether higher insulin concentrations are due to greater insulin secretion from the pancreas or lower hepatic extraction, i.e. the amount of insulin cleared by the liver after secretion but prior to reaching the circulation. Purpose: To quantify changes to insulin secretion, hepatic extraction and beta cell function following 7 days of increased free-living sedentary time. Methods: Physical activity and sedentary time were measured for 7 days in 10 healthy, recreationally active (≥150 minutes of physical activity/week), men and women age 18-35 using the thigh-worn ActiPAL™ wearable sensor, with participants maintaining their habitual physical activity levels. Following this baseline condition participants were instructed to reduce their physical activity level and increase their sedentary time for 7 consecutive days. Participants completed a 5-sample oral glucose tolerance test (OGTT) and glucose, insulin and C-Peptide concentrations were measured following each condition. Hepatic extraction was quantified at basal (HE_0) and 2h time-points (HE_2h) as well as area under the curve (AUC) for the OGTT (HEAUC). The insulinogenic index (IGI, C-Peptide (0-30)/Glucose (0-30)) and the disposition index (IGI (x) Insulin sensitivity) were calculated to determine insulin secretion and beta cell function, respectively. Paired t-tests were used to evaluate differences between baseline and sedentary conditions and Pearson product moment correlations were used to test for relationships between sedentary time and beta cell function. Results: HE_0, HE_2h, and HEAUC were significantly lower (85.4 ± 7.2% vs. 74.6 ± 6.6%, p<0.05 and 73.6 ± 9.4% vs. 67.5 ± 11.3%, p<0.05) after 7 days of increased sedentary time. Additionally, changes in sedentary time were associated with changes in HE_2h (r=-0.65, p=0.04). There were no significant differences in HEm, insulin secretion, or measures of beta cell function. Conclusion: Postprandial hyperinsulinemia following one week of sedentary behavior is primarily due to reductions in hepatic extraction rather than increases in insulin secretion.

Supported by NIH RC1HL095575

EXERCISE, INFLAMMATION, AND SUGAR CONSUMPTION IN ADULTS WITH NORMAL VERUS IMPAIRED FASTING OR Glucose Tolerance

Exercise improves glucose tolerance and insulin sensitivity, but little is known about how consuming sugar sweetened beverages (SSB) during and post exercise influences the metabolic benefits of exercise.

Purpose: Determine how the metabolic benefits of exercise are influenced by SSBs during and after exercise in overweight and obese adults of normal (NFG/NGT) and impaired fasting glucose (IFG) or glucose tolerance (IGT).

Methods: Male (n=9) and female (n=11) participants (18-52 y) completed two exercise and one control (CON+H2O) conditions. A standard, isocaloric diet to meet energy needs was given post exercise in EX-H2O and CON-H2O conditions, but SSB replaced 2 kcal per kg lean mass of calories from food in EX-S SB. Exercise was performed midday and consisted of an upright walk at 65% predicted VO2max for 45 minutes on the first and matched on the second exercise condition. Participants completed a 75 g oral glucose tolerance test (OGTT) 18 h later with blood samples collected -50, 60, 120 minutes for analysis. Results: The area under the curve for 120 minutes (AUC120) was significantly lower (p<0.05) in EX-H2O (7487 ± 1723 mg·dl·min) compared to CON-H2O (9276 ± 2465 mg·dl·min). TNF-alpha concentration was also significantly lower (p<0.05) in EX-H2O (14.3 ± 4.7 pg·ml-1) compared to CON-H2O (17.9 ± 4.7 pg·ml-1). EX+SSB (2.42 ± 0.34 pg·ml-1) at 120 min. TNF-alpha (p=0.022) in EX+H2O was lower (p=0.022) in EX+SSB compared to CON-H2O. The IGF/IGT group had higher (p<0.05) sTNFR1 with consumption of SSB regardless of exercise. There was a significant time by group interaction (p=0.009) for RONS to increase during the OGTT in IGF/IGT but not NFG/NGT.

Conclusions: Inflammation responses to glucose ingestion were lower 1h after exercise compared to the non-exercise. This is the first study that we know of to demonstrate a prolonged anti-inflammatory effect of exercise. IGF/IGT had greater RONS responses during the OGTT, regardless of condition. Thus, metabolic benefits of exercise may partially compromised by increases in some inflammatory markers when IGF/IGT adults consumed SSBs.

Abstracts were prepared by the authors and printed as submitted.
A purified vegan diet known as “Daniel Fast” (DF) has attracted great attention due to its health-enhancing properties. However, the effects of this vegan diet combined with exercise training on physical performance and cardio-metabolic health remains to be established. PURPOSE: To determine the effects of a 12-week DF with or without endurance exercise training on body composition, physical performance, cardio-metabolic profile, and oxidative stress in male rats. METHODS: Long-Evans male rats (N=28) were assigned to be exercised trained (E) or sedentary controls with a DF or a Western Diet (WD) group. Food was provided as ad libitum for 12 weeks. Once post-intervention physical performance and body composition assessments (dual X-ray absorptiometry (DXA)) were completed, blood was collected for evaluation of cardio-metabolic profile parameters (glucose, triglyceride, cholesterol) and a selected biomarker of oxidative stress [advanced oxidation protein products (AOPP)]. Analysis of variance (ANOVA) was used with significance set at P<.05. RESULTS: Body mass and body fat accumulation, enhanced physical performance, and improved cardio-metabolic parameters with lower oxidative stress regardless of amount of calories consumed. AOPP concentration was lower in the DF (67±15 µmol·L-1) than in the WD (573±53 µmol·L-1) and WD+E (413±56 µmol·L-1) groups, respectively. Further, the AOPP concentration was lower in both the DF+E (50±7 µmol·L-1) and WD+E (413±56 µmol·L-1) groups, respectively. CONCLUSION: The DF with ad libitum feeding resulted in lower body mass and body fat accumulation, enhanced physical performance, and improved cardio-metabolic parameters with lower oxidative stress regardless of amount of calories consumed. Positive health benefits of engaging in regular physical activity (PA) have been well documented. Current PA recommendations for children include engaging in 60 or more minutes of daily aerobic activity and at least 3 days per week participation in muscular-strengthening activities (USDHHS, 2008). However, the underlying mechanism of how muscular strength, BMI, and PA are related to overall health has not been fully investigated among children with disabilities. PURPOSE: This study examined the relationships between overall health, PA engagement, muscular strength, and BMI. The goal was to reveal the potential underlying mechanism of general health among children with disabilities using mediation analysis. METHODS: This study employed secondary data analysis using the 2012 National Youth Fitness Survey. Data from 218 surveys of children with disabilities (101 male and 117 female) aged 6 to 15 years (M = 10.93 ± 2.72) were extracted from the nationally representative sample. Children with disabilities were defined as having one of four criteria: (a) receiving special education services, (b) having long term health impairment, (c) having mobility limitations, or (d) needing special equipment. Frequency of participation in daily PA, BMI, grip strength, and general health condition were used for data analysis. A multiple mediator model was employed to examine the potential underlying mechanism using SPSS 22, process macro (Hayes, 2014). RESULTS: As expected, the general health of children with disabilities was influenced by PA engagement, BMI, and muscular strength. The mediation analysis revealed that daily PA engagement not only directly affects general health (b = .24, p<.01), but also indirectly through muscular strength (b = .03, 95% CI: -.001, .006) as a single mediator, and through strength in the ¼ mile walking model (coeff=0.03; P<0.05) and through strength in the ½ mile walking model (coeff=0.03; P<0.05) and through walking a block model (coeff=0.03; P<0.05). AOPM effects were significantly mediated through strength in all three models (coeffs ~0.05; all P<.05), whereas there were no significant mediating effects through PA. All TTest models were not significant. CONCLUSIONS: The association of biomarkers with functional limitations and the mediating role of CAP or strength is biomarker-specific. It is plausible that these biomarkers represent systems (e.g. inflammatory and endothelial function) that differentially impact system impairments (e.g. cardiorespiratory vs. musculoskeletal) and subsequent functional limitations. Early detection of system dysregulation may aid in targeted interventions.
testing, which included the assessment of learning disabilities and sport-related concussion. Odds ratios were calculated (95% CI) for the 148 athletes who had concussion and for the 48 athletes who incurred a concussion during the study to assess the relation of learning disabilities and the incidence of concussion. Results: At baseline, 32 athletes had a history of one concussion and 59 athletes had a history of two or more concussions. Athletes with a learning disability were 2.06 times more likely to have a history of concussion and 1.63 times more likely to have a history of multiple concussions than those without a learning disability. Further, athletes with a learning disability were 2.62 times more likely to suffer a concussion during the course of the study than athletes without a learning disability. Conclusion: The current data suggest that having a learning disability may be a significant risk factor for incurring a concussive injury.

Autism spectrum disorders (ASD) are a group of developmental disorders characterized by difficulties in social interaction and communication, as well as by repetitive, restricted interests, and behaviors. Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder identified through developmentally inappropriate symptoms of inattention, impulsiveness, and overactivity. As these two disorders seem quite distinct in terms of their description; however, children with ASD and ADHD have been found to display a variety of motor skill and executive function deficits. There has been little research directly contrasting the profiles of these groups. Purpose: To compare the motor proficiency and executive function in children with ASD, ADHD, and typically developing (TD) children. METHODS: Eighty-three children (ASD, n = 21; ADHD, n = 31; TD, n = 31), ages 6-12 years, were of average IQ participated. The Bruninks-Oseretsky Test of Motor Proficiency-2 and the Stroop Color and Word Test were used to collect data. One-way multivariate analysis of covariance and one-way univariate analysis of covariance, controlling for age, were performed to evaluate the group differences for the BOT-2 and the Stroop test, respectively. Results: Group differences were found in all BOT-2 measures (total motor composite, F = 6.29, p < 0.01; fine motor control, F = 3.64, p < 0.05; manual coordination, F = 4.87, p < 0.05) and Stroop Color-Word task (F = 16.40, p < 0.01). Post hoc tests showed that (a) the ASD group exhibited lower score than the TD group on total motor composite, manual coordination, and strength and agility, (b) the ADHD group showed lower score than the TD group on fine motor control and manual coordination, (c) both the ASD and ADHD groups demonstrated lower score than the TD group on body coordination, (d) the ASD group had lower score than the ADHD group on manual coordination, and (e) both the ASD and ADHD groups obtained a significantly lower score than the control on the Stroop Color-Word task. Conclusion: The current study highlights the motor proficiency and executive function observed in children with ASD and ADHD are worse than those without a disability. Supported by Taiwan MOST grant 103-2410-H-017-026-MY3.

Accelerometry has become widely used to determine energy expenditure (EE) and daily physical activity patterns in a variety of able-bodied populations. The reliability and validity of this device has been well documented in the able-bodied population, however the assumption has been made that the prediction equations used are appropriate for use in those with locomotor dysfunction (LD). Purpose The purpose of this study was two fold: 1) to examine the validity of the able-bodied prediction equations in a heterogeneous group of individuals with LD and 2) determine the effectiveness of using clinical measures of locomotor function to improve the prediction of EE in this population. Methods Actical™ accelerometers were placed bilaterally on the wrists and ankles of 90 individuals (18 to 91 yrs). Diagnoses included stroke, MS, brain injury, arthritis, congenital anomalies, and other locomotor dysfunction. The Actical™ Mobile metabolic system was used to collect and determine actual EE (AEE). Baseline AEE was determined with the participants supine for 5 min, followed by 5 min of quiet standing, 5 min of a sweeping/vacuuming task, 5 min walking at a self-determined comfortable pace and completing a 6 minute walk test (6MWT). The Timed Up and Go (TUG), 10 Meter Walk (10W), 30-second Chair Stand (30CS), and 4 stage standing balance (4SB) were used as a determinants of balance. Results The AEE was found to be significantly higher than the PEE (p < 0.05) at both the wrist and ankle. The correlations between AEE and the 4 Actical™ sites were poor and not significant. The activity counts (AC) at the bilateral wrist and ankle sites were poorly correlated. Backwards regression, produced an R² = 0.718 and used the variables of gender, weight, age, 30CS, 4SB, the fast 10mW, and fast 10mW – slow 10mW. Conclusion We found the AEE was consistently under predicted in people with LD. In contrast to the able-bodied there is no correlation between measures of EE and AC regardless of the measurement site. This study demonstrates that with the addition of a few clinical indicators of locomotor function it is possible to improve the prediction of EE in individuals with LD.

Children with intellectual disabilities (ID) are less active than typically developing peers and rely on others for physical activity (PA) support. School is an important environment for PA accrual, but there is little other orthopedic/neurocortical conditions. An Oxycon Mobile metabolic system was used to collect and determine actual EE (AEE). Baseline AEE was determined with the participants supine for 5 min, followed by 5 min of quiet standing, 5 min of a sweeping/vacuuming task, 5 min walking at a self-determined comfortable pace and completing a 6 minute walk test (6MWT). The Timed Up and Go (TUG), 10 Meter Walk (10W), 30-second Chair Stand (30CS), and 4 stage standing balance (4SB) were used as a determinants of balance. Results The AEE was found to be significantly higher than the PEE (p < 0.05) at both the wrist and ankle. The correlations between AEE and the 4 Actical™ sites were poor and not significant. The activity counts (AC) at the bilateral wrist and ankle sites were poorly correlated. Backwards regression, produced an R² = 0.718 and used the variables of gender, weight, age, 30CS, 4SB, the fast 10mW, and fast 10mW – slow 10mW. Conclusion We found the AEE was consistently under predicted in people with LD. In contrast to the able-bodied there is no correlation between measures of EE and AC regardless of the measurement site. This study demonstrates that with the addition of a few clinical indicators of locomotor function it is possible to improve the prediction of EE in individuals with LD.
Few studies reported reliability of step counts measured by activity monitors, low walking speed and differences of attachment side such as affected side (A/S) or unaffected side (U/S) for stroke survivors influence it. However, the conditions of that are yet unclear for the patients with abnormal gait. PURPOSE: To investigate the devices and conditions under which reliable step count measurements can be obtained in patients with abnormal gait using several activity monitors. METHODS: The subjects were 32 hospitalized patients (12 patients with femoral fracture; 8 patients with spondylolepaties; 5 patients with cerebrovascular disease; 7 patients with other conditions). Four types of activity monitors were used: monitors with triaxial accelerometers, biaxial accelerometers, uniaxial accelerometers, and spring-levered pedometers. Measurements were performed by attaching an activity monitor to the left and right sides (A/S, U/S) and then having a patient walk 25 m at their normal speed. This task was performed 4 times using all the activity monitors. For statistical analysis, the dependent variables were 2 groups with measurement error [(activity monitor count - actual step count) / (actual step count × 100)] ≥ 3% (Japanese Industrial Standards of pedometer) as the dividing line and the independent variable was walking speed. The cut-off velocity (COV) and area under the curve (AUC) was determined from receiver operating characteristic (ROC) curves for each activity monitor attachment side. RESULTS: The mean walking speed was 0.78 ± 0.29 m/s. Based on the ROC curve results for the monitors with triaxial accelerometers (U/S; COV: 0.96 m/s, AUC: 0.99, p<.001); A/S; COV: 0.99 m/s, AUC: 0.98, p<.01); biaxial accelerometers (U/S; COV: 1.04 m/s, AUC: 0.81, p<.05); A/S; COV: 0.97 m/s, AUC: 0.80, p<.01); and spring-levered pedometers (A/S; COV: 1.00 m/s, AUC: 0.80, p<.05), it was easier to obtain a measurement error of less than 3% at a higher COV. Significant results were not obtained for the other combinations. CONCLUSIONS: This study suggests that the condition is walking speed higher than 0.9 to 1.0 m/s for measurement of step count of patients with abnormal gait. In addition, the better devices are triaxial and biaxial accelerometers. Spring-levered pedometers are also reliable, but only affected side.

Asthma and chronic obstructive pulmonary disease (COPD) are prevalent conditions that affect 1 in 2 and 1 in 6 Canadians, respectively. Asthma-COPD overlap syndrome (ACOS) has been shown to affect 15-20% of those with COPD. However, little is known of sedentary time in any of these groups. Given the health consequences of sedentary time, reduction interventions may be an important avenue for improving health among those with chronic obstructive pulmonary disease. PURPOSE: To investigate the devices and conditions under which reliable step count measurements can be obtained in patients with abnormal gait using several activity monitors. METHODS: The subjects were 32 hospitalized patients (12 patients with femoral fracture; 8 patients with spondylolepaties; 5 patients with cerebrovascular disease; 7 patients with other conditions). Four types of activity monitors were used: monitors with triaxial accelerometers, biaxial accelerometers, uniaxial accelerometers, and spring-levered pedometers. Measurements were performed by attaching an activity monitor to the left and right sides (A/S, U/S) and then having a patient walk 25 m at their normal speed. This task was performed 4 times using all the activity monitors. For statistical analysis, the dependent variables were 2 groups with measurement error [(activity monitor count - actual step count) / (actual step count × 100)] ≥ 3% (Japanese Industrial Standards of pedometer) as the dividing line and the independent variable was walking speed. The cut-off velocity (COV) and area under the curve (AUC) was determined from receiver operating characteristic (ROC) curves for each activity monitor attachment side. RESULTS: The mean walking speed was 0.78 ± 0.29 m/s. Based on the ROC curve results for the monitors with triaxial accelerometers (U/S; COV: 0.96 m/s, AUC: 0.99, p<.001); A/S; COV: 0.99 m/s, AUC: 0.98, p<.01); biaxial accelerometers (U/S; COV: 1.04 m/s, AUC: 0.81, p<.05); A/S; COV: 0.97 m/s, AUC: 0.80, p<.01); and spring-levered pedometers (A/S; COV: 1.00 m/s, AUC: 0.80, p<.05), it was easier to obtain a measurement error of less than 3% at a higher COV. Significant results were not obtained for the other combinations. CONCLUSIONS: This study suggests that the condition is walking speed higher than 0.9 to 1.0 m/s for measurement of step count of patients with abnormal gait. In addition, the better devices are triaxial and biaxial accelerometers. Spring-levered pedometers are also reliable, but only affected side.

The effects of physical activity on bone formation remain unclear. Herein, we compared running and jumping exercise and their effects on osteogenesis. Methods: Fifty female Wistar rats, 6 weeks-old, were divided into a control group (S) and 4 exercise groups: treadmill training (T), 3 Free-Fall (F) groups, rats dropped from height of 30cm (F30), 45cm (F45) and 60cm (F60), 5 days/week, for 8 weeks. We evaluated: BMD (by DXA), trabecular bone of the femur and vertebrae and cortical bone architecture of the femur (by μCT), mechanical strength of the femur (bending test), osteocalcin and NTX levels (by ELISA). Results: After 8 weeks, whole body BMD was significantly higher from baseline in all 4 exercise groups, with no difference between groups (p<0.04). Left femur BMC and BMD significantly increased in F45 and F60 groups compared to S and T groups (p<0.03). In the exercise groups, BV/TV, Tb.Th, Tb.N and Tb.Pf were significantly higher at W8 in the F45 and F60 compared to S, F30 and T groups (p<0.04). Biomechanical properties were modified only in the F30 and F45 groups. CSA of the left femur was significantly higher for F30 compared to S and F60 (p<0.05) while moment of inertia, yield point stress and Youngs modulus were significantly higher for F45 compared to S and F60 (p<0.03). Bone alkaline phosphatase (ALP) levels were higher in all three F groups compared to the control group (p<0.03). Osteocalcin was significantly increased in F45 compared to the other groups (p<0.02). NTX level was significantly decreased in F45 group compared to S and T groups (p<0.03). Conclusion: These data show free fall exercise exerts significant positive effects on bone formation marker and strength compared to running. Free fall from 45cm produced the highest benefit on osteogenic biomarkers.

Clinical studies indicate that taking ibuprofen before exercise prevents the expected increase in bone mineral density in women. However, it is unknown whether this translates to an attenuation of bone strength and structural adaptations to training. PURPOSE: To determine whether taking ibuprofen before exercise prevents changes in bone strength and structure due to treadmill running. METHODS: Adult female Wistar rats (n=43) were individually housed in metabolic caging designed to promote physical inactivity. Rats were randomized to Ibuprofen (IBU) or Vehicle (VEH) and Running (RUN) or Sedentary (SED) groups in a 2x2 (drug, activity) design. Ibuprofen drops (30 mg/kg BW) or vehicle (volume equivalent) were administered orally 1 hour before treadmill running or at a similar clock time. Treadmill exercise occurred 5 days/week for 60 min/day at 20 m/min with a 5° incline for 12 weeks. MicroCT, mechanical testing, and finite element modeling were used to quantify bone characteristics. ANCOVAs were covaried on body weight, and data are reported as mean±SE. RESULTS: There was a nonsignificant drug*activity interaction for tibia failure load (p=0.08), where VEH-RUN had the highest bone strength. Other interactions were not
Significant (all p<0.14). Exercise increased tibia cortical cross-sectional area (RUN: 5.67±0.10; SSD: 5.37±0.10 mm2, p<0.01) and micro-CT based estimates of the bending resistance (Imax) and torsional strength (I-POM) of the tibia (Imax: RUN: 5.16±0.18; SSD: 4.70±0.18 mm4, p<0.01; SeeModPolar: RUN: 4.01±0.11; SSD: 3.74±0.10 mm4, p<0.01). RUN had increased failure load (RUN: 243.9±9; SSD: 223±14 N, p<0.01) and decreased distortion in response to a standardized load (200 N) (Ven Mises Stress at Tibia-Tibiala Junction: RUN: 48.2±1.3; SSD: 51.7±1.2 MPa, p<0.01), but there was no effect of ibuprofen. These results revealed similar trends. CONCLUSIONS: Ours data do not support the hypothesis that taking ibuprofen before exercise prevents the skeletal benefits of exercise. However, an exercise paradigm that engenders higher bone strains may be required to detect an effect of ibuprofen.

1801 Board #3
June 2, 1:00 PM - 3:00 PM
Unique Effects of Energy versus Estrogen Deficiency on Components of Bone Strength in Exercising Women
Emily Southmayd, Rebecca Mallinson, Nancy Williams, FACSM, Mary Jane De Souza, FACSM. Penn State University, University Park, PA. Email: emily.southmayd@gmail.com
(No relationships reported)

Exercising women with menstrual disturbances are at risk for poor bone health due to hypogonadism. Energy deficiency often instigates menstrual dysfunction resulting in metabolic adaptations that independently threaten bone. Women experiencing both an energy and estrogen deficiency have an exacerbated risk to bone health. PURPOSE: To describe volumetric bone mineral density (vBMD), bone geometry, and estimated an energy and estrogen deficiency face an exacerbated risk to bone health. Menstrual status, both past and current, has been established as an important determinant of bone mineral density (BMD) in young exercising women. However, it is discussed whether it is possible to induce improvements in bone mass after peak bone mass, especially after menopause. PURPOSE: To investigate the osteogenic impact of high-intensity, multimodal training in postmenopausal women (I-PREM) compared to premenopausal women (I-PRE). Methods: 49 healthy, sedentary women differed in muscular strength: n = 6; 23.2±1.7 y, 165.7±0.9 cm, 59.3±10.1 kg) and micro-CT based estimates of the femoral neck (FN). The 23.7±3.3% vs. -3.3±3.2% HS). Plasma OC was increased more (0.005<P=0.005) in I-PREM than in I-POM in PF (total R 0.81±1.6% vs. -1.01±1.1%; total L 0.71±1.6% vs. -0.51±1.1%; shift L 0.81±2.1% vs. -0.81±1.6%; shift L 1.11±1.9% vs. -0.31±1.0%; trochanter R 1.22±2.4% vs. -1.1±2.0%; trochanter L 0.83±3.4% vs. -0.31±1.9% and in LS (1.1±4.9±1.9% vs. -1.2±2.8%; 1.2±1.5% vs. -1.3±3.3%; Plasma OC increased was more (0.005<P=0.005) in I-PREM than in I-POM after 3 weeks (11.7±20.5% vs. -9.3±19.4%), 12 weeks (23.7±17.6% vs. -15.1±29.0%) and post-intervention (18.0±25.9% vs. -14.8±28.6%), but plasma P1NP and CTX-1 did not differ between the groups. The change scores in BMD, plasma OC, P1NP and CTX-1 did not differ between I-PREM and I-POM. CONCLUSION: The osteogenic effect of 19 weeks training was higher in postmenopausal than in premenopausal women. This exercise intervention is possible to improve bone mass after menopause and counteract the age-related reduction in BMD.

1802 Board #4
June 2, 1:00 PM - 3:00 PM
Cumulative Menstrual Status is an Important Determinant of Femoral Neck Geometry in Exercising Women
Rebecca J. Mallinson1, Nancy I. Williams, FACSM1, Jenna C. Gibbs2, Karsten Koehler3, Heather C.M. Allaway1, Emily A. Southmayd1, Mary Jane De Souza, FACSM. 1Penn State University, University Park, PA. 2University of Waterloo, Waterloo, ON, Canada. 3University of Nebraska, Lincoln, NE. Email: mallinsonr@gmail.com
(No relationships reported)

Menstrual status, both past and current, has been established as an important determinant of bone mineral density (BMD) in young exercising women. However, little is known about the association between the cumulative effect of menstrual status and bone geometry and strength. Purpose: To explore the association between cumulative menstrual status and estimated femoral neck (FN) geometry and strength assessed using dual-energy x-ray absorptiometry (DXA) in exercising women. Methods: 95 exercising women (22.2±4.0 y, BMI 21.1±0.2 kg/m2) participated in this cross-sectional study. Women were divided into three groups: 1) current and past regular menstrual cycles (C<P-IR, n=23), 2) current and past irregular menstrual cycles (C<P-IR, n=15), and 3) current or past irregular cycles (C<P-IR, n=21). Estimates of FN geometry and strength were obtained from hip strength analysis. Cross-sectional moment of inertia (CSMI), cross-sectional area (CSA), and strength index (SI) were calculated at the FN. Low CSMI, CSA, and SI were operationally defined as values below the median. Chi-square tests and multivariable logistic regression were performed to compare the prevalence and determine the odds, respectively, of low CSMI, CSA, and SI among groups. Results: The groups did not differ in weight, height, BMI, or body composition (p>0.05); however, the C<P-IR group was younger than the C<P-R group (p=0.023). Cumulative menstrual status was a significant predictor of low FN CSMI and low FN CSA after controlling for confounding variables. When compared with the C<P-R group, the odds of C<P-IR women having low FN CSMI and low CSA were 7.3 times greater (95% CI: 1.6-34.9, p=0.011) and the odds of C<P-R women having low FN CSA were 4.5 times greater (95% CI: 1.1-19.8, p=0.039). Chi square analysis revealed no significant association between menstrual group and low FN CSMI, CSA, or SI (p>0.05). Conclusion: In exercising women, the cumulative effect of current and past menstrual irregularity appears to be an important predictor of smaller estimates of FN geometry, which may serve as another means, beyond BMD, by which menstrual irregularity compromises bone strength. These findings support the recommendation that current and past menstrual status should be evaluated in female athletes when assessing bone health. Supported by US DoD (PR054531).

1803 Board #5
June 2, 1:00 PM - 3:00 PM
The Osteogenic Response was Higher in Postmenopausal than in Premenopausal Women Following The Same Exercise Intervention
Eva W. Helge1, Michael T. Lund2, Mogens T. Pedersen1, Sofie G. Didriksen1, Carina V. Ablidtskov1, Simon Esrup2, Maritus Bendtsen1, Anders O. Madsen1, Anette Bundgaard1, Niklas R. Jørgensen1, 1University of Copenhagen, Copenhagen N, Denmark. 2Research Center for Ageing and Osteoporosis, Glostrup, Denmark. Email: ewhelge@nexx.ku.dk
(No relationships reported)

Bone loading exercise is an important osteogenic stimulus, and multimodal exercise regimens associated with high bone strains are suggested to improve bone mass. However, it is discussed whether it is possible to induce improvements in bone mass after peak bone mass, especially after menopause. PURPOSE: To investigate the osteogenic impact of high-intensity, multimodal training in postmenopausal women (I-PREM) compared to premenopausal women (I-PRE) and two matched control groups (C-POM and C-PREM). METHODS: The supervised intervention lasted 19 weeks, 3 x 30 min weekly. The varied training was of high musculoskeletal intensity aimed to elicit large and powerful forces on the skeleton. 49 healthy, sedentary women participated: I-POM (n=21; 57.1±4.8 yrs; 64.5±1.8 kg), C-POM (n=12; 57.9±3.9 yrs; 63.9±1.0 kg), I-PREM (n=9; 43.6±4.7 yrs, 76.5±1.5 kg), and C-PREM (n=7; 42.9±5.9 yrs; 66.0±12.3 kg). DXA-derived bone mineral density (BMD, g/cm²) in right (R) and left (L) proximal femur (PF) and lumbar spine (LS), plasma osteocalcin (OC, µg/L), procollagen type 1-amino-terminal propeptide (P1NP, µg/mL) and C-terminal telopeptide of type 1 collagen (CTX-1, µg/L) were measured at baseline and post-intervention. Plasma P1NP and CTX-1 were also measured after 3 and 12 weeks. RESULTS: Post-intervention BMD was increased more (0.001<P=0.005) in I-POM than in C-POM in PF (total R 0.81±1.6% vs. -1.01±1.1%; total L 0.71±1.6% vs. -0.51±1.1%; shift L 0.81±2.1% vs. -0.81±1.6%; shift L 1.11±1.9% vs. -0.31±1.0%; trochanter R 1.22±2.4% vs. -1.1±2.0%; trochanter L 0.83±3.4% vs. -0.31±1.9%) and in LS (1.1±4.9±1.9% vs. -1.2±2.8%; 1.2±1.5% vs. -1.3±3.3%; Plasma OC increased was more (0.005<P=0.005) in I-PREM than in C-PREM after 3 weeks (11.7±20.5% vs. -9.3±19.4%), 12 weeks (23.7±17.6% vs. -15.1±29.0%) and post-intervention (18.0±25.9% vs. -14.8±28.6%), but plasma P1NP and CTX-1 did not differ between the groups. The change scores in BMD, plasma OC, P1NP and CTX-1 did not differ between I-PREM and C-PREM. CONCLUSION: The osteogenic effect of 19 weeks training was higher in postmenopausal than in premenopausal women following the same multimodal high-intensity exercise intervention. It was possible to improve bone mass after menopause and counteract the age-related reduction in BMD.
higher strength (n = 6; 22.8 ± 2.0 y; 164.6 ± 4.8 cm, 72.7 ± 12.2 kg) groups on the basis of their isometric MVC values (lower strength women MVC = 98.0 ± 20.6 Nm, higher strength women MVC = 169.2 ± 27.5 Nm). An accelerometer (EGAS S704 10, Rev C) was placed over the vastus lateralis to detect the MMG signal. The amplitude of the MMG signal was expressed as root mean square (RMS), while frequency data were expressed as mean power frequency (MPF). Torque (Nm) was recorded by the dynamometer.

RESULTS: Polynomial regression analyses indicated that the relationships for MMG amplitude versus isometric MVC were quadratic for both the lower strength (R² = 0.987) and higher strength (R² = 0.964) women. However, for the lower strength women, MMG amplitude increased most between 60 and 100% isometric MVC, whereas for the higher strength women, MMG amplitude increased most between 10 and 60% MVC; then began to plateau. For MMG MPF, the relationships were cubic for the lower strength women (R² = 0.861) and linear for the higher strength women (R² = 0.902).

CONCLUSIONS: The different torque-related responses for MMG amplitude and MPF may reflect differences in the motor control strategies that modulate torque production for lower vs. higher strength women. These results also suggest that isometric torque production is controlled by a combination of recruitment and firing rate, but that the reliance on each mechanism differed throughout the entire range of torque production between lower strength and higher strength women. Lastly, the torque-related patterns for MMG amplitude and frequency may also have been affected by differences in absolute torque, and thus muscle stiffness, between the lower strength and higher strength women.

Older adults are often more fatigable than young adults during high-velocity concentric contractions. This age-related difference in fatigability, however, has been studied primarily in men, and the contribution of supraspinal mechanisms are unknown.

PURPOSE: The purpose of this study was to quantify the changes in voluntary activation and contractile properties of the knee extensors in response to high-velocity dynamic contractions in 12 young (22.5 ± 0.6 [SE] y) and 18 old women (71.7 ± 1.5 y).

METHODS: Subjects performed 80 maximal voluntary concentric contractions (1 every 3 s) with a load set at 20% of the maximal voluntary isometric contraction (MVC). Transcranial magnetic stimulation (TMS) and peripheral nerve stimulation (1 every 3 s) were used to measure voluntary activation and the contractile properties, respectively, and immediately (i = 0 s) following the fatiguing task. RESULTS: Old women generated 55% less power (P < 0.01) and 43% lower isometric MVC torque (P < 0.01) than the young women. At the end of the fatiguing task, power was reduced by 35 ± 4.7% in the old compared to 20 ± 3.7% in the young (P = 0.02). The reduction in MVC torque, however, was similar for the old and young (25 ± 2.5% vs 22 ± 1.6%, respectively, P = 0.28). Voluntary activation was similar between the old and young (97 ± 0.7% vs 97 ± 0.6%, respectively, P = 0.90) before fatigue, but was reduced only in the old after the fatiguing task by 3 ± 1% (P = 0.04). Potentiated twitch amplitude was reduced by 30 ± 4.7% in the old compared with 13 ± 5.4% in the young (P = 0.02). Similarly, twitch half-relaxation times increased more in the old compared with the young women (72 ± 12.8% vs 32 ± 9.4%, respectively, P = 0.02). CONCLUSIONS: Both a loss in voluntary activation from supraspinal centers and fatigue within the muscle are responsible for the greater loss in power during high-velocity dynamic contractions in old compared with young women. However, the large age-related reductions in the contractile properties indicate that muscular mechanisms are primarily responsible for the greater loss in power during knee extension in the old compared with the young women.

Supported by NIA (R21 AG045766) to SK Hunter.

Anterior cruciate ligament (ACL) injuries are one of the most common injuries that occur in competitive sports, affecting female athletes two to ten times more than males. While previous studies have correlated ACL volume with injury retrospectively, little information is available on how the ACL volume changes during periods of intense physical activity.

PURPOSE: To characterize the volumetric changes that occur in the ACLs of female soccer athletes over the course of a competitive season.

METHODS: A sample of 16 Division I female collegiate soccer players were recruited for participation in this study. To be included in the study, subjects must have been members of the Quinnipiac University women’s soccer team without previous history of ACL injury. All subjects underwent MRI scans of both knees, prior to the start and at the completion of the competitive season. Contours of the ACL were manually drawn, and sagittal MR images and volumes were calculated. Mean volume comparisons were made using a paired t-test. ACLs were graded for the presence of edema by an orthopedic surgeon. Changes in the occurrence of edema were evaluated using the McNemar test.

RESULTS: Twenty-three of the 32 ACLs (72%) showed a greater volume postseason compared to preseason. The mean difference in volume was statistically significant (preseason 1.43 ± 0.29 cc; postseason 1.56 ± 0.27 cc; P = 0.006). The presence of edema was noted in 33% of the ACLs at preseason versus 47% at postseason, however this increase was nonsignificant (p = 0.17).

CONCLUSIONS: The intense physical demand of a competitive soccer season in female collegiate athletes appears to cause an increase in volume of the ACL which may be associated with edema of the ligament. The clinical significance of this finding requires further research.

Obese children may find it difficult to perform physical activity for a variety of reasons, including low cardiorespiratory fitness, decreased strength and increased joint moments but the relationships among these variables have not been previously investigated. PURPOSE: To explore the effect of including measures of cardiorespiratory fitness, adiposity and muscular strength in predicting gait biomechanics in obese children.

METHODS: Twenty nine children, 14 girls and 15 boys, mean age 9.8±0.9 years, mean BMI 27.06±3.2 kg/m2 and mean BMI percentile 96.1±4.1, were recruited from University of Iowa Obesity Clinics. The 15 m Progressive Aerobic Cardiovascular Endurance Run (PACER) protocol was used to estimate cardiorespiratory fitness (VO2max). Adiposity measured as percent body fat, was estimated by air displacement plethysmography (Bod Pod). Right lower limb isometric strength was assessed using a custom leg press device. Intra-red emitting markers were applied to lower limbs, pelvis, and trunk segments to generate subject specific biomechanical anatomical models of walking gait on an 8 m walkway using a 3D motion analysis system (Optotak, Kistler). Peak hip and knee moments normalized to body weight for the right side were analyzed for five walking gait cycles. Step wise regression model included moments as dependent variable and fitness, adiposity and right lower limb strength, as the three independent variables. P-value <0.05 was considered significant. RESULTS: Mean aerobic fitness as estimated by PACER was low (34.1±6.0 ml·min⁻¹·kg⁻¹). Mean adiposity was 32.2±7.6 % body fat and mean right lower limb strength, was 7.5±4.29 N/kg. The step-wise regression model for hip and knee adductor moments included adiposity as the only predictor variable (adjusted R²=0.3 and 0.22 respectively). Knee extensor moments selected both strength and adiposity as the predictor variables (adjusted R²=0.35) whereas hip extensor moments did not include any variable. None of the step-wise models included cardiorespiratory fitness. CONCLUSION: Adiposity was the main factor in models for adduction moments, whereas adiposity and knee strength correlated with knee extensor moments. The result suggests that level of adiposity and strength may be important factors in predicting gait biomechanics in obese children.
Lower extremity joint moments during gait are higher among obese individuals compared to non-obese individuals. However, because obese individuals also exhibit greater lower extremity strength, it is unclear if these joint moments are higher relative to available strength. **PURPOSE:** To investigate the effects of obesity on lower extremity joint moments during gait, expressed relative to available strength. **METHODS:** Participants included 19 obese (body mass index, or BMI ≥30 kg/m²) and 20 normal-weight (19 kg/m² ≤BMI ≤25 kg/m²) adults. Sagittal plane, lower extremity joint moments were determined during gait at a self-selected speed using an inverse dynamics analysis. Maximum voluntary isometric capacity (MVIC) was measured at the knee, ankle, and hip in flexion and extension. Joint moments were normalized to MVICs, and compared between groups using a two-way ANCOVA with gait speed and leisure-time activity level as covariates. **RESULTS:** Obese participants used 2% higher normalized knee extensor moments during weight acceptance (p<0.05), and 55% higher normalized ankle plantar flexor moments during push off (p<0.05). No other differences in normalized joint moments were found between obesity groups. **CONCLUSIONS:** The higher joint moments at the knee and ankle relative to available strength could help explain gait limitations present among obese individuals.

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**1810 June 2, 1:30 PM - 1:45 PM**  
**The Effect of Added Weight on Foot Anthropometry in Pregnant Women and Controls**  
Jean L. McCrory, FACSM¹, Kathryn D. Harrison², Corrie A. Mancinelli¹, Petra Meszaros¹, Krystal Thomas¹.  
West Virginia University, Morgantown, WV; Virginia Commonwealth University, Richmond, VA.  
Email: jmccrory@hsc.wvu.edu  
(No relationships reported)

Foot anthropometry is altered by pregnancy, but it is not known if these changes are due to increased weight or hormonal effects of pregnancy on the body. **PURPOSE:** The purpose of this study was to examine the effect of added weight on foot anthropometry in pregnant women and never-pregnant controls. **METHODS:** Fifteen primigravid women and 13 nulliparous controls participated. Controls were matched to the pregnant women based on the pregnant women’s self-reported pre-pregnancy weight. Informed consent was obtained. Data were collected on the pregnant subjects in each trimester and post-partum. Foot length, foot width, arch index, arch height index, arch rigidity index, and arch drop were assessed. To determine the effect of added weight on foot anthropometry, pregnant subjects in their first two trimesters donned a weighted pack on the anterior trunk such that total weight difference from pre-pregnancy weight was 124N, which was based on data from a previous study. Foot measurements were then repeated while the subjects wore this pack. Third trimester subjects did not wear a pack as they were at full-pregnancy weight. For post-partum subjects, their body weight plus the weight of the pack equalled their third trimester weight. For control subjects, their body weight plus the weight of the pack equalled the third trimester weight of the pregnant subject to whom they were matched. A MANOVA was performed with the independent variables of trimester (control, 1st, 2nd, 3rd, and post-partum) and weight condition (natural or weighted). Tukey post-hoc analyses were performed if appropriate (α=0.05). **RESULTS:** Arch drop increased by 18% (p<0.001) and arch rigidity index decreased by 1% (p=0.002) in the weighted condition compared to the natural condition. *Decreased pelvis and trunk rotation likely minimizes torque production while walking with load. Increased pelvic lateral sway with added load was significant with added load relative to BW (both p ≤ 0.001, Table 1). In the frontal plane, pelvis ROM increased significantly as load increased. There were no changes in the sagittal plane.*  
**CONCLUSIONS:** Decreased pelvis and trunk rotation likely minimizes torque production while walking with load. Increased pelvic lateral sway with added load was significant with added load relative to BW (both p ≤ 0.001, Table 1). In the frontal plane, pelvis ROM increased significantly as load increased. There were no changes in the sagittal plane.  
**Table 1. Pelvis and trunk range of motion (Mean ± SD degrees) for sagittal (X), frontal (Y) and transverse (Z) planes.**  
<table>
<thead>
<tr>
<th></th>
<th>BW</th>
<th>15 kg</th>
<th>35 kg</th>
<th>55 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk</td>
<td>4.7 ± 2.5</td>
<td>3.8 ± 0.8</td>
<td>3.8 ± 0.9</td>
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</tr>
<tr>
<td>Y</td>
<td>5.2 ± 1.0</td>
<td>5.4 ± 1.0</td>
<td>5.5 ± 2.0</td>
<td>4.8 ± 1.8</td>
</tr>
<tr>
<td>Z</td>
<td>0.3 ± 2.2</td>
<td>7.6 ± 2.1</td>
<td>*6.9 ± 2.0</td>
<td>*5.1 ± 1.6</td>
</tr>
<tr>
<td>Pelvis</td>
<td>5.7 ± 1.1</td>
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<td>8.8 ± 3.2</td>
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<tr>
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<td>*6.8 ± 2.2</td>
<td>*7.3 ± 2.2</td>
</tr>
</tbody>
</table>

**BW = bodyweight only; * sig different from BW; * sig different from 15 kg.**

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**1811 June 2, 1:45 PM - 2:00 PM**  
**Pelvis and Trunk Kinematic Changes in Response to Carrying Heavy Loads**  
Joseph F. Seay, Shane G. Sauer, Peter N. Frykman, Rebecca E. Fellin. U.S. Army Research Institute of Environmental Medicine, Natick, MA.  
Email: joseph.f.seay.civ@mail.mil  
(No relationships reported)

Low back injuries are prevalent in warfighters, and have been linked with carrying loads. Trunk mechanics change with load carriage, but trunk and pelvis motions have not been studied while carrying heavy loads. Research has studied loads up to 40% bodyweight; however, today’s warfighter can carry loads in excess of 50 kg for extended periods. **PURPOSE:** To examine the effect of carrying heavy vest-borne loads on pelvis and trunk mechanics. **METHODS:** 23 active duty male volunteers (21 ± 3 yrs; 176 ± 7 cm; 82.9 ± 12 kg) walked on a treadmill at 1.34 m/s during four conditions. The first condition was body weight only (BW), and the participants also carried vest-borne loads of 15, 35 and 55 kg. Each load was carried for 10 min (randomized order) after BW. Pelvis and trunk motion data were collected. Volunteers rested between loads for 3 min once their heart rate was <100 beats/min. Three-dimensional pelvis and trunk segment ranges of motion (ROM) were compared among loads using a 1-way RM ANOVA. **RESULTS:** Trunk and pelvis rotational ROM (transverse plane) decreased significantly with added load relative to BW (both p ≤ 0.001, Table 1). In the frontal plane, pelvis ROM increased significantly as load increased. There were no changes in the sagittal plane.  
**CONCLUSIONS:** Decreased pelvis and trunk rotation likely minimizes torque production while walking with load. Increased pelvic lateral sway with added load was necessary to maintain stride mechanics and walking speeds. These load-related changes in pelvis and trunk mechanics may provide mechanistic insight into the link between load carriage and risk of back pain. Disclaimer: authors’ views, not DoD/DA.
Effect Of Unweighting Assistance On Sit-to-stand Mechanics

Kelsey L. Piersol, George J. Davies, Bryan L. Riemann.
Armstrong State University, Savannah, GA.
Email: piersol.kelsey@gmail.com

Methods: 12 healthy adults (5 males, 26.1±8.1 years) walked 10-30 minutes and feedback was gradually removed across the 3-minute assessment session before and after retraining. Speed was maintained for the training sessions, and the pre and post assessments. The peak positive acceleration (PPA), along with the vertical impact peak (VIP) of the ground reaction force data were extracted and averaged over the 3-minute assessment session before and after retraining. Results: PPA and the VIP were both significantly reduced following the retraining (Table 1). Conclusion: These findings suggest impact loading during walking can be lowered with gait retraining, without compromising gait speed. Future studies will involve individuals experiencing knee pain related to OA.

Table 1. Peak positive acceleration and vertical impact peak before and after gait retraining

<table>
<thead>
<tr>
<th></th>
<th>Pre-training</th>
<th>Post-training</th>
<th>Cohen's d</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
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<td>Peak positive acceleration (g)</td>
<td>12.00 (3.80)</td>
<td>6.14 (2.55)</td>
<td>1.73</td>
<td>0.002</td>
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<tr>
<td>Vertical impact peak (body weight)</td>
<td>1.22 (0.07)</td>
<td>1.09 (0.10)</td>
<td>0.96</td>
<td>0.022</td>
</tr>
</tbody>
</table>

Research has previously documented reduced ground reaction forces, cadences, and stride lengths when using lower body positive pressure (LBPP) treadmills. However, it remains unknown how running on LBPP treadmills alters plantar pressure distributions.

Effects of Reduced Body Weight on Plantar Pressures During Running

Brianne Borgia, Natalie Maltz, David Lee, Ralph Rozenez, James Becker. California State University, Long Beach, Long Beach, CA.

Methods: 10 healthy, recreationally active individuals (sex: 4M, 6 F; age: 21 ± 2.5 years) participated in this study. Participants ran for 10 minutes at 100% BW, 75% BW, and 50% BW at a moderate intensity (2.29 ± .33 m/s). During the last 2 minutes at each condition, plantar pressures were recorded using a wireless in-shoe system. Peak pressures under 10 specific regions of the foot were determined. For each region, differences in peak pressure between BW conditions were analyzed using repeated measures ANOVA.

Results: For all regions except the hallux, peak pressure was lower in the 50% BW condition than the 100% BW condition (all ANOVAs p < .005). Comparing 100% and 75% BW conditions, the only regions where peak pressure was different was the 2nd, 3rd, and 4th metatarsals (Figure 1). Peak pressure under the hallux was not different between any BW conditions (Figure 1). Conclusion: While removing BW reduced peak pressures, the effects were region dependent. This has implications for rehabilitation of running injuries. For example, when using a LBPP treadmill for rehabilitation in patient with stress fractures of 2nd, 3rd, or 4th metatarsal, a reduction to 75% BW may be sufficient. However, for other injuries BW may need to be reduced to 50%. Further research is required to investigate how these changes in BW may influence kinematics while running on a LBPP treadmill.
Data (Burgomaster et al. 2008; Astorino et al. 2013) demonstrate improved maximal oxygen uptake (VO2max) after 6 and 12 wk of high intensity interval training (HIIT) which enhances exercise performance and health status. A few studies (Daussin et al. 2008; MacPherson et al. 2011) document changes in cardiac output (CO) in response to HIIT in which increases in VO2max occurred, and their results are equivocal.

**PURPOSE:** To examine changes in VO2max and CO in response to various regimes of HIIT. METHODS: Fifty active men and women were randomized to control (CON, n = 24, age = 23.5 ± 4.7 yr) or one of three HIIT regimes, HIIT + sprint interval training (SIT) (n = 10, age = 22.8 ± 7.0 yr), HIIT + HIIT (n = 8, age = 21.8 ± 2.2 yr), or HIIT + periodized training (PER) (n = 8, age = 24.4 ± 6.8 yr). Training was performed 3 d/wk for 6 wk, with 10 sessions of HIIT (6–10 bouts of cycling for 60 s separated by 75 s recovery at 90–110% peak power output) completed followed by randomization to one of three regimes for the ensuing 5 wk of the study. VO2max was measured pre- and post-training during progressive exercise in VO2max pulmonary gas exchange data were obtained. Cardiac output, heart rate (HR), and stroke volume (SV) were continuously estimated using thoracic impedance (PhysioFlow Enduro). Participants maintained their habitual physical activity during the study, and prior to all assessments, they abstained from exercise for 48 h.

**RESULTS:** VO2max was unchanged in CON, yet a significant group X time interaction (p < 0.01) was demonstrated showing higher VO2max in HIIT + SIT (2.85 ± 0.47 L/min to 3.08 ± 0.34 L/min, HIIT + HIIT (2.81 ± 0.62 L/min to 3.02 ± 0.73 L/min), and HIIT + PER (2.64 ± 0.77 L/min to 2.92 ± 0.78 L/min). A significant group X time interaction (p = 0.038) was revealed for HR in that it was higher through HIIT. Stroke volume differed across time (p = 0.009) but no interaction occurred (p = 0.31). Cardiac output differed across time (p = 0.006) and a significant group X time interaction (p = 0.032) was shown. Compared to CON (20.9 ± 3.3 L/min to 20.8 ± 3.2 L/min), CO was increased in HIIT + SIT (20.9 ± 2.5 L/min to 21.4 ± 1.0 L/min), HIIT + HIIT (21.3 ± 4.0 L/min to 22.2 ± 2.7 L/min), and HIIT + PER (20.9 ± 3.7 L/min to 21.6 ± 4.4 L/min). CONCLUSIONS: Similar increases in VO2max occur in HIIT + SIT (2.85 ± 0.47 L/min to 3.08 ± 0.34 L/min, HIIT + HIIT (2.81 ± 0.62 L/min to 3.02 ± 0.73 L/min), and HIIT + PER (2.64 ± 0.77 L/min to 2.92 ± 0.78 L/min). A significant group X time interaction (p = 0.038) was revealed for HR in that it was higher through HIIT.

Despite the fact that rowers compete close to maximum capacity, the majority of training is performed at lower exercise intensities. However, high intensity interval training (HIIT) may be effective at improving aerobic capacity and muscle fatigue, though the effect of HIIT on rowing performance is not well determined. Several studies (daussin et al. 2008; macpherson et al. 2011) have examined the effect of HIIT on VO2max and pulmonary gas exchange, but little is known about the effect of HIIT on VO2max and cardiac output (CO) in response to HIIT in which increases in VO2max occurred, and their results are equivocal.}

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Accelerometer-derived metrics have become an increasing popular means of assessing the internal load, or physiological training stress endured, in soccer athletes. Heart rate (HR) monitoring is considered to be the gold standard for assessing maximal oxygen uptake (\(\dot{V}_\text{O}_2\max\)).

**METHODS:** Biceps femoris baseline contractile responses was obtained by means of tensiometryography, in which maximal displacement amplitude (DM), contraction time (TC) were measured, and velocity of contraction (Vc) was calculated after them. Afterwards the participants undertook a 45 induced fatigue soccer protocol, and a 15 minutes seated break, in which the cool vest was applied. After that tensiometryography was used again. Contractile responses were made using two-way ANOVA with repeated measures.

**RESULTS:** TC was increased in both control (CG) and cool vest group (CV), resulting on 35.76±8.78 ms to 37.14±2.18 ms, and 33.20±6.12 ms to 37.45±2.03 respectively (p<0.359). DM showed a different outcome, meanwhile CG reduced his maximal displacement, 6.52±2.27 mm to 5.88±2.12 mm, CV increased that displacement, 6.83±1.06 mm to 7.00±1.37 mm (p=0.079). Vc was calculated in millimeters per second, having as a result a better performance for CV 211.47±46.80 mm/s to 194.40±45.13 mm/s, demonstrating a 8.07% of velocity while CG contractile velocity was reduced a 12.62%, from 181.69±46.12 mm/s to 158.75±45.22 mm/s (p=0.593).

**CONCLUSION:** The cool vest jacket contributes positively to nerve conduction velocity improving contractile response when fatigued in lab conditions.

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**1821**

**June 2, 2:00 PM - 2:15 PM**

**Training Effects On A Lower Body Positive Pressure Treadmill At Different percentages of Body Weight**

David Lee, Natalie Malitz, James Becker, Joshua Cotter, Ralph Rozenc rat. **California State University, Long Beach, Long Beach, CA.**

Email: davidlee02@gmail.com

(No relationships reported)

**While training on a lower body positive pressure treadmill (LBPP) has become a tool for injury rehabilitation, these devices are now used for training in healthy individuals. While several acute studies have documented lower impact forces and differences in energy expenditure when body weight (BW) is reduced, to date there are no studies examining the longitudinal effect of training at reduced BW. PURPOSE: This study examined the physiological adaptations resulting from an 8-week training program on a LBPP treadmill at three different levels of BW. METHODS: Twenty-four healthy college aged students (age: 25.3±7 years) participated in this study. Participants performed a grade-1 exercise test (GXT) and were placed in one of three training groups: 100% BW, 75% BW, or 50% BW. Groups were balanced based upon the initial BW. One-way ANOVA was used to compare the absolute change among groups from pre-training to post-training. RESULTS: A difference in the change scores in relative \(\dot{V}_\text{O}_2\max\) was observed among the 3 training groups (F2,23 = 4.99, p = 0.017). The 100% BW group improved their relative \(\dot{V}_\text{O}_2\max\) (1.7±1.70 ml·min⁻¹·kg⁻¹) when compared to the 50% BW group \(\dot{V}_\text{O}_2\max\) (1.41±2.10 ml·min⁻¹·kg⁻¹) (p = 0.014). Relative \(\dot{V}_\text{O}_2\max\) for the 75% BW group (0.20±2.02 ml·min⁻¹·kg⁻¹) was not different than either the 100% BW group (p = 0.131) or 50% BW group (p = 0.443). No significant differences were observed for absolute \(\dot{V}_\text{O}_2\max\) (F2,23 = 2.91, p = 0.076), HRmax (F2,20 = 2.00, p = 0.164), or time of GXT (F2,22 = 2.09, p = 0.150) among the 3 groups. CONCLUSION: Based on the results, it appears that running at 50% BW results in a slight reduction of aerobic capacity compared to running at 100% BW, while running at 75% BW does not result in any significant change. In order to maintain aerobic fitness, individuals should run with ~75% or more of their BW on LBPP treadmills at moderate intensities.**

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**1822**

**June 2, 2:15 PM - 2:30 PM**

**Relating Internal and External Loads in Collegiate Men’s Soccer Players During Off-Season Training**

David P. Looney, Chris A. West, Robert A. Huggins, Andrea Fortunati, Lindsay J. DiStefano, Samantha E. Scarneo, Douglas J. Casa, FACSM. **University of Connecticut, Storrs, CT.**

(Sponsor: Douglas J. Casa, FACSM)

Email: david.looney@uconn.edu

(No relationships reported)

Heart rate (HR) monitoring is considered to be the gold standard for assessing the internal load, or physiological training stress endured, in soccer athletes. Accelerometer-derived metrics have become an increasing popular means of quantifying the physical demands of training, known as the external load, in indoor environments where GPS signals are obstructed. Although internal and external load measures have been previously related, few studies have accounted for training duration as a potential confounder. Even less is known regarding how the relationship between internal and external loads changes over long-term soccer training.

**PURPOSE:** To assess the relationship between external and internal load measures over an off-season soccer training program. **METHODS:** HR and accelerometer data collected over 40 off-season indoor sessions (session duration, 97 ± 20 min) were analyzed from 19 Division-I Men’s Soccer players (age, 20 ± 1 years; height, 180 ± 7 cm; resting HR, 49 ± 5 beats/min; max HR, 195 ± 7 beats/min). Mean HR Reserve (HRR, [Mean HR – Resting HR]×[Max HR - Resting HR]) and Mean Player Load (PL), an accumulated measure of instantaneous tri-axial accelerations, were used to quantify the average internal and external loads per session respectively. All variables were rescaled to standard scores prior to analysis. Mean HRR was subsequently regressed on mean PL, session duration (min), and time (days from baseline) using a mixed effects model with random effects for player on each explanatory variable.

**RESULTS:** Mean HRR was significantly related to mean PL (0.674 ± 0.040, p < 0.001), session duration (0.247 ± 0.025, p < 0.001), and time (0.216 ± 0.032, p < 0.001). **CONCLUSION:** The strong association between mean HRR and mean PL confirms that the relationship between these measures is not artificially induced by session duration. However, the positive association between mean HRR and session duration suggests that mean HRR may underestimate internal loads of brief, high-intensity training. The decrease in HRR over time demonstrates reduced physiological stress per given external load, possibly reflective of training-related improvements in fitness.

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**1823**

**June 2, 2:30 PM - 2:45 PM**

**Acute Effects of Different Stretching Protocols Combined with Potentiating Exercise on Flexibility and Power Performance in Males**

Hyun Chul Jung, Nan Hee Lee, Gina Ok, Soeun Jeon, Sukho Lee. **Texas A&M University-San Antonio, san antonio, TX.**

(Sponsor: Minsoo Kang, FACSM)

Email: hjung@tamusa.tamus.edu

(No relationships reported)

The importance of stretching prior to exercise and sports events has been widely accepted for preventing injuries and maximizing their exercise performance. However, there are only a few studies investigating the acute effects of different stretching protocols combined with potentiating exercise on performance.

**PURPOSE:** The purpose of this study was to examine the acute effects of different stretching protocols combined with potentiating exercise on flexibility and power in males.

**METHODS:** This study was conducted in repeated and cross-over designed. Thirteen healthy males, aged 25.4±3.46 years, voluntarily participated in this study. Participants performed jogging on the treadmill for 5 min prior to stretching session. Then, four different stretching protocols (non-stretching; NS, static stretching; SS, dynamic stretching; DS, and proprioceptive neuromuscular facilitation stretching; PNFS) specially targeted for lower limb muscles with potentiating exercise (3 sets x 5 times tuck jumps) were randomly applied at the same time of the day with 7 days interval. Straight leg raise, sit and reach, and vertical jump tests were measured at baseline, after stretching, and potentiating exercise. The percent changes of scores were calculated for all measures. Repeated measure ANOVAs were used to analyze the data, and significant level was set at p<0.05.

**RESULTS:** Jogging improved straight leg raise (F=30.971, p<0.001), sit and reach (F=30.239, p<0.001) and vertical jump (F=46.759, p<0.001) in all trials compared to baseline. After stretching session, greater improvement in straight leg raise was observed in SS (0.6%) and PNFS (11.1%) than NS (0.6%) and DS (5.0%) (F=6.941, p=0.001). However, vertical jump was significantly improved only in DS (1.8%) whereas it was reduced in NS (-2.6%), SS (-3.6%), PNFS (-4.4%) compared with previous score (F=5.947, p<.001). After potentiating exercise, greater improvement in vertical jump was observed in SS (2.2%), NS (3.2%) and PNFS (6.5%) than DS (-0.4%) compared with previous score (F=5.947, p<.001). After potentiating exercise, greater improvement in vertical jump was observed in NS (9.6%) and PNFS (11.1%) than SS (9.6%) and DS (5.0%) (F=6.914, p<0.001).
Recent research suggests that fascial tissues directly connect the skeletal muscles forming a body-wide network of myofascial chains. Both cadaveric studies and in vivo experiments yield indications for force transmission along such muscle-fascia lines. In a previous pilot trial, we demonstrated that lower limb stretching increases cervical range of motion (cROM) in the sagittal plane. However, it remains unclear (1) whether other planes are also affected and (2) if remote stretching is inferior or superior to a local treatment. PURPOSE: To study the remote effects of lower limb stretching on cROM in comparison to local stretching. METHODS: The superficial back line (myofascial chain consisting of plantar fascia, gastrocnemius, hamstrings and erector spinae) was selected in order to investigate its significance as a myofascial pathway. Fifty-four healthy subjects (38±13 yrs.) were randomly allocated to three groups. One group (G1, n=18) bilaterally performed three consecutive 30 s bouts of static stretching for both the gastrocnemius muscle and the hamstrings, respectively. Another group (G2, n=18) isometrically stretched the neck extensors for the same duration while a control group (G3, n=18) remained inactively seated. Prior (M1), immediately post (M2) and 5 min. following intervention (M3), maximal cROM was assessed in the sagittal (flexion-extension), frontal (lateral flexion) and transversal plane (rotation) using an ultrasonic 3D movement analysis system. Kruskal-Wallis tests and Sidak-Holm adjusted post hoc between-group comparisons were computed.

RESULTS: Data analysis revealed significant differences between the three disposed conditions (p < .05). In comparison to the control group, G1 (flexion-extension +4.9%, lateral flexion +6.2%, rotation +5.5%) and G2 (flexion-extension +6.5%, lateral flexion +8.8%, rotation +5.0%) increased cROM in all movement planes and at all measurements (p < .05). No differences were found between G1 and G2 at any measurement (p > .05).

CONCLUSION: Lower extremity stretching induces similar improvements in cervical range of motion as local neck stretching. Therapists might consequently consider using remote stretching exercises, in particular, if local treatments (e.g., manipulations of the cervical spine) are contraindicated.

D-20  Clinical Case Slide - Cardiovascular Issues I
Thursday, June 2, 2016, 1:00 PM - 2:40 PM
Room: 206

Chair: Aaron L. Baggs, FACSM. Massachusetts General Hospital, Boston, MA.
(No relationships reported)

Discussant: Irfan Asif. University of South Carolina, Greenville, SC.
(No relationships reported)

Discussant: Philip F. Skiba. Advocate Lutheran General Hospital, Park Ridge, IL.
(No relationships reported)

June 2, 1:00 PM - 1:20 PM
Heart Matters: A Rower Flourishes After Her Career Impacting Cardiac Diagnosis
Sharon A. Chirban1, Aaron Baggs, FACSM. 1Boston Children’s Hospital, Boston, MA. 2Massachusetts General Hospital, Boston, MA.
Email: sharon.chirban@childrens.harvard.edu
(No relationships reported)

Abstract
History: A 19 year old female NCAA Division I scholarship rower was referred to a sport psychologist 10 months after being diagnosed with catecholaminergic polymodal ventricular tachycardia (CPVT). Cardiac symptoms were stable and she had been exercising at or below prescribed threshold. She reported mood irritability and mild depression. Psychiatric Evaluation: Athlete denied symptoms of clinical depression, anxiety or any significant mental health history. She is the older of two daughters, both of whom row. She reported waves of sadness, inexplicable moments of tearfulness, fear about losing her competitive identity and transient concerns about weight gain and body transformation secondary to the adjustment to physical fitness limited to heart rate efforts at 120 or below.

Differential Diagnosis:
1. Mild Depression r/o
2. Adjustment disorder with mixed emotional features

Assessment:
1. Challenges to athletic identity
2. Assess Grief and Coping and overall adaptation
3. Assess level of acceptance of long-term implications of diagnosis
4. Provide support around team re-integration

HISTORY: A 16 year old female was found by a passer-by unconscious on the street. She was arousable and fully conscious by the time EMS arrived. She was taken to a local hospital and later transferred to a pediatric hospital for evaluation. She was discharged home the same day with instructions to follow up with cardiology. Six days later, she presented to PMD for complaints of persistent chest pain. Cardiac enzymes were mildly elevated. She returned to the pediatric hospital for re-evaluation. She was admitted with an abnormal ECG. Past medical history was notable for three episodes of sudden onset tachycardia. One episode occurred while walking down the stairs at home. The episode was sudden in onset lasting about 15 minutes with dizziness, lightheadedness and blurry vision during the episode. The other two episodes were similar but not as long.

PHYSICAL EXAMINATION:
HR: 51 BPM, BP 105/67 mmHg
CV: 1L S1, S2 no murmur, rub, gallop
Lungs: CTA
Abd: benign
DIFFERENTIAL DX:
1) Neurocardiogenic syncope
2) LQTS
3) CPVT
5) ARVD

RESULTS:
1) ECG: sinus rhythm, LAD, T-wave inversion anterior and mid-precordial leads. Flat T-waves lateral precordial leads
3) ECG (admission): monomorphic ventricular tachycardia
4) MRI: mild-mod RV dilation with mildly dec. function; thining of RV myocardium; delayed gadolinium enhancement consistent with fibrofatty infiltration

DIAGNOSIS:
1) Arrhythmogenic right ventricular cardiomyopathy
2) Ventricular tachycardia

OUTCOME:
1) RFA of RVOT VT
2) Amiodarone 200 mg daily
3) Spironolactone 25 mg daily
4) LIFEVEST-awating release of MRI compatible AICD

1830 June 2, 1:40 PM - 2:00 PM
Palpitations and Difficulty Breathing in a Collegiate Volleyball Player
Jacklyn Lindsay Quade, Amy Miller. University of Michigan Health System, Ann Arbor, MI. (Sponsor: Bob Kinningham, FACSM)
Email: lindsayquade@gmail.com
(No relationships reported)

HISTORY: A 20-year-old college volleyball player presented to an athletic medicine clinic with a complaint of difficulty breathing. This was often accompanied by palpitations, and it was unclear which happened first. Her symptoms seemed to consistently occur during shuttle runs. She used an inhaler in high school for exercise-
related breathing issues, but felt as though her symptoms had been progressively worsening over the past 6 months. There was no history of syncope, chest pain, or recent illness. Her mother passed away at a young age from an unknown etiology.

PHYSICAL EXAMINATION: Examination revealed a well-appearing adult female. Her neck exam did not reveal thyromegaly. On cardiac exam, her blood pressure was low normal at 93/62 and her heart rate was bradycardic at 55 but regular. No murmur was auscultated. On lung exam, her work of breathing was non-labored and she had clear breath sounds bilaterally, without rales or wheezes. Her extremities were warm and without edema.

DIFFERENTIAL DIAGNOSIS:
1. Symptomatic palpitations/PVCs
2. Exercise-induced asthma/bronchospasm
3. Cardiac arrhythmia or structural abnormality
4. Hyperthyroidism

TEST AND RESULTS:

EKG:
- sinus bradycardia (ventricular rate of 49) with PACs with aberrant conduction
- normal PR, QRS, and QTc intervals, normal axis

Labs:
- TSH normal
- CBC normal

48 hour Holter monitor:
- intermittent episodes of atrial fibrillation and atrial flutter
- very frequent multifocal PVC’s with episodes of couplets, triplets, bigeminy and runs of ventricular tachycardia

FINAL/WORKING DIAGNOSIS:
ARVC (Arrhythmogenic Right Ventricular Cardiomyopathy)

TREATMENT AND OUTCOMES:
1. Sent to the Emergency Department and admitted to General Medicine with a consult to Cardiology Electrophysiology
2. Initiated and maintained on atoral for ventricular ectopy and atrial fibrillation/flutter
3. Diagnosis of ARVC made after completion of inpatient TTE, MRI, and additional EKGs; met 3 major criteria (Epsilion waves in V1/V2, arrhythmia LBBB superior axis, and MRI showing RV dysfunction and RV regional motion abnormalities) and 1 minor criteria (T wave inversion V1/V2)
4. Discharged with LifeVest and returned in 4 weeks for ICD placement
5. Genetic Counseling recommended
6. Restricted from future competitive athletics, with mild/light activity encouraged

FINAL DIAGNOSIS:
Severe mitral valve regurgitation likely secondary to a ruptured chordae tendinæ.

TREATMENT & OUTCOMES:
1. Withheld from all contact and noncontact exercise
2. Repeat exam at 6 weeks showed no evidence of volume overload
3. Plan for transesophageal echocardiogram
4. Referral to cardiovascular surgery for pre-operative workup and valve repair vs. replacement

HISTORY: 18 year old college freshman cross country runner presents with bilateral leg weakness/heaviness. In the past 6 years have had 10 separate incidences of bilateral leg weakness/heaviness few minutes into running. But since the symptoms always resolve after resting and the incidences are few and far in between, the patient never thought much about it. However, since starting college running, had the same symptoms on two consecutive days. During the episode, patient states he also has normal breathing, but can’t seem to “utilize the oxygen”. Denies any chest pain but just a twinge in his upper chest. No past medical history, no surgical history, not on any medications, no allergies. Family history of father and paternal grandfather with A-fib.

PHYSICAL EXAM:
VSS
Gen: Well appearing, NAD
HEENT: NC/AT, EOMI
Resp: CTABL, no w/r/r
GI: BS+, no HSM
Neuro: CN 2-12 intact, sensation intact, 5/5 strength bilaterally to upper and lower extremity
Skin: intact, no rashes or signs of infection

DIFFERENTIAL DIAGNOSIS:
1. Over training
2. Iron deficiency
3. Anemia
4. Hypothyroid

TESTS AND RESULTS:
- In office EKG: ST segment elevation, T wave inversion, increased QRS voltage, Q waves
- In the ER the same night: normal blood work with 3 sets of negative troponins
- In office Echo in cardiology office one week later: thickened ventricles consistent of HCM

FINAL/WORKING DIAGNOSIS: Hypertrophic Cardiomyopathy

TREATMENT AND OUTCOMES:
1. Restriction from sports
2. Repeat echo in 6 months to rule out athletic heart
1837  June 2, 1:20 PM - 1:40 PM  
Exertional Leg Pain In A Collegiate Basketball Player

Prakash Jayabalan1, Kristin Abbott2, Monica Rho1.
1Rehabilitation Institute of Chicago, Chicago, IL. 2Northwestern University, Evanston, IL. (Sponsor: Joel Press, FACSM)
Email: pjayabalan@ric.org
(No relationships reported)

HISTORY: 20 year-old female collegiate basketball player presented with right lower lateral leg pain. Three years previously she had a stress fracture of the right fibular head, and 12 months prior had a stress reaction of the same region. She now presented with 9-month history of pain radiating from her right lower lateral leg to the dorsum of her foot. Pain described as tightness, rated 3/10, and occurred intermittently during exertion. She denied weakness in her lower extremities, but had intermittent low back pain.

PHYSICAL EXAMINATION: No muscle bulk atrophy in the bilateral lower extremities. Strength testing - 5/5 bilateral hip flexion, knee extension, ankle dorsiflexion, eversion, plantar flexion and great toe extension. Lumbar spine exam - full ROM without pain; no pain with single leg hop and seated slump tests. Non-tender to palpation at the fibular head bilaterally. Tinel’s behind the right fibular head did elicit pain down the right lower lateral leg. Sensation was intact to light touch throughout and reflexes were 2+/ bilaterally.

DIFFERENTIAL DIAGNOSIS:
1. Common peroneal neuropathy
2. Stress reaction/fracture
3. L5 radiculitis
4. Chronic exertional compartment syndrome

TESTS AND RESULTS: Xray tib/fib normal. MRI right lower extremity: No stress fracture or reaction. MRI lumbar spine: Mild disc bulging at L4/5 and L5/S1 without stenosis.
Compartment pressure test right lower extremity: No increase in pressures post-exertion.
Electrodiagnostics right lower extremity: Nerve conduction - prolonged latency and decreased conduction velocity across fibular nerve. Needle EMG - increased insertional activity, polyphasic potentials in muscles innervated by branches of the common peroneal nerve.
Ultrasound right lower extremity with peroneal nerve block: Nerve conduction - prolonged latency and decreased conduction velocity across fibular nerve.

TREATMENT AND OUTCOMES: 1. Therapy regimen - lower extremity strengthening, back extension exercises and nerve glides with improvement in back symptoms and leg pain. 2. Compliance with further treatment is challenging and she currently is held from sports.

1838  June 2, 1:40 PM - 2:00 PM  
Lower Leg Pain- Basketball

Jenna Neufeldt, Kyle Lennon, Bryan McCarty. North Shore University Hospital, Manhasset, NY. (No relationships reported)

HISTORY: 15 year old female basketball player presented with right lower lateral leg pain that started progressively 6 hours ago while playing basketball. Prior to the game, patient had no symptoms. Denies any trauma to the leg during the game. The pain is localized to the anterior and lateral aspects of the right lower leg with only mild pain noted posteriorly. Patient stated similar pains over the past year during exercise but today pain is much more severe and not improving with rest. Also c/o numbness in his foot and is having difficulty lifting his foot.

PHYSICAL EXAM: No obvious deformities or signs of trauma. The anterior lower leg is extremely firm and tender to palpation with painful passive ROM and weakness in plantar ROM. Decreased sensation of first dorsal webspace. Palpable DP pulse. No overlying skin changes or mottling.


TESTS AND RESULTS:
xray tib/fib normal
FINAL DIAGNOSIS: Acute on chronic exertional compartment syndrome
TREATMENT AND OUTCOMES: Patient went directly to the OR for fasciotomy
Outcome pending
midshaft of the fibula. No point tenderness at the ankle. No pain to palpation over the midfoot or heel. Tibialis anterior, Achilles, peroneal and tibialis posterior tendons were normal by palpation. Dorsiflexion of the left foot intact but painful. No change in sensation of left foot.

**DIFFERENTIAL DIAGNOSIS:**
1. High ankle sprain
2. Lateral ankle sprain
3. Fibular fracture

**TESTS AND RESULTS:** Left Tib-Fib AP/lateral Xray: Midshaft Lt fibula fracture noted. Acceptable alignment. No severe shortening. Repeat Left Tib-Fib AP/Lateral Xray 6 weeks post immobilization: Fracture of the distal fibula. No change in alignment. Interval healing is noted.

**FINAL WORKING DIAGNOSIS:**
Left midshaft fibular stress fracture

**TREATMENT AND OUTCOMES:** Pt initially placed in 6 weeks of short leg walking cast immobilization with crutch-assisted touch down weight-bearing. At 2 week follow-up athlete was tolerating cast and pain improving. Vit D levels were checked at this visit and returned normal. Discussed well cushioned shoes and correction of gait abnormalities once healing complete. At 4 week visit pain had resolved and he was able to bear weight in cast without issue. At 6 weeks pt remained pain free and was transitioned to Aircast walking boot with weight bearing as tolerated. DXA scan ordered at 6 week visit to rule-out low bone density. Plan for physical therapy and gait abnormalities once out of cast and prior to returning to running.

1840  
**June 2, 2:20 PM - 2:40 PM**

**Calf Pain In A Young Runner**

Alexandra M. Rivera Vega, Melissa Learned, Guillermo Escobar, Roopa Ram. *University of Arkansas for Medical Sciences, Little Rock, AR.* (Sponsor: William F. Micheo, FACSM)  
(No relationships reported)

History: 23 year-old long distance runner with right calf pain starting 4 months after weighted calf presses. Pain was initially sharp but transitioned to achy/burning pain in the upper calf occurring with intensive exercise. Symptoms progressed and would occur when walking briskly with the development of blanching, numbness and coolness in his first 3 toes when power walking.

Physical exam: clinic exam revealed mild tenderness of right medial gastrocnemius and slightly diminished pulse when compared to contralateral foot with no leg discoloration, coolness or sensory deficits.


4. Calf strain
Results: Right ankle bimalleolar indices were normal at rest but decreased with both dorsiflexion and PF, with a great toe pressure of 0 mmHg upon PF. Of note, the left gastrocnemius had a fibrous band but no popliteal artery compression. MRI angiogram was ordered showing an anomalous course of the medial gastrocnemius with a fibrous band causing 2cm of high-grade popliteal artery stenosis which worsened with plantar flexion (PF). Post-exercise muscle edema was present suggestive of ischemic changes.

Final Diagnosis: Popliteal artery entrapment syndrome

Treatment and Outcomes: Anticoagulation was started until fibrous band excision with right popliteal thromboendarterectomy and patch angioplasty was done. Six months post-op the patient remains symptom free.
HISTORY: A 51-year-old woman presented to clinic with several year history of low back pain. No inciting event. Pain described as primarily aching in nature, localizing to right mid-low back and worse with overhead activity. Denies any numbness, tingling or weakness in L5’s. No change in bowel or bladder. Has pertinent medical history of breast cancer status post mastectomy with reconstructive breast surgery using her right latissimus dorsi. This procedure was performed 18 years ago without complications. Her exercise habits included running on a treadmill once weekly, walking frequently and nightly stretching routine. Reported mild relief with weekly deep tissue massage.

PHYSICAL EXAMINATION: Neurologic examination intact with normal strength, sensation and reflexes from L2-S1. Lumbar exam with full range of motion with flexion-extension, but reduced side-bending and rotation. She had marked levoscoliosis with forward flexion and prominent, tender paraspinal musculature on the right lower thoracic/upper lumbar region with some associated tenderness. She did not have any specific tenderness to palpation along the spinous processes. She denied pain with facet loading tests. Very poor activation of the right quadratus lumborum (QL). She had incipient scoliosis with forward flexion and prominent, tender paraspinal musculature on the right lower thoracic/upper lumbar region with some associated tenderness. She did not have any specific tenderness to palpation along the spinous processes. She denied pain with facet loading tests. Very poor activation of the right quadratus lumborum (QL). 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She denied pain with facet loading tests. Very poor activation of the right quadratus lumborum (QL). She had incipient scola

TEST AND RESULTS: MRI Lumbar Spine:
- Grade 5 anterolisthesis at L5-S1 with severe spinal stenosis at the lumbosacral junction
- CT Lumbar Spine:
- Grade 5 anterolisthesis at L5 relative to S1 with severe spinal stenosis at the lumbosacral junction

TREATMENT AND OUTCOMES:
1. Referral to Neurosurgery
2. PCP started her on gabapentin 300mg that was increased to a TID dosing for neuropathic pain.
3. Pain relief with alternating ibuprofen 400mg-800mg and Tylenol 500mg Q4 hours PRN for pain.
After the PanAm games she stopped running completely to try to allow for healing; however, pain remained. Gained no benefit from physical therapy at home. Grew 7 cm in the last year. Questionably regular menses. Resting pain a 6/10.


DIFFERENTIAL DIAGNOSIS:
1. Sacroiliitis
2. Pars fracture/spondylolysis
3. Quadratus lumborum strain
4. Referred pain from hamstring strain
5. Pelvic/sacral stress fracture in the setting of possible female athlete triad
6. Discogenic low back pain
7. Facetogenic back pain

TEST AND RESULTS:
1. Core strengthening program. Encouraged to remain as active as possible.
2. Running evaluation.
3. Gradual return to run.
4. Decided not to get HLA-B27 because diagnosis already made.
5. Started on indomethacin 75mg BID. Consideration for TNF blockers in the future.
6. Rheumatology follow-up recommended. Expected to develop characteristic findings of spondyloarthropathy as she gets older.

BACKGROUND: While concussions and repeated head impacts in football have received increased attention and scrutiny; soccer athletes are repeatedly exposed to head impacts during routine play. Limited research however, has been completed among this population, especially at the high school level. PURPOSE: A pilot investigation to evaluate the relationship between a season of soccer participation and cognitive function among male high school athletes.

METHODS: Six male high school soccer players (ages 15.8 ± 0.8yrs, height 178.0 ± 7.8cm, and weight 65.3 ± 8.6kg) were assessed prior to and following the 2015 soccer season. Participants played in 18 games and 32 practices, including 2 scrimmages, over the season. Each participant signed an Institutional Review Board approved assent form and proper parental consent forms were obtained. Participants completed a 22-item Symptom checklist, Satisfaction with Life Scale (SWLS), Brief Symptom Inventory 18 (BSI-18), King-Devick, AXON computerized cognitive task, and Head Rehab virtual reality tasks assessing Balance, Spatial Memory, and Reaction Time. Paired t-tests were calculated. Significance was noted at p < 0.05. Head Rehab composite scores showed no significant difference pre to postseason for spatial memory or reaction time. Significant improvement in balance was observed for the roll condition (p = 0.03), while no changes were observed for the stationary, pitch, or yaw conditions. CONCLUSION: This preliminary study found no significant cognitive declines following a season of high school soccer. Future research should address male and female athletes in a larger cohort where head impact exposure is directly monitored.

This research was supported by The National Institutes of Health: National Institute of Neurological Disorders and Stroke (1R15NS081691-01S1).

RESULTS: Subjects with one or more atypical validity scores reported a broader profile of post-concussive symptoms than those with fully acceptable performance (Mean = 17.8, SD = 15.7 versus Mean = 28.3, SD = 21.4, t = -2.571, p = 0.012) and had worse performance on measures of information processing (t = 2.571, p = 0.012), response accuracy (t = 5.929, p < 0.001), learning (t = 3.209, p = 0.002), and impulse control (t = 2.01, p = 0.049). Higher atypical validity scores were positively correlated with responses to two self-reported postconcussive symptom surveys (r = 0.354, p < 0.001; r = 0.235, p = 0.035) and negatively correlated with measures of response accuracy (r = 0.665, p < 0.001), learning (r = 0.501, p < 0.001), impulse control (r = -0.339, p = 0.002), and verbal memory (r = 0.275, p = 0.012). Among subjects with fully valid test scores, post-concussive symptom severity was positively correlated with two measures of anxiety symptoms (r = 0.479, p < 0.001; r = -0.433, p = 0.002), and their subjectively experienced balance problems were not significantly associated with objectively measured balance performance.

CONCLUSION: Since post-injury test performance can be affected by non-neurological factors, embedded validity checks can guide test interpretation and case formulation. Elevations on validity indices combined with elevations on
psychological measures may suggest emotional stress and identify an opportunity for early intervention to prevent an atypical course of persistent symptoms after pediatric concussion.

1851 Board #3 June 2, 2:00 PM - 3:30 PM
Eye Tracking as a Biomarker for Concussion in Pediatric Patients
Christina Lin Master1, Abdullah Bin Zahid2, Julia Lockyer2, Eileen Houseknecht1, Vikalpa Dammavalam2, Matthew Grady3, Michael Nance4, Uzma Samadani5, 1The Children’s Hospital of Philadelphia, Philadelphia, PA. 2Hennepin County Medical Center, Minneapolis, MN. 3Department of Surgery, Minneapolis VA Health Care System, Minneapolis, MN.

PURPOSE: The diagnosis of concussion remains a challenge. Eye movements tracked at a very high frequency (~500Hz) can detect oculomotor abnormalities that last only a fraction of second. We mathematically converted abnormalities in eye movements related to concussion into a model that predicts the probability of being concussed in a pediatric patient population.

METHODS: This cross-sectional case-control study examined concussed and healthy control children from a concussion referral center. Eye movements were recorded while children watched a 220 second video clip as it rotated clockwise around the periphery of a 17'' viewing monitor. The pupils’ raw coordinates were processed to obtain metrics that included measures from each eye separately and from both eyes together. Concussed patients were also evaluated clinically by measuring convergence on physical examination.

RESULTS: There were 32 age and gender matched subjects in each group (ages 4-21; mean 13; p-value for age-matching=0.979). Eye tracking data was used to build an optimal model that predicts the probability of concussion as defined by the CDC. Accurate detection as demonstrated by an area under the curve of 0.85 (sensitivity of 72% and specificity of 84%) was achieved. Clinical identification of abnormal near point of convergence on physical examination also correlated with eye tracking (AUC=0.8).

CONCLUSION: Objective measures of eye tracking correlate with convergence on physical examination in a pediatric concussion referral center population.

1852 Board #4 June 2, 2:00 PM - 3:30 PM
Descriptive Epidemiology of Pediatric and Adolescent Concussion Patients in the Primary Care Setting
Johna K. Register-Mihalik1, Mackenzie M. Herzog1, O. Josh Bloom2, Janna Fonseca3, Valerie J. De Maio4. 1University of North Carolina at Chapel Hill, Chapel Hill, NC. 2Carolina Family Practice & Sports Medicine, Cary, NC. 3UNC School of Medicine, Chapel Hill, NC. 4University of Virginia, Charlottesville, VA.

PURPOSE: This study describes the epidemiology and gender differences of young SRC patients presenting to the primary care setting.

METHODS: This was a prospective cohort presenting to 3 clinics of a large urban/suburban practice group from December 19, 2015-October 10, 2015. Included were patients 8-18 years, presenting within 3 days of a SRC, who consented to participate. certified athletic trainers completed data collection at the initial visit. Participants completed a standardized initial concussion visit, including a clinical exam, a symptom checklist, the Immediate Post-Concussion and Cognitive Test (ImPACT), and a visual-vestibular screening. T-tests and Chi-Square analyses were used to examine gender differences.

RESULTS: A total of 131 patients were included: 75 (57.3%) were male, 101 (77.1%) Caucasian, 17 (13.5%) were injured in football, 16 (12.2%) had ADHD, 7 (5.4%) had a history of a psychological disorder, and 46 (35.1%) had a prior history of head trauma. Emergency department visits preceded the clinic visit for 19 (14.5%) patients and 10 (7.6%) patients had imaging for their SRC. There were 10 (7.6%) with loss of consciousness and 16 (12.2%) with amnesia post-injury. Mean age was 14.3±2.0 years. Mean symptom severity was 27.3±21.2. Mean ImPACT composites scores for patients clinically able and within the appropriate age range (n=123) were: Visual Memory=91.6±12.4, Visual Memory=71.8±13.9. Reaction Time=1.0±0.5, and Processing Speed=33.7±1.8. Thirty-seven (28.2%) patients had abnormal near point convergence (>5cm). Females (Symptom Total=34.1, 95% CI: 27.4-40.8) reported a significantly greater symptom burden than males (Symptom Total=22.9; 95% CI: 19.2-26.7). Females also scored slightly lower on Verbal Memory (Female=78.7, 95% CI:75.3-82.0; Male=83.2, 95% CI: 80.0-86.3) and Visual Memory (Female=68.8, 95% CI: 65.2-72.4; Male=73.8, 95% CI: 70.4-77.3). No other gender differences were observed (p>0.05).

CONCLUSIONS: Clinicians face multiple presentations when evaluating SRC, and gender may drive some of this variability. Future studies should evaluate how initial presentation impacts treatment and outcomes.

Funded by the National Operating Committee on Standards for Athletic Equipment.

1853 Board #5 June 2, 2:00 PM - 3:30 PM
Effects of Sports Specialization on the Rates of Iliotibial Band Syndrome in Pediatric Athletes
Sarah S. Jackson, Dai Sugimoto, David R. Howell, William P. Meehan, III, Andrea Stracciolini, FACSM. Boston Children’s Hospital, Boston, MA. (Sponsor: Pierre D’Hemecourt, FACSM) Email: ss.jackson25@gmail.com

PURPOSE: To examine the effect of sports specialization on rates of ITB syndrome history in pediatric athletes.

METHODS: In this cross-sectional study, participants completed electronic questionnaires describing their current sport participation and previous injury history (N=549). Participants were categorized into three groups: those athletes who participated in 1, 2, or 3 sports throughout the year. The proportions of athletes with a history of ITB syndrome were compared between the three groups using a chi-square analysis.

RESULTS: 18 ITB cases were reported (mean age of athletes = 15.2±1.9 years). The mean age in which athletes reported beginning organized sport(s) participation was: 1 sport athletes: 5.5±2.3 years, 2 sport athletes: 5.7±2.5 years, and 3 sport athletes: 5.1±1.8 years. Thus, the athletes participated in organized sport(s) for approximately 10 years. A higher proportion of 1 sport athletes reported a history of ITB syndrome than 3 sport athletes (9% vs. 2%; p=0.045). No significant differences in the proportion of ITB cases were found between 1 and 2 sport athletes (p=0.294) or between 2 and 3 athletes (p=0.707).

CONCLUSION: Pediatric athletes who participate in a single sport reported a higher proportion of history of ITB syndrome when compared to multiple sport athletes. The findings of this study support the notion that training in a single sport place pediatric athletes at an increased risk for overuse injuries. Future research is needed to evaluate effect of sports specialization on other musculoskeletal injuries in pediatric athletes.

1854 Board #6 June 2, 2:00 PM - 3:30 PM
Sport Comparison of Shoulder Adaptations in 8-10 Year Old Overhead Athletes
Aaron H. Struminger1, Matthew M. Astolfi2, Charles B. Swanik3. 1University of Delaware, Newark, DE. 2Thomas Jefferson University, Philadelphia, PA. 3University of North Carolina at Chapel Hill, Chapel Hill, NC.

PURPOSE: To compare range of motion and tissue adaptations in the shoulders of swimmers, baseball players, and non-overhead athletic controls ages 8-10. METHODS: 55 youth athletes; 20 swimmers (years played=3.1±0.14), 15 baseball players (years played=4.9±1.7), and 20 non-overhead athletes participated. Glenohumeral internal (IR) and external rotation (ER) were measured with a digital inclinometer. Posterior capsule thickness (PCT) and humeral twisting (retrotorsion, HR) were examined using musculoskeletal ultrasound. All measurements were taken bilaterally. The dominant arm was defined as the arm preferred to throw a ball for maximum distance. Age and years played were identified as potential co-variates, but neither significantly affected statistical models. Therefore, 3x2 ANOVAs and Tukey post-hoc testing were used to analyze group and arm dominance differences. RESULTS: Interaction effects were observed for IR (p=0.03), ER (p=0.01), PCT (p=0.02), and HR (p>0.01). Youth baseball players exhibited a

Shoulder pain in adult, overhead athletes has been attributed to a loss of glenohumeral internal rotation. However, underlying soft tissue and bony changes that alter range of motion likely contribute to pain expression. Shoulder pain can begin as early as 8 years of age in overhead athletes, but little data exists on the adaptations that potentially occur at a young age. PURPOSE: To compare range of motion and tissue adaptations in the shoulders of swimmers, baseball players, and non-overhead athletic controls ages 8-10.

METHODS: 55 youth athletes; 20 swimmers (years played=3.1±0.14), 15 baseball players (years played=4.9±1.7), and 20 non-overhead athletes participated. Glenohumeral internal (IR) and external rotation (ER) were measured with a digital inclinometer. Posterior capsule thickness (PCT) and humeral twisting (retrotorsion, HR) were examined using musculoskeletal ultrasound. All measurements were taken bilaterally. The dominant arm was defined as the arm preferred to throw a ball for maximum distance. Age and years played were identified as potential co-variates, but neither significantly affected statistical models. Therefore, 3x2 ANOVAs and Tukey post-hoc testing were used to analyze group and arm dominance differences. RESULTS: Interaction effects were observed for IR (p=0.03), ER (p=0.01), PCT (p=0.02), and HR (p>0.01). Youth baseball players exhibited a
Four hundred and twenty female and chi-square analyses were used. Chi-squared analysis was used to compare cam replacement and management (operative vs non-operative) was extracted. Descriptive

**METHODS:**
Retrospective chart review of female athletes 10-25 years with FAI was performed. Participants (n=240) were 11.3±4.9 years old at the time of their initial visit to the sports medicine clinic. Sixty-five percent were female. Participants were divided into three groups based on their FAI type: cam (56.9%), pincer (36.5%), and mixed (6.6%). The most common FAI type was cam, followed by pincer and mixed. To examine the difference in intrinsic foot muscle strength (IFS) and standing broad jump performance across stages of maturation, participants were divided into three groups: pre-pubertal, pubertal, and post-pubertal. The sample size was 100 in each group. IFS was measured using a handheld dynamometer, and standing broad jump performance was assessed using a standardized protocol. All participants were ambulatory and had no history of foot or ankle surgery.

**RESULTS:**
IFS was found to be significantly greater in the post-pubertal group compared to the pre-pubertal group (p=0.032). No significant differences were found between the pre-pubertal and pubertal groups. Standing broad jump performance was also found to be significantly greater in the post-pubertal group compared to the pre-pubertal group (p=0.047). No significant differences were found between the pre-pubertal and pubertal groups. These findings suggest that maturation stage has a significant impact on both IFS and standing broad jump performance.

**CONCLUSIONS:**
IFS and standing broad jump performance are significantly greater in the post-pubertal group compared to the pre-pubertal group. These findings have implications for athletes training and rehabilitation programs, as they suggest that maturation stage should be considered when designing training programs. Further research is needed to explore the mechanisms underlying these differences and to determine how to optimize performance in different maturation stages.
RESULTS: Median days of rest prior to return to sport for acute injury patients (138.9, IQR = 49.0) were statistically significantly higher (p = 0.001) than for chronic injury patients (107.4, IQR = 60.8). Acute injuries successfully returned to sport at a higher rate (90.9% vs. 80.9%, p = 0.044). The percentage of patients with recurrent symptoms during care did not differ between the groups (25.2% vs. 14.9%, p = 0.128).

To date, 111 patients (40.1%) participated in the follow-up phone survey (96 acute, 15 chronic). Fifty eight (60.4%) acute group respondents reported sports participation level as “same or higher” compared to eight (53.3%) from the chronic group. Recurrence of symptoms was similar (36.5% vs. 40.0%), but a higher percentage of acute injury patients experienced symptoms requiring medical treatment rate of symptoms requiring medical treatment (21.9% vs. 13.3%). Collection of follow up data is ongoing.

CONCLUSIONS: A smaller percentage of chronic injury patients returned to sport, but those who did return had shorter recovery times than the acute group. Preliminary follow up data suggest patients treated for acute injuries have more favorable long-term outcomes more likely to recover to their pre-injury functionality.

Are Specific Aspects Of Training Associated with the Development Of Atrial Fibrillation in Older Runners and Endurance Athletes?

Martin E. Matsumura1, Yassir Khalili2, 4Geisinger Health System, Wilkes Barre, PA. 4Coordinated Health System, Allentown, PA. Email: mmatsumura@geisinger.edu

(No relationships reported)

Purpose: Accumulating data support a relationship between chronic participation in endurance sports and the occurrence of atrial fibrillation (AF). However, the specific aspects of training which are related to the development of AF are not well characterized. In the present study we assessed in a population of older athletes whether specific training habits are related to the presence of AF, and whether these relationships are independent of traditional AF risk factors.

Methods: Data regarding medical history and training characteristics were assessed for 2819 participants in the MASTERS Athletic study, a web-based survey of runners ages 35 and older. Data were stratified by those who reported a diagnosis of AF vs. those who reported no diagnosis of AF.

Results: AF was reported by 69/2819 respondents (2.4%). Runners reporting AF were significantly older (59.8yrs vs. 48.1yrs, p<0.001) and more likely to be male (85.3% vs 67.8% males, p=0.003) and report diabetes (7.3% vs. 1.3%, p<0.001) and hypertension (47.1% vs. 20.3%, p<0.001). Of specific running/training characteristics only accumulated years of running were associated with AF (X2=37.0, p=0.001); in contrast, average training pace, weekly mileage, average training days/week, the use of speedwork for conditioning, and participation in triathlons were not associated with the report of AF. In a multivariable logistic regression model chronic age (OR 1.076, 95% CI 1.041-1.113, p<0.001), hypertension (OR 1.972, 95% CI 1.029-3.779, p=0.041), and years of accumulated running (OR 1.162, 95% CI 1.002-1.348, p=0.047) remained independent predictors of AF. In contrast, male sex and diabetes did not independently predict AF.

Conclusions: In older runners accumulated years of running was the only training variable that appeared to relate to the risk of AF. Importantly, the relationships of years of running with AF appears to be independent of traditional AF risk factors and not simply related to chronic age. Physicians should consider the risk of AF in patients who long-term participants in endurance sports regardless of athlete age and traditional AF risk factors.

Energy Expenditure during Power Wheelchair Soccer

JP Barfield1, Laura Newsome1, Laurie A. Malone2, 2Radford University, Radford, VA. 1UAB/Lakeshore Foundation Research Collaborative, Birmingham, AL. (Sponsor: Hank Williford, EDAS, UAB)

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(No relationships reported)

Purpose. The purpose of this study was to determine energy expenditure during power wheelchair soccer (PWS) among persons with physical disabilities. Methods. Sixteen participants with severe physical disabilities (M_age = 33.88 ± 17.12 yrs, M_height = 22.82 ± 6.82, M_grip Strength (Right) = 7.58 ± 4.09 yrs, M_grip Strength (Left) = 11.58 ± 10.02 yrs) were recruited from multiple PWS teams. Portable metabolic carts were used to collect oxygen consumption data (expressed in METs) during the following conditions: resting (REST), practice (DRILL), and gameplay (SCRIMMAGE). A subsample of participants was assessed on a second day for reliability analysis. Results. Players sustained light-intensity exercise during both DRILL and SCRIMMAGE of the PWS conditions, approaching 2.0 METs. These intensities demonstrate a 27% ± 7% increase in energy expenditure from REST to DRILL and REST to SCRIMMAGE, respectively. These scores were stable, as demonstrated by ICC values of .88, .89, and .90 for REST, DRILL, and SCRIMMAGE, respectively. Conclusion. Although this intensity does not meet the threshold recommended to reduce chronic disease risk, the ability to demonstrate physiological strain during PWS is a meaningful outcome. Specifically, the documented energy expenditure in the current study was consistent with thresholds sufficient to enhance functional capacity and performance of daily living activities.
Evaluation Of Glenohumeral Joint Laxity In Physically Disabled Athlete

Aynur Demirel, Nevin Ergun, FACSM. Hacettepe University, Ankara, Turkey.

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(No relationships reported)

RESULTS:
The purpose of this case study was to analyze aerobic capacity during walking treadmill test and during a staircase walk following bilateral TKR surgery.

The case study patient demonstrated major improvement over time post-surgery from 8 minutes 2 months post-surgery to 5 minutes. The time it took the patient to perform four passes on a three story staircase greatly decreased 2 months, 31.2% lower 4 months, 39% lower 6 months, and 27.2% lower 12 months post-surgery. Maximum exercise oxygen consumption was 24.2% lower 23.9% lower 2 months, 37% lower 4 months, 37.8% lower 6 months, and 43.7% lower 12 months post-surgery.

PURPOSE:
The aim of this study was to evaluate the effectiveness of Tai Chi intervention in essential hypertension.

METHOD:
A systematic literature search was performed in 7 databases from their respective inceptions from January 2013 to January 2015, including: PubMed, Socolar, Elsevier, Springer Link, Wiley Online Library, CNKI and Wanfang Databases. A meta-analysis was conducted by software Rev Man 5.1 to examine the pooled effect of Yang’s Tai Chi Exercise controlling hypertension upon 789 subjects from randomized controlled clinical trial.

RESULTS:
The results of meta-analyses showed that Yang’s Tai Chi intervention could lower blood pressure and increase the concentration of nitric oxide; Subgroup analysis showed that Tai Chi group was superior to the control group in decrease of SBP [MD=8.53, 95%CI (7.02, 10.05), P=0.31], DBP [MD=3.60, 95%CI(3.41, 3.78), P=0.91] and increase concentrations of NO[MD=5.16,95%CI(1.20, 9.12), P=0.36].

CONCLUSIONS:
Tai chi exercise can increase the concentration of NO. Practicing Tai Chi for 1.5 hours per day while among 65%–85% of HRmax can significantly decrease the systolic blood pressure and diastolic blood pressure. And we will extend our research to the other branches of Tai Chi including Chen’s, Sun’s, Wu’s.
INTRO: This investigation attempted to determine the ability of the Fibronectin-Aggrecan complex (FAC) to predict response to biologic therapy with concentrated autologous alpha-2-macroglobulin (A2M) for patients with LBP from DDD.

METHODS: This study was a prospective cohort of 24 patients with low back pain and MRI positive for DDD. Outcome Measures included Oswestry disability index (ODI) and visual analog scores (VAS), noted at baseline and 3 and 6-month follow-up. Primary outcome of clinical improvement was defined as patients with both a decrease in VAS of at least 3 points and ODI >20 points. All patients underwent lavage for molecular discography, delayed FAC analysis and injection of platelet poor plasma (PPP) rich in A2M at the time of the intradiscal injection.

RESULTS: Patients with FACT-positive assays were significantly more likely to show improvement in their VAS and ODI at follow-up. Mean VAS improvement in FACT-positive patients was 4.9 ±0.9 and 4.0 ±1.0 at 3 and 6-months, compared to 1.5 ± 1.2 and 2.3 ±1.3 in those with negative FACT (p < 0.0001). ODI improved on average 37 ±9.3 and 28 ±14 points at 3 and 6-months in FACT-positive patients compared to 9.4 ±11.9 and 12.6 ±11.8 points at 3 and 6-months in FACT-negative patients (p=0.0001). Correlation analysis demonstrated that a FACT-positive test correlates with improvement in 3-month VAS (Pearson r = 0.83; p < 0.0001) and ODI (Pearson r = 0.71; p<0.0001) and 6-month VAS (Pearson r = 0.58; p<0.0001) and ODI (Pearson r = 0.53; p<0.0001). When a 20-point ODI improvement cut-off is applied, 77% of FACT+ patients and 27% of FACT-negative patients meet this strict definition of clinical improvement.

DISCUSSION: Patients who are FAC+ within the disc are more likely to demonstrate clinical improvement following intradiscal autologous A2M injection. The results of this investigation suggest that autologous A2M may be an efficacious biologic treatment in discogenic pain and that FAC may be an important biomarker in patient selection for this treatment. We utilized a definition of clinical improvement that was in excess of the minimal clinically improved difference (MCID). This study demonstrates that a PPP concentrate rich in A2M is likely to result in clinical improvement of LBP in patients who demonstrate the FAC in the suspected disc.

Fig. 1. VAS at 12 and 24 weeks

Fig. 2. ODI at 12 and 24 weeks

D-24 Free Communication/Poster - Cancer

Thursday, June 2, 2016, 1:00 PM - 6:00 PM
Room: Exhibit Hall A/B

1867 Board #19 June 2, 3:30 PM - 5:00 PM
Association Between Cardiovascular Health Metrics and Cancer Mortality in Men and Women
Yoon Jung Bae1, Yoonsun Son2, Chong Do Lee3. 1Medi Plus Solution, Seoul, Korea, Republic of. 2Arizona State University, Phoenix, AZ. (No relationships reported)

BACKGROUND: Whether cardiovascular health (CV) metrics relates to cancer mortality in US population remains less explored.

PURPOSE: We investigated the combined effects of 7 ideal cardiovascular health metrics on cancer mortality in men and women.

METHODS: We followed a total of 16,506 men and women, aged 20 to 85 years, who participated in the 1999-2010 National Health Examination Survey. All participants completed baseline lifestyle factors and lifestyle behavior questionnaires. The 7 ideal CV metrics were defined as never smoked, physically active, a healthy diet, waist girth (<102/88 cm), untreated blood pressure (<120/80 mmHg), untreated total cholesterol (<200 mg/dL), and untreated fasting glucose (<100 mg/dL) defined by the American Heart Association. We further categorized these variables as having 0, 1, 2, 3, 4, 5 to 7 combined cardiovascular health metrics.

RESULTS: During an average of 8.6 years of follow-up (141,292 person-years), there were a total of 337 cancer deaths. Men and women with 5 to 7 ideal CV metrics had a lower cancer deaths (3.1%), while men and women with 3 or less ideal CV metrics had a higher cancer deaths (10.2%).
had greater cancer deaths (89.1%). After adjustment for age, sex, race, and multiple baseline risk factors, men and women with all 5 to 7 combined ideal health metrics had a 79% (95% CI: 14% to 72%) lower risk of cancer mortality compared with men and women with zero ideal health metrics. The risks of cancer mortality across 0, 1, 2, 3, 4, and 5 to 7 ideal health metrics were (95% CI) 1.00 (referent), 0.92 (0.65, 1.31), 0.75 (0.51, 1.21), 0.57 (0.40, 0.83), 0.56 (0.32, 0.96), and 0.40 (0.18, 0.86) (p for trend <0.001), respectively. Men and women with increasing number ideal health metrics had a substantially lower risk of cancer mortality. Men and women with 5 to 7 compared with 0 combined ideal health metrics had a longer life expectancy by 11.8 years (95% CI: 1.0 to 20.5 years). Approximately 46% (95% CI: 11% to 73%) of all cancer deaths might have been avoided if men and women had adopted 5 or more combined health factors and healthy lifestyle behaviors.

CONCLUSIONS: The AHAs 7 ideal cardiovascular health metrics is associated with lower risk of cancer mortality and longer life expectancy in men and women. This study was supported by Medi Plus Solution Co., Ltd.

**RESULTS:** SED-T animals exhibited significantly lower left ventricular developed pressure values when compared to SED, WR, and WR+T (P < 0.05). This coincided with a significant increase in cardiac autophagic flux (increased LC3-II) in SED-T animals when compared to SED, WR, and WR+T (P < 0.05). Furthermore, SED-T hearts showed a significant increase in JHMC expression vs NT groups (P < 0.05). Tumor mass and volume were significantly larger (P < 0.001) in SED-T animals when compared to WR+T animals, which was accompanied by a significant increase in tumor LC3-II expression (P < 0.05).

**CONCLUSION:** Non-exercised tumor-bearing rats showed severe cardiac dysfunction and excessive, maladaptive autophagy in the heart and tumors. Voluntary exercise preserved cardiac function and attenuated the autophagic response in heart and tumor tissues. This preservation may be related to the reduced tumor growth observed in aerobically exercised rats, to the improved regulation of autophagy by exercise, or both.

**RESULTS:**: In INT, 9 of 10 patients completed the program (attendance rate 79%, 2 sessions abandoned due to hypoglycemia and weakness). One patient stopped the program after 2 sessions due to repeated nausea, vomiting and joint pain. No serious adverse events occurred. RT had significant beneficial effects on strength in INT (maximum voluntary isometric contraction of the knee extensors: from 158±61 to 169±61 Nm) compared to CO (from 165±68 to 150±36 Nm, adjusted p<0.005). No effects were found on VO2peak (INT: -0.01±0.18 l/min, CO: 0.14±0.26 l/min, adjusted p=0.488), general or physical fatigue (INT: 0.3±4.1 and 0.3±4.7, CO: 1.3±3.2 and 0.9±2.5, adjusted p=0.303 and 0.275) and QOL (INT: -5.6±16.1, CO: -8.4±17.9, adjusted p=0.763).

**CONCLUSIONS:** RT appears feasible in most but not all advanced cancer patients undergoing TKI therapy. In contrast to findings in curatively treated patients, the positive effects on strength were not associated with positive effects on fatigue and QoL. However, this should be interpreted cautiously regarding the small and heterogeneous sample and needs further evaluation.

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exercise for 1 week, b) home exercise for 1 week, and c) fitness improvement exercise for eight weeks. The fitness improvement exercise program consisted the combination of aerobic and resistance exercise for 60 minutes/session for 3 times per week. All measurements including body composition, functional assessment, depression, fatigue, and inflammatory markers (e.g., WBC count, CRP, etc.) were assessed during the preoperative period (T1), after postoperative recovery (2 weeks after surgery; T2), and after completing the PREP-GC (10 weeks after surgery; T3). Twenty additional gastric cancer patients (age-, sex-, and BMI-matched) were also recruited to compare inflammatory markers with those patients in the PREP-GC across intervention.

**Results:** Body weight (64.5 ± 11.2 vs. 59.9 ± 9.3 kg), body mass index (23.6 ± 3.0 vs. 21.9 ± 2.5 kg/m²), body fat mass (17.1 ± 1.5 vs. 13.4 ± 1.2 kg), and waist-to-hip ratio (0.87 ± 0.5 vs. 0.84 ± 0.5) were significantly reduced from T1 to T3 (p<0.05). The skeletal muscle mass was also reduced after surgery (T1 vs. T2: 26.6 ± 5.5 vs. 25.5 ± 5.3, p<0.001), but it significantly increased after the PREP-GC (T1 vs. T3: 25.5 ± 5.3 vs. 26.1 ± 5.5 kg, p<0.01). There were no statistical differences in social and functional well-being (p>0.05), but physical and emotional well-being and gastric cancer subscales were recovered or improved after the PREP-GC (all p<0.05). Depression remained unchanged, while fatigue was decreased at T3 (50.33 ± 7.0) as compared to T1 (68.00 ± 8.4) and T3 (78.00 ± 9.7) assessed by CES-D (p<0.05). There were no statistical differences in inflammatory markers between those GC patients with and without the PREP-GC.

**Conclusion:** Our results indicate that the combination of aerobic and resistance exercise was effective to improve muscle mass and physical and emotional well-being in gastric cancer patients after the gastrectomy.

**1872 Board #24**
June 2, 3:30 PM - 5:00 PM

**Pilot Study : Can Inspiratory Muscle Training Relieve Symptoms Of Dyspnoea And Improve Quality Of Life For Advanced Cancer Patients ?**

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**PURPOSE:** Dyspnoea is a common symptom of advanced cancer patients, and impacts upon physical, social and psychological wellbeing. Currently opioids are recommended for those suffering with chronic dyspnoea, despite an association with longer term health issues. Inspiratory muscle training (IMT) promotes chronic adaptations within the inspiratory musculature and has consistently been shown to reduce dyspnoea and improve lung mechanics, functional exercise capacity and quality of life in a variety of clinical populations, however this has yet to be tested in patients with cancer. METHODS: This small pilot study recruited advanced stage cancer patients (n=3) with dyspnoea from the Derby Royal Hospital, UK, who consented to an incremental IMT programme of 9 weeks (Powerbreathe classic light). Patients were given advice on breathlessness management strategies and asked to record self-set goal achievement in a diary. Functional measurements taken at baseline, and then 3 and 9 weeks post IMT included a 6 minute walk test (6MWT), spirometry and maximal inspiratory mouth pressure (MIP). Ratings of perceived exertion (Borg 6-20 scale) and modified dyspnoea score (1-10) were recorded for the 6MWT. Additionally, participants completed a St. Georges Respiratory Questionnaire (SGRQ) at all time points and contributed to a focus group at the end of the study.

**RESULTS:** We found that participants showed a significant functional improvement after 9 weeks of IMT as measured by the 6MWT; although the distance travelled did not change pre 282m +/-141; Post 303m +/-127 (p=0.05), the dyspnoea (pre 4.0/+/1.0; post 2.0/+/1.0) and perceived exertion (pre12+/+3.0; post 9.0+/+2.0) for each participant during the 6MWT was significantly reduced (p<0.05) at end of test. MIP increased in two of the participants (40% and 50%), but remained unchanged in the third participant, who had a higher than predicted baseline (MIP pre 87+/+ 26 cmH2O; post 108+/+ 10 cmH2O). During the focus group all participants asserted that this technique had helped them in their daily life and was easy to fit into their schedules. No significant results were found with the SGRQ or with the goal-setting diary.

**CONCLUSIONS:** IMT is a well-tolerated intervention for advanced cancer patients suffering from dyspnoea however a larger trial is needed and currently being planned.

**1874 Board #26**
June 2, 3:30 PM - 5:00 PM

**Leisure-time Running And All-cause Cancer Mortality**

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**PURPOSE:** We investigated the association between running and overall cancer mortality. METHODS: Participants were 52,917 adults aged 18-100 years (mean age, 44), who received a preventive medical examination during 1974-2002 at the Cooper Clinic. At baseline, all participants were free of myocardial infarction, stroke, and cancer. Running was assessed on a medical history questionnaire. Participants were classified into 6 groups: nonrunners and 5 quintiles of weekly running amount, time, distance, and frequency. Mortality follow-up was through 2003 using the National Death Index. Cox regression models included baseline age, sex, examination year, smoking status, heavy alcohol drinking, levels of other physical activities, and each running characteristic. RESULTS: During an average follow-up of 14.6 years, 1,193 cancer deaths occurred. Compared with nonrunners, runners (24% of participants) had 21% lower risk of cancer mortality with the hazard ratio (HR) and 95% confidence intervals (CI). 0.78 (0.63-0.95) lower risks of cancer mortality, respectively. CONCLUSION: This study highlights that running even less than half of the current minimum doses of vigorous-intensity aerobic activity, which is 500 MET-min/week or 75 min/week, is sufficient for substantial cancer mortality benefits. Supported by NIH Grant AG06945, HL62508, and DK08195.
Prostate cancer (PC) patients treated with androgen deprivation therapy (ADT) are at risk for an increased rate of adipose tissue accumulation and skeletal muscle wasting, which may lead to reductions in muscular strength and ultimately functioning, function, and loss of independence. Resistance training that includes at least 2 sessions per week, targeting all major muscle groups, may offer one strategy to arrest these declines.

PURPOSE: To examine i) changes in upper body (seated chest press) and a lower body (leg extension) muscular strength in older PC patients on ADT treatment and ii) the associations between age, time on treatment with ADT, muscular strength and body composition in 32 PC patients in the IDEA-P trial. METHODS: 32 PC patients were randomized to resistance training coupled with exercise and dietary counseling (16) or a standard care group control (16). The treatment group attended 2 sessions p/week of resistance training (supervised month 1&2, independent month 3). Muscular strength was assessed with a HR protocol for both upper (UB) and lower body (LB) at baseline and again after 2 and 3 months. Body composition (%BF) was measured with the BODpod, while time on treatment (TOT) was measured in months. RESULTS: At baseline PC patients were M=66.7±7.4 years of age, had been on ADT treatment for M=22±22 months and were obese according to their body composition (%Body Fat M=38.2±9.1). At baseline, there were significant bivariate correlations between age, UB and LB muscular strength (r=0.537, p<0.01) (r=0.392, p<0.05) respectively. TOT was not associated with baseline scores but was associated with 2 month change in LB muscular strength. A 2 (treatment) x 3 (time) ANCOVA controlling for age revealed a significant treatment by time interaction for UB (F=6.721, p<0.01) and LB (F=3.988, p<0.05) strength. CONCLUSION: Resistance training is a safe and feasible means of improving and maintaining muscular strength in older men undergoing ADT for prostate cancer. Increases in muscular strength may protect aging PC patients against future declines in physical function. However, increasing adherence to home-based exercise programs outside of supervised sessions is key to changing lifestyles and health outcomes for prostate cancer patients over the long term.

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Although exercise consistently results in significant improvements in clinically relevant outcomes in prostate cancer (PC) patients undergoing androgen deprivation therapy (ADT), the synergistic benefits of promoting concomitant change in both exercise and dietary behavior could represent an optimal lifestyle intervention approach for offsetting the adverse effects of ADT on mobility performance experienced by PC patients. PURPOSE: The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D), implementing a group-mediate cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment upon change in mobility performance among PC patients undergoing ADT.

METHODS: A total of 32 PC patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Measures of mobility performance include 400M Walk and stair climb performance. RESULTS: Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant Treatment main effect for (p<0.01) for 400M Walk and stair climb performance. Post hoc analysis revealed that the intensive phase of the EX+D intervention resulted in superior improvements in 400M Walk (d = .60) and stair climb (d = .47) performance relative to the SC intervention at 2 months. CONCLUSIONS: Findings from the IDEA-P trial may have implications in terms of long-term weight management. However, the effect we

Physical activity (PA) behavior is beneficial for the prevention and control of breast cancer (BC), the most prevalent and mortal type of cancer among Hispanic woman in Puerto Rico (PR). PURPOSE. To evaluate and compare self-reported lifetime PA behavior and its relation with body mass index (BMI). METHODS. This study is part of a larger on-going population-based case-control study of BC in PR with 146 Hispanic women: 51 with and 95 without BC (age range 30-79 years). Lifetime PA questionnaire inquired about PA in different stages (6-11, 12-13, 14-22, 23-50, 51-64, and 65+ years of age), the duration/day, and intensity. Present PA behavior was also evaluated with one equation inquiring about minutes/day of brisk walking. Participants were classified as active or inactive based on the estimated MET-min/week (<600 = inactive, >600 = active). Kruskal-Wallis test was used to compare the proportion of participants in each category of PA, and an independent t-test to compare BMI between groups. Association between PA behavior and BMI was evaluated with Spearman correlations. RESULTS. The majority of cases (98.7%) and controls (99.5%) were classified as active, with no between stage differences. Domestic PA was the most prevalent and leisure time PA the least prevalent type of PA in both groups; however, cases appear to engage more in leisure time and less in domestic type of PA compared with controls. BMI was higher in the older stages of life (>50 years). No significant association was observed between PA behavior and BMI, however, there was also a tendency for higher BMI among those extremely active based on present walking behavior. CONCLUSION. Results suggest a high level of self-reported PA behavior not associated with BMI among women with and without BC in PR. Self-reported PA behavior must be interpreted with caution.

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Structured exercise, such as resistance and impact training may reverse treatment-related bone and muscle loss in breast cancer survivors (BCS) and increase total daily energy expenditure beyond that from supervised training leading to further benefits. PURPOSE: This secondary data analysis examined the changes in daily energy expenditure (EE) from physical activity (PA) in participants of a one-year randomized controlled trial of structured exercise. Changes in EE were compared between BCS assigned to resistance + impact exercise (POWIR) or a placebo control stretching program (FLEX). MEASUREMENTS: 71 BCS (mean age: 46.5 years) participated in the trial and in their assigned supervised exercise group classes 2 times/wk and home-based training 1 time/wk. Participants self-monitored their daily EE using accelerometry (Actical; Total EE and EE expended in light, moderate and vigorous activities measured in kcal/day) for 3 days at a time at baseline, 6 and 12 month time points. RESULTS: 30 women (n=14 POWIR; 16 FLEX) provided valid accelerometry data (>10 hrs wear time/day) at all 3 time points and were included in the analysis. Wear time included days with structured exercise sessions in only 14/126 (8%) of POWIR and 12/144 (8%) of FLEX data and thus primarily reflects EE outside of the intervention. The overall group by time (2x3) interaction was not statistically significant (p=0.10). Further exploration found near significant interactions at 6 months (p=0.05); women in POWIR increased total EE (+49.3 kcal/day) compared to declines in FLEX (+82.9 kcal/d). From 0 to 6 months a significant group by time interaction was observed for EE during moderate intensity PA (p<0.001), but not during light or vigorous PA.

CONCLUSION: Overall PA levels in BCS may increase beyond that achieved by participating in a structured exercise program. A small increase in overall PA may have implications in terms of long-term weight management. However, the effect we
observed appears to be transient with group differences disappearing over the second half of the year intervention. Further investigation about the potential additional benefits of structured exercise on overall PA and how to sustain these increases warrant further investigation.

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1879 Board #31 June 2, 3:30 PM - 5:00 PM Physical Activity Algorithm In A Comprehensive Cancer Center.

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No relationships reported.

Purpose: One third of cancer cases are preventable through the implementation of healthier lifestyle choices including physical activity (PA), diet and weight management. Integrative Health Services (IH) was tasked with developing a PA algorithm (PAA), mapping patient screening and guidance through providing safe and effective PA interventions, to be implemented within clinical settings. The PAA provides PA, diet, and weight management services to patients within a Cancer Prevention Center.

Methods: The algorithm was a collaboration of a multidisciplinary team including: medical and program directors, clinical managers, physical therapists, exercise physiologists, dietitians, dietitians, physicians and clinical effectiveness representatives. This team merged relevant clinical practice with the 2014 National Comprehensive Cancer Network Survivorship Guidelines and American College of Sports Medicine (ACSM) PA guidelines for cancer survivors into a applicable process that can be adopted into any professional setting. The PAA includes risk stratification, with education that discusses symptoms and assist them through treatment. The PAA aims to reduce patients’ barriers for PA evaluation, assessment, and intervention by providing a unique process that guides professionals in successful conversations on PA for the reduction of chronic disease risks, specifically cancer risks. Every patient is unique and the PAA has been created to impact each person’s unique situation in any setting.

Results: In October 2015, the PAA was approved for implementation throughout the institution. It is available to all who are interested in providing quality comprehensive PA services to participants within clinical practices, program services, or even corporate wellness programs.

Conclusion: The PAA was developed to provide a clear process to guide healthcare professionals who are interested in improving the health of patients by providing PA assessment, intervention, and participant centered exercise prescription within any facility. Future goals include the implementation of the PAA throughout the institution, and the world, as a viable means of cancer risk reduction.

Effectiveness of PA interventions in Hispanic breast cancer survivors is an area warranting further research.

Purpose: To determine the effectiveness of a culturally-tailored and standard home-based exercise program in Hispanic breast cancer survivors.

Methods: Nineteen PCS (66.4 ± 9.1 yr) on currently prescribed ADT for at least 3 months were recruited from the USC Norris Comprehensive Cancer Center as part of a larger ongoing exercise trial. Energy intake was reported using a 3 day diet log, while PA was assessed through questionnaire. Total LBM was measured by dual-xray absorptiometry. Muscle strength was assessed on the seated row and leg curl through estimation of the 1 repetition maximum (RM) from 8-12 RM. The 400 m walk was used as a measure of aerobic fitness. Relationships were analyzed using Pearson correlation tests with a statistical significance of p<0.05.

Results: The majority of PCS (76%) met current PA guidelines, and performed 3513 ± 3703.5 MET-min/mk (mean ± SD). Over half (52%) met the macronutrient guidelines for % energy, while 71% satisfied the RDA. On average, 1609.0 ± 320 kcal were consumed daily, with 20.0 ± 3.5% kcal from PRO (1.06–0.44 g/kg day), 47.4±12.1% from CHO and 32.2±7.7% from fat. A moderate correlation was found between % energy from fat and LBM (r=0.68, p<.01), while % energy from CHO was inversely correlated with LBM (r=−0.55, p=0.1). LBM was significantly correlated with strength (seated row: r=0.60, p<0.01; leg curl: r=0.63, p=0.01), but not 400 m walk time. PA level was not significantly correlated with any outcome.

Conclusions: Among this limited sample of PCS on ADT, our findings indicate that higher % energy intake from fat and lower % energy intake from CHO may be associated with greater LBM. Furthermore, self-reported PA was not related to aerobic fitness, but greater LBM may improve muscle strength.

Impact Of Exercise On Prognosis, Quality Of Life, And Exercise Capacity In Lung Cancer Survivors

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Purpose: To determine the feasibility and effects of an exercise intervention on biomarkers of prognosis, health-related quality of life (HRQOL), and exercise capacity in lung cancer survivors.

Methods: Participants were recruited over 13 months for this eight-week intervention. Subjects were randomized to no intervention or an intervention consisting of supervised exercise training two days per week in-clinic and a prescription for at-home exercise three days per week, totaling 150 min/wk of moderate-intensity physical activity (PA). Exercise capacity (long distance corridor walk), health-related quality of life (FACT-L), and serum levels of inflammatory biomarkers (IL-6, IL-8, IL-10, TNF-α, and hs-CRP) and oxidative stress (8-OHdG) were measured pre- and post-intervention. Descriptive statistics and effect sizes (Cohen’s d) were calculated.

Results: Of all eligible subjects (n=191), less than 7% agreed to participate, leaving a final analytic sample of 11 survivors (n=5 treatment; n=6 control) with a mean age of 63 (±7.3) years, 64% of which were female, 91% white, and 100% diagnosed with
non-small cell lung cancer. Those randomized to the exercise arm more frequently had Stage IV cancer (80% vs. 17% in controls) and were currently receiving cancer treatment (69% vs. 9% in controls). Both the retention and adherence rate in our exercise group was 83%. Negative effects of our treatment were observed in some outcomes (IL-8, IL-10, IL-HDGF, FACT-L), though hs-CRP was lowered (Δ = -0.66) and exercise capacity was maintained.

Conclusions: For individuals interested in and well enough to participate, exercise training appears to be safe and feasible. The majority of our sample was compliant with the intervention and met the 150 min/wk PA goal, though our small sample size did not allow for a thorough evaluation of the effectiveness of this intervention as it relates to biomarkers of prognosis, HQOL, and exercise capacity.

1883 Board #35 June 2, 3:30 PM - 5:00 PM The Effect Of Exercise Training On Mediators Of Inflammation In Breast Cancer Survivors: A Systematic Review With Metaanalysis

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PURPOSE: Several studies have proposed that exercise during and after breast cancer could positively modulate the tumor microenvironment. This metaanalysis aimed to determine the effects of exercise training on mediators of inflammation in breast cancer survivors.

METHODS: We searched for randomized controlled trials published from January 1990 to March 2014. An inverse variance method of metaanalysis was performed using a random effects model in the presence of statistical heterogeneity (I2 = 50%).

RESULTS: Eight high quality trials (n = 478) were included. Exercise improved the serum concentrations of IL6 (Weighted mean difference [WMD] = -0.55 pg/mL, [95% CI 1.02 to 0.09], TNFα (WMD = -0.64 pg/mL, 95% CI 1.21 to 0.06), IL8 (MD = -0.49 pg/mL, 95% CI 0.89 to 0.09), IL2 (WMD = 1.03 pg/mL, 95% CI 0.40 to 1.67). Conversely, no significant differences were found in the serum concentrations of C reactive protein (CRP) (WMD= -0.15, 95% CI 0.56 to 0.25) or IL10 (WMD = -0.41, 95% CI 0.18 to 1.02).

CONCLUSIONS: Exercise training positively modulates chronic low grade inflammation in women with breast cancer, which may impact upon carcinogenic mechanisms and the tumor microenvironment. These findings align with the other positive effects of exercise for breast cancer survivors, reinforcing the appropriateness of exercise prescription in this population.

1884 Board #36 June 2, 3:30 PM - 5:00 PM Effect Of Different Rest Intervals On Isokinetic Muscle Performance In Hodgkin’s Lymphoma Survivors

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Hodgkin’s lymphoma is a cancer that affect the lymphatic system. Resistance training (RT) can be an effective alternative in reducing the deleterious effects of cancer treatment, such as lean mass loss and fatigue. However, there are no studies to date on the appropriate rest interval (RI) between sets of RT exercises in Hodgkin’s lymphoma survivors (HLS) so more effective RT programs can be designed and implemented in this cancer population.

Purpose: To evaluate the acute effect of different RIs in isokinetic muscle performance of HLS after treatment.

Methods: This is an early exploratory study, which evaluated 9 HLS who had completed treatment within at least 6 months, with mean age 34.11 ± 10.35 years. The HLS performed an isokinetic exercise - unilateral extension of the right knee - consisting of three sets of 10 repetitions at 60°/s, with 3 different rest intervals (1, 2 and 3 min) between sets. The three exercise protocols were performed on different days, separated by a minimum of 72 hours and maximal of 1 week between each session; RIs trials were randomized and counterbalanced. The isokinetic muscle performance was evaluated by peak torque (PT) and total work (TW). Before the exercise protocol, volunteers performed a warm-up consisting of two sets of 5 repetitions at 60°/s with 1 min rest between sets. Kolmogorov-Smirnov test confirmed data normality. A three-way ANOVA was used to analyze data, with Bonferroni post hoc. A significance level of p <0.05 was used for all analyses.

Conclusions: Results indicate a decline in the PT and TW in all sets regardless of the different RIs. However, the decline of performance was lower as the RI was increased, suggesting that HLS need a longer RI (at least three minutes) to better recover between sets.

1885 Board #37 June 2, 3:30 PM - 5:00 PM General Fatigue and Decline of Muscle Performance in Hodgkin’s Lymphoma Survivors

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Cancer Related Fatigue (CRF) is characterized by a subjective feeling of exhaustion and tiredness experienced by cancer patients. CRF promotes a depressant effect on the physical, emotional and mental function. Physical exercise has been shown to significantly reduce CRF. However, it is still unclear if a relationship exists between CRF and the decline of muscle performance during an acute bout of isokinetic exercise training.

PURPOSE: To explore the relationship between fatigue and decrease in muscle performance during a bout of isokinetic exercise training in Hodgkin’s lymphoma survivors (HLS).

METHODS: This is an initial exploratory study where 9 HLS, mean age 34.11 ± 10.35 years, where fatigue was assessed using the Multidimensional Fatigue Inventory (MFI-20) on the domains of physical, mental, reduced motivation, reduced activity and general fatigue. Subjects performed 3 sets of 10 unilateral isokinetic knee extension repetitions, with the right leg at 60°.s(-1), with one minute between sets. The fatigue index (FI) was calculated as the difference between total work (TW) of the first set and TW of third set. Spearman correlations were used to analyze the relationship between the domains and general fatigue of the MFI-20 and FI. A level of significance of p ≤0.05 was used for all analyses.

RESULTS: General fatigue of 11.91 ± 3.94 was observed using the MFI-20. HLS scored 10.09 ± 4.70 for the physical aspect, 12.09 ± 4.57 for the mental aspect, 8.45 ± 3.98 for activity reduction and 7.91 ± 3.33 for reduced motivation domains of the MFI-20. A fatigue index of 19.69 ± 8.60% was attained during the acute bout of isokinetic exercise training. There was no significant correlation between FI and MFI-20 general fatigue. (r = 0.538; p = 0.135) and any domain of the MFI-20. However, the relationship between FI and the MFI-20 domain of reduced motivation approached significance (r = 0.68, p = 0.083).

CONCLUSIONS: From this initial exploratory study, it appears that the subjective evaluation of general fatigue and the different domains of the MFI-20 do not correlate with the FI. The relatively small sample could have influenced the study results. It could also be speculated that the subjective measurement of fatigue may not be sensitive enough to capture specific muscular alterations, commonly observed in HLS due to anti-cancer treatments.

1886 Board #38 June 2, 3:30 PM - 5:00 PM Inpatient Exercise Therapy Versus Relaxation And Mental Training In Pediatric Stem Cell Transplantation: Results Of ARCT

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Hematopoietic stem cell transplantation (SCT) as aggressive treatment for hematological malignancies and the long hospitalization lead to declines in physical
Evidence suggests that endurance athletes who follow a habitual, high fat/adequate protein/low carbohydrate meal plan can maintain endurance performance in a singular exercise bout. However, whether active exercisers who are accustomed to a high fat/low carbohydrate meal plan require specific postexercise nutrition to support subsequent exercise is unknown. PURPOSE: To determine if postexercise nutrition affects subsequent endurance performance following an initial endurance bout in adults accustomed to a high fat/low carbohydrate meal plan. METHODS: Regularly exercising males and females (n=10, 22.5 ± 3.3 y, V02max = 45.6 ± 9.5 ml·kg·min⁻¹) consumed a 29-d, eucaloric meal plan that consisted of 40% of total energy from carbohydrate, 1.5 g·kg⁻¹·d⁻¹ of protein, and the remaining kilocalories from fat. Performance testing covered three nonconsecutive days, each separated by 72 h. Each test day, a 60-min exercise bout on a cycle ergometer was performed (65%-75% of V02max, switching every 10 min), followed by ingestion of one of three isovolumic, postexercise beverages: 20g fat, 5g carbohydrate, 25g protein (FAT); 50g carbohydrate, 25g protein (CHO); or 25g protein (PRO). Each participant recovered passively for 3 h and then completed a 15-min maximal time trial (TT) on the ergometer, during which total work produced (TW), mean power output (MP), mean V02, and mean respiratory exchange ratio (RER) were recorded. RESULTS: RAMANOVA resulted in no significant mean difference in TW (2.2 ± 0.5 kJ·kg⁻¹, 2.1 ± 0.5 kJ·kg⁻¹, 2.2 ± 0.5 kJ·kg⁻¹), MP (2.4 ± 0.6 W·kg⁻¹, 2.4 ± 0.6 W·kg⁻¹, 2.4 ± 0.6 W·kg⁻¹), V02 (27.9 ± 5.4 ml·kg⁻¹·min⁻¹, 28.5 ± 5.7 ml·kg⁻¹·min⁻¹, 28.5 ± 5.8 ml·kg⁻¹·min⁻¹), or RER (0.84 ± 0.08, 0.85 ± 0.08, 0.85 ± 0.08) during each TT among PRO, CHO, and FAT, respectively (p<0.05). CONCLUSION: Consuming postexercise beverages of varying macronutrient content resulted in similar subsequent exercise performance and metabolic outcomes, and in fact resulted in similar performance measures compared to individuals on a traditional high-carbohydrate diet. For regularly exercising males and females habitually consuming a low-carbohydrate/high fat meal plan, consuming any of the three beverages would be a logical postexercise nutrition option.

Funding provided by Southern Connecticut State University School of Graduate Studies

Glucose uptake by muscle is mediated by up-regulation of glucose transporters during exercise. It is presumed that higher intensity exercise eliciting more forceful contractions will promote increased glucose transport into active tissue. Whether exercise intensity affects blood glucose regulation during recovery from exercise is of interest. PURPOSE: To examine whether fixed distance exercise (walking vs. running) causes differences in oral glucose tolerance test (OGTT) response following exercise. METHODS: Seven participants performed two exercise trials, consisting of one trial of running (RT: 7.5 mph for 3 miles using 2-min intervals with 2-min recovery segments) and one trial of continuous walking (CW: 4 mph for 3 miles). Each trial day, participants arrived having fasted for at least four hours prior to testing. Participants ingested 75 g of dextrose, in 300 ml of water upon completion of the assigned exercise trial. Blood glucose (BG) was sampled every 15 min over a 75-min OGTT period. Trial order was counter-balanced.

RESULTS: V02, HR, RER, and RPE for the RT condition were significantly higher (p < 0.02). BG was significantly higher for RT post exercise (~45% higher) and at 15 minutes (~29% higher) of the OGTT (p < 0.01). These differences were attributed to two outliers. When outliers were removed, the differences disappeared. Area under the curve during the OGTT following RT tended (p = 0.109) to be smaller (9,535±534 vs. 10,834±482 a.u.) with outliers removed.

CONCLUSIONS: Based on the study results, when energy expenditure is controlled between low and high exercise intensities, BG regulation following exercise of the same fixed distance tends to be enhanced when the exercise is performed at a higher intensity.

**Effect of Exercise Intensity on Post-Exercise Oral Glucose Tolerance Test Response**

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A single bout of aerobic exercise improves executive function (EF), but thereafter EF returns to the baseline level quickly. Compared with a single bout of aerobic exercise, recently, we found that high-intensity interval exercise (HIIE) could maintain the improvement in EF longer. However, the mechanism of the effect of different exercise mode on modifications of EF remains unclear.

**PURPOSE:** The purpose of the present investigation was to test our hypothesis that the amount of exercise-induced lactate production and its accumulation affects the human brain function during and after exercise, thereby affecting post-exercise EF.

**METHODS:** To manipulate the concentration of HIIE-induced lactate by muscle glycogen depletion, 10 healthy male subjects performed the two HIIE protocols with a 60 min resting period between 1st and 2nd HIIEs. The HIIE protocol consisted of four 4-min bouts of cycling exercise at 90% peak VO2 and three 3-min active recovery period at 60% peak VO2 between each exercise bout. Blood glucose and lactate concentrations were measured at each experimental stage. To evaluate EF, a color-word Stroop task was performed, and reverse-Stroop interference scores were obtained.

**RESULTS:** EF immediately after the 1st HIIE was significantly improved from the resting baseline ($p < 0.05$), and this improved EF was sustained throughout 40 min of the post-exercise recovery. However, in the 2nd HIIE protocol, the improved EF was only sustained at the beginning of the post-exercise recovery period (~10 min). In addition, the concentration of HIIE-induced lactate was lower in the 2nd HIIE ($p < 0.01$), and it was likely associated with the different response of EF to 2nd HIIE.

**CONCLUSIONS:** These findings of the present study suggest that the lower lactate production/accumulation could not sustain adequately elevations in brain neuronal activity and metabolism throughout the recovery period following the 2nd HIIE. Exercise-induced lactate may be an important physiological factor to determine EF during and after exercise.

**The direct quantification of muscle glycogen storage or utilization during exercise involves an invasive biopsy protocol, while non-invasive measurements via magnetic imaging require expensive and inaccessible equipment. Recently, ultrasound technology has been promoted as a practical, non-invasive technique for determining muscle glycogen based on changes in the grey scale of the image associated with glycogen-binding of water. If valid, this technology would have widespread application in applied sports nutrition. Purpose: To validate ultrasound technology for the measurement of muscle glycogen (Gly) concentrations in well-trained athletes under conditions considered to achieve normal (GlyN), depleted (GlyD) or loaded (GlyL) concentrations of Gly. In addition, creatine (Cr) loading was undertaken by some subjects to provide a potentially confounding effect on muscle water. Method: Twelve well trained cyclists undertook a protocol where Gly was measured by biopsy from the vastus lateralis and ultrasound on the non-biopsied leg. Muscle Glycogen was measured under the conditions of GlyN, GlyD or GlyL, with and without Cr loading. RESULTS: The mean values from 5 ultrasound determinations of glycogen were calculated, whereby images were analysed by proprietary software (MuscleSound 2015) and an arbitrary score indicating Gly concentrations in well-trained athletes under conditions considered to achieve normal (GlyN), depleted (GlyD) or loaded (GlyL) concentrations of Gly was generated. The correlation between ultrasound scores and biopsy Gly concentrations was -0.264 ($p = 0.432$), and when separated into CrN and CrL, the correlations were 0.088 ($p = 0.868$) and 0.354 ($p = 0.559$), respectively. Conclusion: Although it is an attractive prospect, we were unable to validate the use of ultrasound technology to estimate muscle glycogen or increases/decreases in these stores across a range of scenarios including exercise-depletion, normalized stores, carbohydrate loading and concomitant creatine loading.
RESULTS: In this population, plasma glucose concentration (6.12±0.76 mM/L) was negatively correlated with %LM (r=0.36, P<0.01) and positively correlated with TFM (r=0.36, P<0.01). The positive correlation with TFM remained when adjusted for TLM (r=0.39, P<0.05).

CONCLUSIONS: Results from this study are consistent with literature from other population studies supporting greater %LM as being beneficial in glucose regulation and being associated with lower plasma glucose concentration. The benefit of greater %LM may be due to the required quantity of glucose absorption needed for sustained metabolic function of the larger muscle mass. A greater TFM associated with elevated plasma glucose concentration may be due to the inhibitory effect of fatty acids on insulin, which results in greater glucose concentration.

Supported by NIH/NIA R01AG031297

1894 Board #46 June 2, 3:30 PM - 5:00 PM The Effect of Exercise and Resveratrol on Hippocampus in Type 2 Diabetes Mellitus Han Li, Yun Chang, Peng Zhao. China Institute of Sport Science, Beijing, China.

Type 2 Diabetes Mellitus (T2DM) is a metabolic disease which characterized by hyperglycemia resulting from insulin secretion defects or insulin action disorders. The hippocampus as one of the most important brain regions, is really easy to be impaired by T2DM. Resveratrol and exercise training have been considered useful measures for treating T2DM. However, the definite mechanism is still unknown.

PURPOSE: To investigate the possible mechanism of SIRT1 and exercise training on the effect of Akt/PKB insulin signaling pathway in the hippocampus of T2DM rats.

METHODS: 75 Male mature T2DM SD rats were divided into RE, R and Control groups. Both RE group and E group rats were arranged to load swimming 5 days/week, 1-hour/day. At the same time, RE group rats needed to take resveratrol with the dosage of 45mg/kg/day, 7 day/week, but the Control group without any treatment. After 8 weeks, we examined the content of IRS-1, AKT, SIRT1 of all the rats which in the hippocampus.

RESULTS: (1) When compared with other 3 groups, the content of SIRT1 and pAKT/Ser473 in the Control group rats decreased with extreme significance (p<0.01). (2) The volume of SIRT1 and pAKT-Ser473 in the RE, E group rats improved, but RE group increased more evidently (RE vs. R, P<0.05). (3) When compared with other 3 groups, the expression of pIRS-1-Ser307 in the Control group rats increased significantly (p<0.05). (4) The volume of SIRT1 in the RE, E group rats increased, RE group increased more evidently than E group rats (RE vs. E, P<0.05).

CONCLUSIONS: 8-week swimming or/and resveratrol could ameliorate the hippocampus of the T2DM rats. Meanwhile, the results showed two remedies could ameliorate effectively than the single treatment. The possible reason was, SIRT1 as an important NAD+ dependent histone deacetylase, exercise training or/and resveratrol could ameliorate the hippocampus of T2DM. In conclusion, pectin and/or VWR could ameliorate the hippocampus of T2DM rats significantly.

1895 Board #47 June 2, 3:30 PM - 5:00 PM Circadian Rhythms In Blood Glucose And Blood Pressure: Are They Reproducible? Brian E. Barnett, Samuel L. Buckner, Scott J. Dankelev, Brittany R. Counts, Matthew B. Jessece, J Grant Mousers, Tanya M. Halliday, Jeremy P. Loennekke. Delta State University, Cleveland, MS. The University of Mississippi, University, MS. Virginia Tech University, Blacksburg, VA.

Circadian rhythms are physiologic fluctuations over a 24-hour period. Two variables thought to demonstrate a circadian rhythm include brachial blood pressure and blood glucose. However, there is great variation among the protocols in the current literature, and a lack of control of diet points chosen for measurement.

PURPOSE: To examine potential rhythms of systolic (SBP), diastolic (DBP) blood pressure and blood glucose without interrupting an individual’s natural sleep/wake cycle. A second aim was to determine if these potential rhythms are reproducible.

METHODS: After establishing a normal waking time, 7 strength trained participants scheduled their first “Circadian testing” day. The first measurement of SBP, DBP and blood glucose was taken approximately 2 hours after their normal wake time. Measurements were repeated every 2 hours for 12 hours, while participants rested.

To examine the repeatability of the potential rhythm, participants returned and completed the same procedures as before within 14 days of their first “Circadian testing” visit. Food and drink intake was recorded during the first visit and participants consumed the same diet on the second day of “Circadian Testing”. A 2x7 (Day x Time) repeated measures ANOVA was used to determine if differences existed for SBP, DBP, and blood glucose. Significance was set at p ≤ 0.05. Data are presented as mean ± SD. Cosinor analysis was used to determine rhythm patterns for each variable each day.

RESULTS: There was no interaction (p=0.751) or time main effect (p=0.236, range: 115-120 mmHg) for SBP. There was a main effect of time, with SBP being lower on Day 2 than Day 1 (116.7±2.3 vs. 118.6±2.3; p=0.018). No differences were observed for DBP. For blood glucose, there was no interaction (p=0.844), time main effect (p=0.613, range: 95.1-103.7 mmol/L), or main effect of day (Day 1: 98.7±7 vs. Day 2: 97.5±4 mmol/L, p=0.501). Cosinor analysis revealed that there was no rhythm for blood pressure or blood glucose across time for either day (p>0.05)

CONCLUSIONS: When accounting for an individual’s natural sleep/wake cycle, no measurable rhythms for SBP, DBP, or blood glucose were detected. Given this finding was observed twice, suggests that these hypothesized intrinsic rhythms may be masked by different zeitgebers or, perhaps, less pronounced when not disturbing sleep.

1896 Board #48 June 2, 3:30 PM - 5:00 PM Effects Of Dietary Fiber And Exercise On Cognition, Muscle Function, And Scfa In Young Mice Brandt D. Pence, Tushar K. Bhattacharyya, Jennifer L. Rytich, Pul Park, Jacob M. Allen, Yi Sun, Robert H. McCusker, Keith W. Kelley, Rodney W. Johnson, Justin S. Rhodes, Jeffrey A. Woods, FACSM. University of Illinois at Urbana-Champaign, Urbana, IL.

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(No relationships reported)

PURPOSE: Short chain fatty acids (SCFAs) contribute to immune and brain function and are produced by gut bacteria through metabolism of fermentable fiber.

METHODS: Young (6 week) male C57Bl/6J mice were fed AIN-93M diet or AIN-93M with 5% pectin substituted for cellulose for 6 weeks and voluntarily exercised on a wheel (VWR) or remained sedentary (SED), making up four groups with n=5/group.

RESULTS: VWR mice maintained body weight, while Sed mice gained 2 grams (p<0.001, time*VWR). Neither exercise (p=0.233) or pectin (p=0.481) affected performance on the active avoidance task. In the Morris Water Maze task, neither exercise (p=0.908) or pectin (0.781) affected latency to find the hidden platform during the acquisition phase, and no significant differences were found during the probe trials for either treatment. Interestingly, both pectin and exercise decreased grip strength, although only the pectin effect remained after normalization to body weight (p=0.004).

As expected, VWR increased performance on the rotorod (p=0.028) and exhaustive fatigue test (p=0.012). Pectin increased acetylacetate (p=0.001), propionate (p=0.002), and butyrate (p=0.005). Interestingly, there was also a significant VWR effect for increased acetate (p=0.030) and a significant VWR effect (p=0.002) and interaction (p=0.031) such that the pectin + VWR group had the highest levels of cecal propionate.

CONCLUSION: In conclusion, pectin and/or VWR had little effect on cognitive function but tended to increase cecal SCFAs in young mice, which may have implications for brain and immune system function.

Funding from the Abbott-UIC Center for Nutrition, Learning, and Memory.

1897 Board #49 June 2, 3:30 PM - 5:00 PM Passive Heating As An Option For Improving Glucose Control: Take A Bath! Steve H. Faulkner, Sarah Jackson, Kate McDaid, George Havenith, FACSM, Christof A. Leicht. Loughborough University, Loughborough, United Kingdom. (Sponsor: George Havenith, FACSM).

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(No relationships reported)

Obesity and type 2 diabetes are increasing in prevalence and can be treated by lifestyle interventions such as diet and exercise. Acute exercise has an insulin sensitising effect, leading to improved glucose control. This may in part be due to the attenuated synthesis of heat shock protein 70 (HSP70) in obesity and diabetes. HSP70 may be elevated by exercise and passive heating (PH). Furthermore, animal studies suggest PH may be beneficial to glucose control.

PURPOSE: To determine the effect of PH versus exercise on the HSP70 response and glucose control in overweight and lean humans.

METHODS: In a crossover design, ten physically inactive males (5 lean (L) BMI = 23.5 kg/m², fat mass = 9.5 ± 4.8 kg; 5 overweight (OW) BMI = 28.0 kg/m², fat mass = 29.9 ± 5.3 kg) underwent 60 minutes of exercise at a fixed rate of metabolic heat production (EX: 7.5W/kg·1). In a second trial, participants underwent PH (2.0 W/kg·1) matched to EX for duration, core temperature (Tc) increase and dietary intake. A venous blood sample was obtained before and immediately following heating for analysis of HSP70. Continuous glucose monitoring was used to measure interstitial glucose for the subsequent 24 hours.

RESULTS: There were no differences in ΔTc between groups (L = 0.87 ± 0.23°C; OW = 0.85 ± 1.7°C, p = 0.784) or conditions (EX = 0.8 ± 0.2°C, PH = 0.9 ± 0.2°C, p = 0.913) following heating. Resting HSP70 was negatively correlated with fat mass (r=−0.528, p<0.05). There was a trend between HSP70 and fat mass (r=−0.303, p = 0.194).
Postprandial hyperglycemia is associated with the development of macrovascular and microvascular diseases. Thus, there is a need for effective treatments that reduce postprandial hyperglycemia. Metformin is used clinically to reduce blood glucose, however, hyperglycemia is not always adequately controlled with metformin. It is currently unknown how the combination of metformin and postmeal exercise affects postprandial glucose. PURPOSE: Examine the effects of postmeal exercise on postprandial glucose in people being treated with metformin. METHODS: 2-hr area under the curve after a standardized breakfast meal and postprandial glucose, assessed with continuous glucose monitoring, were compared in sedentary versus postmeal exercise conditions in 6 people treated with metformin. Postmeal exercise began 30 minutes into the postprandial phase and consisted of 5 x 10 minutes bouts of treadmill walking at 60% maximal oxygen uptake. RESULTS: 2-hr area under the breakfast curve was 27% lower after postmeal exercise (sed: 1315 ± 299 vs. ex: 958 ± 235 mmol-L-1; p < 0.008). Peak glucose was 28% lower after postmeal exercise (sed: 11.8 ± 2.9 vs. ex: 8.9 ± 1.1 mmol/L; p = 0.01). Postmeal exercise lowered postprandial glucose levels below the current International Diabetes Federation postmeal recommendation of 8.8 mmol/L in 3 of 6 participants. CONCLUSION: Postmeal exercise resulted in postprandial glucose reduction in people being treated with metformin, and therefore may be a useful approach for managing postprandial hyperglycemia. Funded by the University of Georgia College of Education, Office of the Vice President for Research, and the Mary Ella Lunday Soul Scholarship.

CONCLUSION: Twenty-four sessions, equivalent to 8 hours of ISE, significantly increased aerobic fitness and decreased fasting insulin and insulin resistance of sedentary, overweight postmenopausal women.

CARBOHYDRATE INGESTION WITH EXERCISE

Obesity is an independent risk factor for type 2 diabetes and cardiovascular disease. Oxidative stress or low total antioxidant capacity has been shown to be associated with decreased insulin sensitivity (SI) in overweight/obese individuals. Exercise training has been shown to improve systemic antioxidant capacity (TAC) and SI; however, whether or not correlations between SI and TAC observed under untrained conditions are associated following exercise training is less clear. PURPOSE: The purpose of this study was twofold: 1) to determine if SI was correlated with serum TAC in a cohort of overweight/obese men at baseline and following six-weeks of exercise training; and 2) to determine if the relationships between SI and TAC responded differently for high and low TG. METHODS: Thirty-six overweight/obese men (age = 45 ± 10 years, body mass index = 32 ± 3 kg/m2) participated. Participants were stratified into low (<150 mg/dL) and high (≥150 mg/dL) TG groups. Blood samples were collected pre-exercise and immediately post exercise (PRE) and 30 minutes post exercise (IPE) at baseline and six-weeks post training. RESULTS: A significant correlation was observed between SI and TAC at baseline (R² = 0.458, P = 0.001). SI significantly improved from baseline to post-training in both groups (P = 0.037), with no significant time x group interactions for HIIT or CT. A significant decrease in TAC was observed in the hyperTG group compared to the normTG group (0.66 ± 0.04 VCO2/VO2) in the HIIT + H2O condition. Resting RER was lower (p < 0.05) in the normTG group compared to the hyperTG group (0.74 ± 0.03 VCO2/VO2) in the HIIT + H2O condition. CONCLUSION: Consuming sugar with exercise was followed by higher fasting TG and glucose and insulin responses compared to EX + H2O. Fat utilization and metabolic flexibility during the OGTT were lower in the hyperTG group compared to the normTG group. Sugar consumption affected post-exercise metabolism more negatively in individuals with hyperTG. Supported by the Mountain West Clinical Translational Research - Infrastructure Network under a grant from NIGMS of the NIH under Award Number 1U54GM104944.
High-intensity interval training (HIT) represents a very time-efficient mode of exercise training and induces several health benefits. However, little is known regarding the role of HIT to combat whole body insulin resistance. **PURPOSE:** To investigate the effect of HIT on whole body insulin resistance in high-fat diet (HFD)-induced obese mice. **METHODS:** At 5-week postnatal period, a total of 30 male mice (C57BL/6) were randomly assigned to standard chow (SC) (n=10) or HFD (n=20) for 23 weeks. After 15 weeks of dietary treatment, the HFD mice were further assigned to HFD (n=10) or HFD+HIT (HFD+HIT, n=10). The HFD+HIT mice were subjected to HIT on a motor-driven rodent treadmill during the last 8 weeks of the 23-week HFD course. **RESULTS:** HIT suppressed HFD-induced increases in body weight (HFD=47.5±1.4 g vs. HFD+HIT=44.2±1.2 g, p=0.023), subcutaneous fat mass (HFD 2.7±0.1 vs. HFD+HIT 2.4±0.1 g, p=0.038), serum total cholesterol (HFD 253.5±48.5 vs. HFD+HIT 198.7±74.4 mg/dL, p=0.010), under the arc of glucose tolerance test (HFD 53070±8585 vs. HFD+HIT 45401±4312, p=0.031), and area under the curve of insulin tolerance test (HFD 5367±597 vs. HFD+HIT 6416±619, p=0.016). HIT prevented HFD-induced decreases of total adiponectin in serum (p=0.001) and adipose tissue (p=0.016). Along with improved metabolic risk factors, HIT prevented HFD-induced decreases in proteins of adiponectin receptor 1 (p=0.010), AMP-activated protein kinase (p=0.001), and NAD-dependent deacetylase sirtuin-1 (p=0.010) and HFD-induced decreases in mRNA of peroxisome proliferator-activated receptor-α (p=0.023), and acyl CoA oxidase (p=0.030) in skeletal muscle. **CONCLUSION:** The current findings show that HIT alleviates whole body insulin resistance associated with obesity via the Adipor1 and AMPK mediated-signaling pathway in skeletal muscle, implying the therapeutic role of HIT to combat whole body insulin resistance.

Supported by the National Research Foundation Grant funded by the Korean Government (NRF-2015S1A3B5A02012775).

**Glucose And Lipid Responses To A Meal: Effects Of Sitting Versus Standing**

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(No relationships reported)

**A growing body of literature suggests that differences in metabolic responses to nutritional challenge can be demonstrated when the postural condition of the individual is changed from sitting to standing. Previously we have shown striking differences in the response to a glucose tolerance test between sitting and a proxy for standing.**

**PURPOSE:** To compare glucose and lipid clearance, in healthy individuals in response to a glucose tolerance test between sitting and a proxy for standing. **METHODS:** 9 individuals, 3 females and 6 males (87.9±20.1 kg.) performed two tests (sit & 0.5 mph walk). After a minimum of an 8-hour fast a baseline glucose, insulin, and lipids were collected. The subjects either spent the next two hours sitting or walking at 0.5 mph (a proxy for standing) on an Active Workstation. A blood sample (finger stick) was obtained every 30 min for the next two hours (Cholestech®). **RESULTS:** The Trigly (Mean±SD) levels (mg %) showed a significant rise across time in the sitting condition: 109.7±34.1 to 151.4±47.3 vs a non-significant rise in the 0.5 mph group: 120.5±49.2 to 148.5±69.3. Glucose responses (mg %) across time were similar in both groups, however the sitting group showed a significantly higher level at the 30 min sample (112.5±10.0 vs 101.5±15.5, p < 2.1, df=8, p=0.03). **CONCLUSIONS:** These results provide limited support for the impact of very low levels of physical activity (proxy for standing) on metabolic responses to a meal. Two hours may be too short an interval to detect the maximum effect of the meal and posture on lipid changes. The results are consistent with the potentially deleterious effects of sitting.

**The Effect Of A High Fat/high Sugar Diet And Physical Activity On Body Fat Percentage And Bone Mineral Density**

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(No relationships reported)

**Akita model mice were used to determine the effect of diet and exercise on body fat and bone mineral density.**

**MATERIALS AND METHODS:**

**Animals:** Akita mice were obtained from a breeding colony maintained by The Jackson Laboratory. The mice were housed under a 12 h light/dark cycle and fed ad libitum. Mice were randomly assigned to one of nine diet groups (n=10/group). The nine diet groups included: HFD (45% fat, 20% fructose in the chow diet), HFD with access to running wheels (HFD + WR), and eight control groups, which were fed a control diet (0% fat, 0% fructose) and 0% or 1% chow access (Total Control (TC0), 1% Chow Control (CC1)).

**Exercise:** Mice were assigned to either a control group (no running wheel) or a running wheel group (4% chow). Mice were placed in running wheels for 14 weeks, and gains in body weight and increases in fat mass were measured. At the end of the study, mice were sacrificed, and bone mineral density and body fat percentage were measured.

**RESULTS:**

**Bone mineral density (BMD):** The control groups (TC0 and CC1) had a significantly lower BMD compared to the HFD group (p<0.05). The HFD + WR group had a significantly higher BMD compared to the control groups (TC0 and CC1) (p<0.05). There was no significant difference in BMD between the HFD and the HFD + WR groups.

**Body fat percentage:** The control groups (TC0 and CC1) had a significantly higher body fat percentage compared to the HFD group (p<0.05). The HFD + WR group had a significantly lower body fat percentage compared to the control groups (TC0 and CC1) (p<0.05). There was no significant difference in body fat percentage between the HFD and the HFD + WR groups.

**CONCLUSIONS:** These results demonstrate that a high-fat/high-sugar diet can increase body fat and decrease bone mineral density, while regular exercise can counteract these effects.

**Exercise Reduces Hepatic Gluconeogenesis in Obese and Insulin Resistant Animals Through CLK2 Protein (Cdc2-like Kinase)**

Rafael C. Gaspar1, Vitor R. Muñoz1, Rania A. Mekary2, Leandro P. Moura1, Marcella R. Sant’Ana1, Paula Quaresma1, Patricia O. Prada1, Rodolfo Marinho1, José Rodrigo Pauli1. 1Faculty of Applied Sciences - FCA/UNICAMP, Campinas, Brazil. 2Harvard T. Chan School of Public Health, Boston, MA.

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(No relationships reported)

**PURPOSE:** CLK2 protein (Cdc2-like kinase) after being phosphorylated by Akt, phosphorylates PGC-1α and consequently reduces the transcription of gluconeogenic genes. Obese and insulin resistant (IR) animals showed lower levels of CLK2 in the liver, which makes this protein an important therapeutic target in the control of gluconeose homeostasis. On the other hand, the exercise is an effective strategy to reduce IR and control hepatic glucose production. For so far, no study has been performed in order to assess the role of exercise in modulating the CLK2 protein in obese animals. Therefore, the aim of this study was to evaluate the role of chronic physical exercise on the levels and phosphorylation of CLK2 in hepatic tissue of obese and IR mice. **METHODS:** Twenty four Swiss mice (4 weeks old) were divided into 3 groups (8 animals / group): Sedentary Control (C) sedentary animals fed with control diet, Sedentary Obese (SO) sedentary animals fed with HFD and Trained Obese (TO) animals fed with HFD and submitted to the training protocol. Protocol training was carried out for 1h / day, 5 days / week during 8 weeks and it was performed at the intensity of 60% of maximum power, which was determined at the beginning of the experiment. During the last experimental week the insulin tolerance test (ITT) and glucose tolerance test (GTT) were performed. Twenty four hours after the last exercise session the animals were euthanized and the liver was harvested for subsequent analysis. **RESULTS:** After the training protocol, TO group improved insulin sensitivity when compared to SO group. This finding was, in part, due to the increased phosphorylation of CLK2 by Akt in the trained animals. Because after occurring the elevation of CLK2 phosphorylation there was increased phosphorylation and nuclear export of FoxO1 and this resulted in a reduced synthesis of gluconeogenic enzymes (G6Pase, PEPCK and PCh) which consequently reduced the hepatic glucose production. **CONCLUSION:** Therefore, it can be concluded that physical exercise, through CLK2 protein, reduces hepatic glucose production which collaborate to reduce the development of type 2 diabetes in obese animals.

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D-27 Free Communication/Poster - Concussion I
Thursday, June 2, 2016, 1:00 PM - 6:00 PM
Room: Exhibit Hall A/B

1906 Board #58 June 2, 2:00 PM - 3:30 PM
The Effect of Over-the-Counter Medication on Symptom Severity Following Sport-Related Concussion
Michael J. Pepin, David R. Howell, William P. Meehan, III.
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No relationships reported

TITLE: The effect of over-the-counter medication on symptom severity following sport-related concussion

Authors: Michael J. Pepin, David R. Howell, William P. Meehan III

Purpose: Although over-the-counter (OTC) medications are commonly administered following sport-related concussion, their effect on reducing symptoms remains unknown. We sought to examine the effect of nonsteroidal anti-inflammatory drugs (NSAIDs) and melatonin on post-concussion symptom severity.

Methods: We conducted a prospective cohort study of patients who presented to a sport concussion clinic within 21 days of injury. We examined the effect of NSAID use on the sum of “Headache” and “Pressure in the Head” scores (HA score) on the post-concussion symptom scale (PCSS) endorsed by the international consensus on concussion in sport. In addition, we examined the effect of melatonin on “Trouble Falling Asleep” scores (Sleep score). Patients who reported taking NSAIDs (n=30) and melatonin (n=16) were matched by age, gender, HA or Sleep score respectively, and overall PCSS scores with controls (n=70 and 35 respectively) who did not report the use of these medications. Mean differences in PCSS scores from the initial clinic visit and first follow-up visit were compared by repeated measures ANOVA.

Results: There was significant improvement in mean HA score for both NSAID users (6.4 vs 3.7; p<0.001) and non-users (6.6 vs 2.8; p<0.001). The mean difference in HA score between initial visit and follow-up visit of NSAID users was not significantly different than that of non-users (3.8 vs. 3.8; p=0.102). Similarly, there was significant improvement in Sleep score between visits in both melatonin users (3.8 vs 2.6; p<0.001) and non-users (3.7 vs. 1.6; p<0.001) showed. The mean difference in Sleep score between initial visit and follow-up visit, however, did not differ between those who used melatonin and those who didn’t (1.8 vs. 2.1; p=0.691).

Conclusion: Headache symptom severity and difficulty falling asleep are commonly treated following concussion using OTC medications such as NSAIDs and melatonin. Our results suggest that symptom severity improves over time, but this effect may not be enhanced by the use of OTC medications.

1907 Board #59 June 2, 2:00 PM - 3:30 PM
Athletes That Continue To Play With Sport-Related Concussion Demonstrate Prolonged Recovery And Worse Outcomes
R.J. Elbin1, Alicia Sufrinko2, Philip Schatz3, Jonathan French2, Michael W. Collins2, Anthony P. Kontos3
1University of Arkansas, Fayetteville, AR.
2University of Pittsburgh, Pittsburgh, PA.
3Saint Joseph’s University, Philadelphia, PA. (Sponsor: Stavros Kavouras, FACSM)

No relationships reported

The Centers for Disease Control (CDC) Head’s Up Concussion education program states, “It is better to miss one game than the whole season.” However, due to sport culture (i.e., play through injury), lack of awareness of sport-related concussion (SRC) signs and symptoms, and limited access medical professionals, many athletes continue to play with SRC. The impact of continuing to play with SRC on recovery is unknown.

Purpose: To compare recovery outcomes among athletes who were removed or not removed from play following SRC.

Methods: A retrospective cohort repeated measures design was used to assess neurocognitive, symptom, and vestibular/oculomotor scores in 36 athletes (15.71 ± 1.73 years) removed (REMOVED) and 39 athletes (15.70 ± 1.73 years not removed (NOT REMOVED)) from play following SRC. Neurocognitive (ImPACT) and symptom assessments (PCSS) were administered at baseline, 1 - 7 days, and 8 - 20 days post injury, and a vestibular and oculomotor assessment (VOMS) was administered at 1 - 7 days post injury. Recovery time was calculated as total days elapsed between injury and medical clearance. A series of 2 group (REMOVED, NOT REMOVED) X 3 time (baseline, 1 - 7, 8 - 20 days) repeated measures analysis of variance was used to examine differences in neurocognitive performance, and a series of independent sample t-tests were performed to examine differences in vestibular/oculomotor function and recovery time between groups. Statistical significance was set at a Bonferroni-corrected p < .001 for multiple comparisons.

Results: The NOT REMOVED group (36.84 ± 24.41 days) took significantly longer to recover from SRC than the REMOVED group (19.47 ± 14.43 days; p < .001), exhibited significantly greater vestibular/oculomotor impairment at 1 - 7 days following injury than the REMOVED group (p < .001), and demonstrated significantly worse neurocognitive performance and increased symptoms at both the 1 - 7 (p < .001) and 8 - 20 day (p < .001) post-injury time points compared to the REMOVED group.

Conclusions: Athletes that continue to play with SRC demonstrate longer recovery times and worse outcomes than athletes that are removed from play following SRC. Immediate removal from play is the first line of prevention for prolonged SRC recovery. Removal from play may be a new modifying factor that predicts protracted SRC recovery.

1908 Board #60 June 2, 2:00 PM - 3:30 PM
The Prevalence Of Sports-related Concussion In Intramural And Club Athletes At The Collegiate Level
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No relationships reported

Sport-related concussions (SRC) are a serious brain injury that influences the physical, cognitive, emotional, and social functioning of student athletes and can impair academic performance when undetected or mismanaged. The majority of SRC research has focused on varsity university athletes, which comprises approximately 6% of the entire university student body population. There are approximately 400,000 intramural and club sport athletes that participate in similar contact and collision sports (e.g., soccer, hockey, basketball) and at risk for SRC. There is a lack of data on the prevalence of SRC in this population and the effects of SRC are unknown.

Purpose: 1) To investigate the prevalence and academic effects of SRC in university intramural and club sport athletes, and 2) to document medical oversight and access to care for SRC in this population.

Methods: A total of 900 collegiate intramural and club sport athletes (M = 20.38, SD = 2.03 years) at four southern universities completed a survey that assessed demographic information, SRC history, concussion knowledge, and barriers to seeking medical care for SRC. Descriptive statistics were used to describe medical coverage, SRC history, and academic difficulties.

Results: Sixty percent (270/452) of respondents reported having medical coverage for club games and 33% (148/454) reported coverage for practices. Medical coverage for intramural games and practices were 41% (284/698) and 82% (62/763), respectively. Medically diagnosed concussions were reported by 9% (40/501) of club athletes and 1% (10/704) of intramural athletes. Thirty-six percent (31/49) of respondents with SRC reported academic difficulties lasting 2 - 3 weeks. Only 22% (7/31) sought academic accommodations.

Conclusion: University intramural and club sport athletes also sustain SRC and experience academic difficulties following their injury. Additional resources are needed to improve care for SRC in these student-athletes.
METHODS: A total of 468 HS athletes (15.84 ± 1.23 years; 140 females - 29.9%) completed baseline VOMS testing. The VOMS is comprised of a series of vestibular (e.g., vestibular ocular motor reflex) and ocular motor components (e.g., saccadic eye movement). Symptom provocation ratings for headache, dizziness, nausea, and fogginess are recorded on a 10-point Likert scale each VOMS component. Descriptive statistics were used to document normative performance for the total sample. The percentage of baseline scores above published clinical cut-offs were tabulated for each VOMS component. Scores outside of 95% confidence intervals (CI) were documented and new cutoff scores were determined using multivariate base rates. RESULTS: Approximately 83% (388/468) of the total sample exhibited VOMS scores within the expected, normal range, whereas 17% (80/468) of the sample were above clinical cut-offs on any one VOMS item. In addition, 12% (54/468) were above clinical cut-offs on two VOMS items, 6% (27/468) were above clinical cut-offs on three VOMS items. However, the clinical cut-off of P=0.007 from VOMS items yielded an acceptable false-positive rate of less than 5% in this population. CONCLUSION: Approximately 83% athletes reported VOMS symptoms scores below clinical cut-offs. These findings suggest that researchers and sports medicine professionals should consider using clinical cutoff scores ≥ 2 on at least 4 VOMS items.

Pediatric traumatic brain injury (TBI) is among the most common causes of acquired morbidity and mortality in adolescents. Approximately, 75-85% of TBIs in children and adolescents are mild TBIs, with an estimated 10-33% of individuals experiencing persistent symptoms beyond 1 to 3 months. There is a critical need to develop evidence-based interventions for individuals with persistent symptoms. PURPOSE: We conducted a pilot randomized clinical trial (RCT) to assess benefits of aerobic exercise in adolescents with persistent symptoms after mTBI. We hypothesized that performance of aerobic exercise at sub-symptom provoking thresholds would be associated with more rapid resolution of symptoms compared to a generalized stretching intervention. METHODS: Adolescents (ages 12-17) who remained symptomatic for 4-16 weeks post mTBI were randomized to either a six week, sub-symptom provoking aerobic exercise or a stretching intervention. The primary outcomes measure, the Post-Concussion Symptom Inventory (PCSI), was completed by both the adolescent and parent at pre-injury (based on retrospective), pre-intervention, at each interval visit, and at the final assessment. RESULTS: Thirty participants were randomized into the aerobic exercise or stretching intervention. There were no statistically significant differences in baseline characteristics between the two groups. Twenty-six participants completed the study (1 dropped out, 1 failed treatment, 2 became ineligible due to non-study related injuries). Repeated measures, mixed model analysis of the adolescent reported PCSI scores (1 dropped out, 1 failed treatment, 2 became ineligible due to non-study related injuries) indicated an improved rate of recovery for the aerobic exercise compared to the stretching group (F-value=4.45, p-value=0.04). CONCLUSIONS: This randomized clinical trial supports the utilization of an active rehabilitation program in adolescents with prolonged symptoms after mTBI. Symptom ratings were improved during the six weeks of aerobic exercise versus a stretching intervention. Additional studies are needed to improve the generalizability of these results, identify individuals most likely to benefit, and determine optimal type, timing, and intensity of active rehabilitation programs for this population.

Exercise is well known to have beneficial effects on the brain, specifically on learning, memory, and mood. Recent studies have shown that aerobic exercise aids recovery in the sub-acute phase of concussion. However, research has not found any preventive strategies to reliably improve concussion outcomes. Risk factors for prolonged recovery have been identified but no modifiable factors prognosticating better recovery have been described.

PURPOSE: To determine if pre-injury exercise level correlates with improved outcomes, specifically concussion severity and duration of recovery. METHODS: A retrospective, exploratory cohort study of 247 patients age 5-18 years with concussion referred to a tertiary pediatric hospital-affiliated sports medicine clinic from July 1, 2010 through December 31, 2011 was conducted. A random sample of all eligible patient visits (3740) was chosen for review. Three subsets of patients were selected according to the Classification of Sports: high dynamic, low static sport, soccer n=32; high dynamic and low-moderate static sport, soccer and basketball combined, n= 53; and non-athletes, n=57. Statistical comparisons using Student’s t-test were made between groups. RESULTS: The percent with vestibular deficits on initial visit was equivalent across groups: 81.3% soccer, 81.1% soccer and basketball, and 80.7% non-athletes. Mean days until vestibular symptoms resolved was significantly less for athletes: 83.88 soccer vs 160 non-athletes (P=0.04), 82.4 soccer and basketball vs non-athletes (P=0.007). Average initial symptom score approached statistical significance, (24.4 for soccer and basketball vs 32.17 for non-athletes, P=0.07). Mean days of school and mean days of sport missed were not statistically significant. CONCLUSION: These findings suggest that pediatric and adolescent athletes with concussion may experience a significantly shorter recovery period, with shorter duration of vestibular symptoms compared to non-athletes, despite similar incidence of initial vestibular deficits. Also, while not statistically significant, there was a trend towards lower initial symptom score in the athlete groups. Supported by NIH, National Center for Advancing Translational Sciences UL1TR000003 for UPHS; CHOP Research Institute Clinical Translational Sciences Award Award 1912 Board #64 June 2, 2:00 PM - 3:30 PM The Effect of Repeated Head Impacts on Measures of Gait Stepping Kinematics

Jessie R. Oldham, Melissa S. DiFabio, Ryan M. DeWolf, Thomas W. Kaminski, FACSM, Thomas A. Buckley. University of Delaware, Newark, DE. Email: jroldham@udel.edu

Collegiate athletes participating in contact sports have arguably sustained large numbers of head impacts during the span of an athletic career. Alterations in gait parameters have been demonstrated following concussion; however, the effect of participation in sports with repeated head impacts on measures of gait has not been explored.

PURPOSE: To evaluate the effects of ongoing participation in contact versus non-contact sports on gait stepping characteristics. METHODS: Ninety-nine NCAA Division I student-athletes were divided into two groups based on the contact nature of his or her sport. There were 57 student-athletes (Age: 19.5 ± 1.3 years, Height: 181 ± 6.9 cm, Weight: 84.4 ± 15.3 kg) who participated in contact sports (e.g., football, men’s lacrosse, women’s soccer) and 42 student-athletes (Age: 19.7 ± 1.3 years, Height: 166.7 ± 7.9 cm, Weight: 63.3 ± 15.4 kg) in non-contact sports (e.g., softball, field hockey). All student-athletes wore three valid and reliable accelerometers (one on each foot and one on the lumbar region) and completed five standard gait trials. During a standard gait trial, the individuals were instructed to being walking on an auditory cue, transverse a 10m walkway, turn around a specified endpoint and return to the original starting position. A multivariate ANCOVA for height was utilized to investigate differences in gait velocity, stride length, and double support with subject height serving as the co-variate. RESULTS: There were no significant differences found between student-athletes participating in a contact versus non-contact sport for gait velocity (1.22 ± 0.15 m/s, 1.27 ± 0.11 m/s, p= 0.34), stride length (1.30 ± 0.11 m, 1.25 ± 0.07 m, p= 0.18) or double support time (18.82 ± 2.84%, 16.12 ± 2.47%, P= 0.61). CONCLUSION: No significant differences were seen in gait stepping characteristics between student-athletes in a contact versus non-contact sport. This suggests that the number of head impacts sustained over the course of an athletic career does not affect gait stepping kinematics. Future studies should incorporate dual task challenges and perturbation studies to further stress the postural control systems.
Attention deficit hyperactivity disorder (ADHD) is characterized by cognitive and attentional impairments, which may have implications for athletes recovering from a sports-related concussion (SRC) as symptoms and deficits of ADHD overlap with those assessed following SRC. A longer recovery from head trauma has been reported in patients with ADHD compared to those without ADHD. Additionally, increased or persistent cognitive symptoms following concussion are a risk factor for protracted recovery, independent of ADHD status. The Post-Concussion Symptom Scale (PCSS), which was used to assess patients following SRC, found that patients with ADHD had greater symptom severity and duration compared to those without ADHD. These findings highlight the importance of addressing ADHD in the context of SRC management.

CONCLUSION: The results of this study provide evidence that patients with ADHD may experience a longer recovery from SRC, highlighting the need for specialized care and management strategies for these athletes. Future research should focus on developing tailored interventions to improve recovery outcomes for athletes with ADHD following SRC.
PURPOSE: Concussion-related injuries are approximately 6% of all collegiate injuries. Assessing and managing concussions are generally a multifaceted approach (Guskiewicz et al., 2004), but research in this area has been insufficient, especially within the university football population. The purpose of this study was to evaluate symptoms and recovery periods after a concussion was identified in college football players, using balance and a computerized neurocognitive assessment tool.

METHODS: Division 1 college football athletes, from 18 to 24 years (n = 166; age, 19.3±1.2 y; height, 183.6±5.5 cm; weight, 102.7±7.6 kg), before fall practice, over a period of 3 years, underwent baseline postural stability testing (sensory organization test [SOT], NeuroCom) and the Impact assessment. Players, who had a concussion (e.g., headache, dizziness, fatigue, confusion, and/or loss of consciousness) during practice or actual competition (n=15, 18.6±1.0 y, 185.9±4.5 cm, 107.8±6.6 kg), were reevaluated on both assessments, starting at 24 hours post-concussion. When the player was considered asymptomatic, the test was repeated on the 1st and 7th day. They did not retake the online concussion assessment. A control group of non-concussed college males were age-matched to the concussed player. The controls were tested during the same time frame as the concussed players.

RESULTS: Results indicated the concussion group had a statistically significant (p = 0.037) change from their baseline SOT (balance) score and the control group (p = 0.025). This change remained significant until day 14 of post-testing. The concussion online assessment also was significant (p=0.41) from their pre-test scores.

CONCLUSIONS: The online (Impact) and balance (SOT) assessment tests, if available, should be considered as other methods of evaluating concussed college-aged football players. This information may also provide additional scientific data to aid with the decision for the player to exercise, attend football practice and, possibly, return to play. This study was only one small part of the complete evaluation provided to the decision makers (physicians, coaches, athletic trainers, and strength and conditioning coaches) in the concussed athlete’s return to play.

Figure 1: Percentage of Concussion Patients Who Received Education on Key Items at Discharge

Figure 2: Percentage of Concussion Patients Who Received Education on Key Items at Discharge Per Phone Survey

THURSDAY, JUNE 2, 2016
Repetitive Head Impacts Influence On The Postural Control System During An Athletic Season

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METHODS: Fourteen Division I football players (CON) (age = 20.4 ± 1.12 years) and fourteen non-contact athletes (NON) (2 male, 11 female; age; 19.85 ± 1.21 years) completed a single trial of two minutes of eyes open quiet upright stance on a force platform (1000Hz) prior to athletic participation (PRE) and at the end of the athletic season (POST). All CON athletes wore helmets outfitted with Head Impact Telemetry (HIT) sensors and total number of RHI and linear accelerations forces of each RHI were recorded. Center of Pressure (CoP) Peak Excursion Velocity (PV), Sample Entropy (SampEn), in the anteroposterior (AP) and mediolateral (ML) directions, and 95% Confidence Ellipse (CE) were calculated at both PRE and POST. RESULTS: CON group experienced 649.5±496.8 mean number of impacts, 1921 ± 24.8 Hz mean excursion velocity, 0.48 ± 0.08 SampEn in the AP direction, and non traditional measures of posture. CONCLUSIONS: One-way ANOVAs revealed that athletes who reported significantly greater anti-saccades (p<0.05) in the PC group (15.2 ± 7.1) than when compared to the NC group (5.4 ± 5.2), significantly greater anti-saccade duration (p=0.023) in the PC group (11.2 ± 8.8 sec) when compared to the NC group (12 ± 1.3 sec), and significantly greater average anti-saccade duration (p<0.001) in the PC group (0.671 ± 0.2 sec) when compared to the NC group (0.13 ± 0.04 sec). CONCLUSIONS: These results suggest a considerable oculomotor impairment, demonstrated by the amount and duration of anti-saccades within 24-48 hours post-concussion. These deficits may indicate that PC do not have sufficient gaze stability to adequately navigate through their environment immediately post-injury. These findings could be a novel objective marker for oculomotor impairment post-concussion. Further research needs to track these deficits longitudinally and compare oculomotor recovery with current neuropsychological and postural stability measures.
We hypothesized that SRA would significantly differ from ACA and NHC for both cognitive health in SRA, ACA and athletes without a history of concussion (NHC). However, little is known about the psycho-affective status and cognitive performance might be used to track recovery and help clinical management of athletes with persistent symptoms.

RESULTS: Statistical analysis was conducted through t-tests, correlations, hierarchical linear regression, and simple linear regression. Male and female data was analyzed separately, as gender differences were found in variables of interest. The threshold for significance was p<0.05. For males, ACT 18 seconds predicted PTSD duration related to past-concussions, SCAT3 symptoms predicted past concussion frequency, PTSD frequency, and RA frequency, and SCAT3 symptom severity predicted past concussion frequency. For females, ACT 18 seconds and SCAT3 symptom severity predicted concussion frequency and SCAT3 Balance Error Scoring System predicted PTSD frequency and RA frequency.

CONCLUSION: Overall, ACT adds predictive power and can enhance concussion assessment. ACT scores were found to correlate with concussion history unlike any of the cognitive scores from SCAT3. The data suggest that a concussion assessment that better taps into cognitive areas affected by concussions and does not prematurely return athletes to play needs to be developed. Any new tool that is developed should take into account potential gender differences in concussive histories and outcomes.

METHODS: Twenty SRA were match on age, gender, time since injury (m = 49.3 ± 40.0 days) and history of concussion (m = 2.2 ± 1.3 with twenty ACA and on age and gender with NHC. All participants completed the Beck’s Depression Inventory-II (BDI-II), which measures depression, and the Profile of Mood State (POMS), which measures aspects of mood disturbance (Tension-Anxiety, Depression-Dejection, Anger-Hostility, Fatigue-Inertia, Vigor-Activity and Confusion-Bewilderment and total mood disturbance). Participants also completed a 2-back to task to evaluate working memory and cognitive performance.

RESULTS: SRA exhibited greater depressive symptoms on the BDI-II relative to ACA and NHC (p < 0.05). SRA also differed from ACA and NHC in terms of Depression-Dejection, Anger-Hostility, Vigor-Activity, Confusion-Bewilderment, and total mood disturbance on the POMS (p < 0.05). Analysis of the 2-back revealed that SRA exhibited slower RT and lower ACC relative to NHC (p < 0.05), but not ACA. ACA did not differ from NHC on any measure.

CONCLUSIONS: These results suggest that athletes with persistent symptoms exhibit worse psycho-affective status relative to asymptomatic athletes with and history of concussion and poorer cognitive performance relative to control athletes. Thus, psycho-affective status and cognitive performance might be used to track recovery and help clinical management of athletes with persistent symptoms.
3.21 errors (±3.123). Females had superior KD scores (p<.026). Hours of sleep before 
testing showed a low positive relationship with symptom scores (p=0.049). History of depression was related to increased symptom scores (p=0.029). Females had less errors than males on modified BESS (p<.013). There was no significant findings in those with history of concussion (4.2%).

CONCLUSIONS: Similar to athletes, it cannot be assumed that a dancer’s baseline symptom score is zero. Dance requires dancers to cope with non-traditional athletes. Normative concussion baseline values are different between sexes and ages and influenced by lifestyle habits and mental health. Normative values should always be used with caution.

1928 Board #80 June 2, 3:30 PM - 5:00 PM The District of Columbia Concussion Care & Training Project: A National Model for Youth Concussion Education
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PURPOSE: The District of Columbia’s “Concussion Protection Act of 2011” legislation requires training of a broad set of athletic, school, medical and family personnel in public and private schools and non-scholastic youth sports programs to ensure increased awareness of concussion and training to properly recognize, treat, and recover from a concussion. A partnership between the Children’s National Medical Center (CNMC), MedStar Sports Medicine (MSM) and a broad set of stakeholders was established in March 2015 to develop an infrastructure and pathways for appropriate training and documentation of compliance.

METHODS: The Concussion Care & Training Program (CCTP) included 4 priority areas: Creating Awareness, Concussion Training, Policy & Protocol Development, and Education & Performance Measurement. The CCTP team implemented a combined clinical/medical and community/public health approach to provide comprehensive, up-to-date training and documentation. Partnerships were established with the Office of the Superintendent of Schools and Education, Department of Parks & Recreation with support from the Brain Injury Association of DC and the Children’s School Services to establish the necessary training needs and maximal accessibility of target audiences.

RESULTS: The evaluation and performance measurement plan provides stakeholders with key tracking data of goal attainment, and serves as a mechanism for continuous training and documentation of compliance.

1929 Board #81 June 2, 3:30 PM - 5:00 PM Determining Mean Heart Rate At Symptomatic Threshold In Post-Concussion Syndrome
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PURPOSE: As most concussion patients present to clinical settings without a baseline score, a standardized normative model to predict accommodations.

METHOD: This analysis was nested in a prospective cohort study of concussed student-athletes presenting to the primary care setting. Accommmodations Among Concussed Student-Athletes Presenting to the Primary Care Setting
Mackenzie M. Herzog1, Johna K. Register-Mihalik, Valerie J. De Maio1, Janna Fonseca2, O. Josh Bloom1. ‘University of North Carolina Chapel Hill, Chapel Hill, NC. ‘Carolina Family Practice & Sports Medicine, Cary, NC. (Sponsor: Kevin Guskiewicz, FACSM)
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PURPOSE: To describe academic accommodations primary care sports medicine physicians recommend to adolescents presenting with sports-related concussion and to identify clinical predictors of accommodations.

METHODS: This analysis was nested in a prospective cohort study of concussed student-athletes presenting to a primary care sports medicine clinic for initial evaluation. Enrolled patients (8-18 years old) were injured during organized or recreational sport, presented within 3 days of injury, and consented to participate. A standardized form including academic accommodations, return to sport guidelines, therapy prescriptions, and referrals was completed by the provider at the initial visit. Patients with no recommendation form were excluded. Recommendations were grouped into 2 academic accommodation categories: 1) cognitive (e.g. limited or no testing, extra time for schoolwork), and 2) visual-vestibular (e.g. auditory participation only, limit visual stimuli). Symptom scores were then compared between symptomatic and asymptomatic non-sport vs sport) symptoms. This could help define a more adapted starting intensity for symptomatic individuals. They could also contribute to the development of an algorithm for a sub-maximal progressive aerobic exercise therapy, which would take into account gender differences.

1930 Board #82 June 2, 3:30 PM - 5:00 PM An Assessment Of Population-based Norms In Child And Adolescent On The King-devic
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The King-Devick test (KD) has been utilized to assess visual motor deficits associated with sports related concussions. The utility of the assessment has been investigated in adults, but clinical usefulness has not been established in children and adolescents. As most concussion patients present to clinical settings without a baseline score, comparative normative data may be useful to help identify visual motor deficits associated with sports related concussion and support clinical management of return to sport.

PURPOSE: To determine age specific normative values and potential learning effects associated with repeat administration of the KD test.

METHODS: Patients, ages 11-18 years, were enrolled across two Sports Medicine Clinics for evaluation and treatment of non-concusive injuries and whose presenting complaint was not believed to confound test administration (LE injury, recovered injury, etc) were recruited for baseline testing. Testing involved the reading of numeric sequence of up to three cards while the time to completion and number of errors were recorded. Two trials were conducted for each participant, with about 15-30 seconds between trials. Paired t-tests were performed to compare Subject’s Trial 1 (KD1) to their Trial 2 (KD2) to examine the potential of an immediate learning effect. Results were then aggregated into 4 age groups (11-12, 13-14, 15-16, and 17-18).

RESULTS: 312 patients (114 male, 198 female) were enrolled in the study. There was no significant effect of age on the overall KD time (R2 = 0.001). Significant improvement of KD baseline test were noted with age and with repeat administration indicating the need for age specific normative values. Future studies are needed to determine the number of KD baseline tests necessary to negate the immediate learning effect.

1931 Board #83 June 2, 3:30 PM - 5:00 PM Predictors of Recommended Academic Accommodations Among Concussed Student-Athletes Presenting to the Primary Care Setting
Mackenzie M. Herzog1, Johna K. Register-Mihalik, Valerie J. De Maio1, Janna Fonseca2, O. Josh Bloom1. ‘University of North Carolina Chapel Hill, Chapel Hill, NC. ‘Carolina Family Practice & Sports Medicine, Cary, NC. (Sponsor: Kevin Guskiewicz, FACSM)

PURPOSE: To describe academic accommodations primary care sports medicine physicians recommend to adolescents presenting with sports-related concussion and to identify clinical predictors of accommodations.

METHODS: This analysis was nested in a prospective cohort study of concussed student-athletes presenting to a primary care sports medicine clinic for initial evaluation. Enrolled patients (8-18 years old) were injured during organized or recreational sport, presented within 3 days of injury, and consented to participate. A standardized form including academic accommodations, return to sport guidelines, therapy prescriptions, and referrals was completed by the provider at the initial visit. Patients with no recommendation form were excluded. Recommendations were grouped into 2 academic accommodation categories: 1) cognitive (e.g. limited or no testing, extra time for schoolwork), and 2) visual-vestibular (e.g. auditory participation only, limit visual stimuli). Symptom scores were then compared between symptomatic and asymptomatic non-sport vs sport) symptoms. This could help define a more adapted starting intensity for symptomatic individuals. They could also contribute to the development of an algorithm for a sub-maximal progressive aerobic exercise therapy, which would take into account gender differences.
RESULTS: 110 patients met the inclusion criteria (mean age=43±1.1 years; 57 males, 52%). Most patients received instruction for academic accommodations (N=95; 86%). The most common recommendations were: “Take rest breaks during the day as needed” (N=75, 68%), “Allow extra time to complete tasks” (N=69, 63%), and “Patient is to limit visual stimulants and screen time” (N=69, 63%). 84 patients (76%) received cognitive accommodations, 80 (73%) visual-vestibular, and 69 (63%) both. Patients with lower visual memory percentile were more likely to receive cognitive accommodations (β = 0.0175; p = 0.03). Patients with higher symptom score (β = 0.0372; p = 0.01) and lower processing speed percentile (β = 0.0223; p = 0.01) were more likely to receive visual-vestibular accommodations.

CONCLUSIONS: Most student-athletes received recommendations for accommodations. Symptom and neurocognitive measures may aid clinicians in decision-making about recommended academic accommodations. This study was funded by the National Operating Committee on Standards for Athletic Equipment.

Exercise is a cornerstone for diabetes management. Still, glycemic control has proven difficulty in exercisers with type 1 diabetes. While light to moderate aerobic and relaxation style exercise, like Yoga, frequently show reductions in glucose levels, anaerobic exercise can increase glucose due to its adrenergic effects. These effects may ensue both during and after the bout making treatment difficult and increasing risk of hypoglycemia, often occurring overnight. PURPOSE: To examine the effects of different exercise modes (Hatha Yoga versus Resistance Training) on the incidence of nocturnal hypoglycemia in adults with diabetes participating in a week-long, high volume exercise training camp. METHODS: Adults with diabetes attending the 2015 Diabetes Training Camp™ were recruited to volunteer in this study. Participants were randomized to 1 of 3 groups: 1) Hatha Yoga (Y); Resistance Training Circuit (RT); or Non-exercise control (C). Each intervention group performed 45 minutes of evening exercise for 3 consecutive days. Data were collected through either electronic uploading using continuous glucose monitoring or self-reported monitoring. RESULTS: Twelve participants provided complete data to be analyzed (6 RT, 5 Y and 1 C). Demographics involved a mean age of 49±13 years; 83% female; 92% Caucasian; BMI=26.5±3.8 kg/m²; estimated VO2peak=36±7.4 ml/kg/min. Also, 75% of the adults were current exercisers with a mean of 4.6±2.3 days of hypoglycemic events per week. No significant differences were found between the groups. Overall, 41% of the study participants experienced at least one nocturnal hypoglycemic event (1 of 6 in RT; 3 of 5 Y; and 1 of 1 C) during the 3 day study. Those who participated in either the Y or C group were more likely to experience a nocturnal hypoglycemic event compared to the Resistance Training group (p = 0.08). Additionally, 40% of the Y group experienced nocturnal hypoglycemia on at least 2 of the 3 nights compared to only 16% in the RT group (p = 0.80). CONCLUSION: Performing RT in the evening, following a high volume of various exercise activities throughout the day, may reduce the incidence of nocturnal hypoglycemia. Future studies should examine additional exercise strategies, with larger samples, to reduce the barriers of hypoglycemia in adults exercising with diabetes.

The effects of evening exercise mode on nocturnal hypoglycemia during an adult diabetes training camp

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(No relationships reported)

Exercise to see whether it would induce autophagy in those with impaired fasting glucose compared to a control group. Additionally, we examined the cellular response of rapamycin-induced autophagy between groups.

METHODS: Two groups matched for age and sex served as subjects and consisted of five insulin-resistant (IR) (44±12.9 y) and five control (43±6.11 y) adults. Subjects exercised at 50% of VO2max for one hour. Peripheral blood mononuclear cells (PBMCs) were harvested pre-, immediately after, and four-hour post-exercise. Additionally, whole blood and cells were treated with either rapamycin (RAPA) (0.5 nM) or no treatment (NT) following a 24-hour incubation period. Western blot analysis was used to detect expression of LC3-II normalized to β-actin. All values are expressed as relative quantity (RQ) compared to pre-exercise or RAPA treatment. Statistical significance between mean values were assessed with independent sample t-tests. RESULTS: We found IR individuals to have suppressed autophagy in response to acute exercise stress immediately (0.90±0.33RQ) and 4 hours-post (1.09±0.10RQ) exercise when compared to age-matched controls (0.94±0.22, 1.18±0.17RQ, respectively; p < 0.05). Additionally, a blunted autophagic response was observed in insulin-resistant individuals (1.27±0.29RQ) that was not demonstrated in control subjects (2.57±0.55, p < 0.05).

CONCLUSIONS: Our findings suggest a blunted autophagic response to exercise and nutrient deprivation (as demonstrated by RAPA treatment) in those with insulin-resistance. This may be attributed to chronically elevated basal autophagy in IR individuals that may lead to a depletion of essential autophagic components and failure to upregulate the autophagy pathway when exposed to acute stress.

The effects of evening exercise mode on markers of autophagy in insulin-resistant individuals

James J. McCormick, Trisha A. McLaren, Cassandra G. Ulrich, Karol Dokladny, Christine M. Mermer. University of New Mexico, Albuquerque, NM. (Sponsor: Ann Gibson, Ph.D., FACSM)

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Autophagy is an important cellular process that is responsible for the degradation of long-lived proteins and for the elimination of redundant or damaged cellular structures. Recently, a malfunction of the autophagic pathway has been implicated with impaired glucose metabolism. PURPOSE: We investigated a single bout of moderate intensity exercise to see whether it would induce autophagy in those with impaired fasting glucose compared to a control group. Additionally, we examined the cellular response of rapamycin-induced autophagy between groups.

METHODS: Two groups matched for age and sex served as subjects and consisted of five insulin-resistant (IR) (44±12.9 y) and five control (43±6.11 y) adults. Subjects exercised at 50% of VO2max for one hour. Peripheral blood mononuclear cells (PBMCs) were harvested pre-, immediately after, and four-hour post-exercise. Additionally, whole blood and cells were treated with either rapamycin (RAPA) (0.5 nM) or no treatment (NT) following a 24-hour incubation period. Western blot analysis was used to detect expression of LC3-II normalized to β-actin. All values are expressed as relative quantity (RQ) compared to pre-exercise or RAPA treatment. Statistical significance between mean values were assessed with independent sample t-tests. RESULTS: We found IR individuals to have suppressed autophagy in response to acute exercise stress immediately (0.90±0.33RQ) and 4 hours-post (1.09±0.10RQ) exercise when compared to age-matched controls (0.94±0.22, 1.18±0.17RQ, respectively; p < 0.05). Additionally, a blunted autophagic response was observed in insulin-resistant individuals (1.27±0.29RQ) that was not demonstrated in control subjects (2.57±0.55, p < 0.05).

CONCLUSIONS: Our findings suggest a blunted autophagic response to exercise and nutrient deprivation (as demonstrated by RAPA treatment) in those with insulin-resistance. This may be attributed to chronically elevated basal autophagy in IR individuals that may lead to a depletion of essential autophagic components and failure to upregulate the autophagy pathway when exposed to acute stress.

The effects of evening exercise mode on markers of autophagy in insulin-resistant individuals

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Type 2 diabetes (T2D) is associated with a high risk of developing physical disability, which is linked to neuromuscular dysfunction. Although the deficit in muscle strength with T2D has been well characterized, the information on the impairment in muscle fatigability is scarce and conflicting.

**Purpose**: To investigate the impact of T2D and motor nerve impairment on muscle endurance in both upper and lower body muscles. Method: From a cohort of 120 sedentary T2D males, two groups of patients (n = 15 each) belonging to the first (lower) and fourth (higher) quartile of the peroneal motor nerve conduction velocity (T1 and T4, respectively) were selected and compared with a matched control group (C).

**Results**: VO2peak, CImax, VO2, COP, and EF were lower in both upper and lower body muscles compared to controls. The relationship between VO2peak, CImax, COP, and EF was positively correlated with tHb and negatively correlated with O2HB in patients with T2DM. Among study completers (exercisers, n=51, control, n=63), the mean age was 55±6 years; 59% were men; and 59% were white. At baseline, mean BMI was 33.1±4.5 kg/m² and mean A1c was 6.6±1.4%. There were no group differences in any other study outcome at baseline. At 6 months, exercisers versus controls had adjusted -0.24% improvement in A1c versus controls (p<0.01).

**Conclusion**: Type 2 diabetes and motor nerve impairment may be a parameter more sensitive than strength to detect diabetic neuromuscular dysfunction.
Our findings support recommendations that exercise is an effective therapy for improving glycemic control and fitness and reducing fitness in T2DM. Nonetheless, the improvement in sedentary behavior was induced despite changes in total strength, VO2peak and body fat. These findings highlight that not all health benefits of exercise training should be considered contingent on changes in fitness and fitness.

### 1940 Board #92

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

**Blood Glucose Response to an Acute Bout of Aerobic and Resistance Exercise in T2DM Patients**


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(No relationships reported)

Achieving and maintaining appropriate blood glucose levels is vital to managing diabetes and has traditionally been achieved through the use of medication, dietary intervention, and exercise. ACSM recommends both aerobic (AE) and resistance exercise (RE) for the diabetic population, yet research to identify which mode of exercise elicits greater acute blood glucose (BG) response is limited when matching energy expenditure, intensity and time. PURPOSE: To determine whether a difference exists between an acute bout of AE and RE on the BG response in type II diabetic patients (T2DM).

METHODS: Sedentary males and females over 30 years of age, diagnosed with T2DM for 1-10 years (N=10) participated in an acute bout of moderate intensity RE, AE and control session. RE protocol consisted of a circuit training regimen, 6 exercises, on plate loaded machines. Subjects performed 2 sets of 12 reps at 60% of estimated 1-RM. The AE protocol consisted of walking on a treadmill at 40-60%HRR. To match energy expenditure, a portable metabolic mask was worn to measure VO2 and Kcal during exercise and for 30 mins after. BG was checked with a glucometer pre and post exercise. Multiple measures were in place to match pre BG concentrations, energy expenditure and time throughout exercise conditions. During the control session subjects self-checked and reported BG over a specific time period, while going about normal ADLs at home. RESULTS: Paired t-tests were conducted to determine if differences existed between testing conditions with respect to VO2, R-value, Kcal, MET levels, time, and RPE. Analyses revealed significant (p < .05) differences across the conditions for all the metabolic variables, except amount of time exercising. Average VO2 (ml/kg/min) for RE 9.8 ± 1.7 and AE 11.9 ± 2.6. Kcal burned for RE 194.1 ± 51.95 and AE 222.0 ± 59.3. No significant interaction (p > .05) existed for condition and time, however, results revealed a significant main effect for time with respect to BG. The average pre and post exercise BG values (mg/dl) for AE was 179.8 ± 65.90; 160.6 ± 58.41 and RE was 187.7 ± 68.93; 172.9 ± 79.17. CONCLUSION: Both AE and RE reduce BG similarly when matched for caloric expenditure. Given the difficulty controlling and matching energy expenditure between the modes of exercise, the current findings should be interpreted with caution.

### 1941 Board #93

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

**The Association between Sleep Quality, Physical Activity, and Risk of Developing Metabolic Syndrome**

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(No relationships reported)

Physical inactivity and poor sleep quality have been shown to increase the risk for Metabolic Syndrome (MetS) in middle-aged and older adults. High levels of sedentary time, independent of physical activity (PA) amount, has also shown a relationship. Whether these relationships manifest at an earlier age has not been well explored. PURPOSE: To determine the independent effects of sedentary time, sleep quality, and physical activity (PA) on risk factors for MetS in young adults. METHODS: 40 young adults (age 20±1.7; BMI 21.2±2.6) underwent waist circumference (WC), BP, HDL, HDL, and Triglycerides (TG). Stepwise linear regression was used to determine the best independent variables (significant predictors of WC (R2 = 0.49; p=.01)) and total MetS risk factors (R2 = 0.28; p=.002). SC was the only significant predictor of HDL (R2=0.13; p=0.025). CONCLUSION: Sedentary time, PA, and sleep quality are predictive of risk factors for MetS in young adults. Therefore, interventions to decrease sedentary time as well as improve PA and sleep quality should be implemented at younger ages as well as older.

### 1942 Board #94

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

**Post-Exercise Hypotension: Effects of Angiotensin II Receptor Blocker in Hypertensive Metabolic Syndrome Patients**

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(No relationships reported)

Hypertension is a modifiable risk factor for cardiovascular morbidity and mortality. Exercise has a blood pressure lowering effect in the short (i.e., post-exercise hypotension) and long term. The pharmaceutical treatment of hypertension could enhance exercise hypotension, although the interaction between hypertensive medicine and exercise is not well described. PURPOSE: To study the interaction between exercise and hypertensive medication (i.e., angiotensin II receptor type 1 blocker; ARB) in metabolic syndrome patients. METHODS: Sixteen metabolic syndrome patients medicated with ARB underwent two trials in a randomized order after an overnight fast. One trial was conducted 2 h after taking the oral antihypertensive dose of ARB (MED) and another after 36 h of ARB withdrawal (NO MED). Before and after each trial, self-reported cycling ramp exercise we measure arm and central blood pressures, pulse wave velocity and post-occlusion reactive hyperemia (PORH). RESULTS: Medication withdrawal increased systolic blood pressure by 2.6% (128.2 to 131.5 mmHg; p=0.25; ES=0.27) although non-significantly. Post-exercise hypotension was similar in the MED and NO MED trials with a lowering of 8 mmHg in systolic and 4.5 mmHg in diastolic pressure (P=0.05). However, in the MED trial post-exercise pulse wave velocity (PWV) was lower than in the NO MED trial (7.7±2.1 vs. 8.6±1.8 mm/s; p=0.029; ES=0.49) and PORH only increase after exercise in the MED trial vs. NO MED trial (6.17±4.2 to 4.4±4.2 AmVolt; p=0.033; ES=0.412). CONCLUSIONS: Although ARB withdrawal does not enhance post-exercise hypotension in hypertensive patients, it reduces arterial stiffness (PWV as an index) likely thru enhanced vasodilatory nitric oxide actions (PORH as an index).

Supported by a Grant from the Spanish Ministry of Economy and Competitivity (DEP2014-52930-R)

### 1943 Board #95

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

**Resting VO2, Significantly Lower in Non-alcoholic Fatty Liver Disease Than General Population Estimate**

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(No relationships reported)

Recent evidence suggests that oxygen consumption rate (VO2) at rest may vary with different populations from the commonly accepted 3.5 ml/kg/min. While sedentary behavior, low physical activity, fatigue, and low self-reports of quality of life are well-documented in patients with chronic liver disease (CLD), cardiorespiratory and metabolic function abnormalities which may underlie these symptoms have not been well described.

PURPOSE: Characterize resting oxygen consumption in patients with CLD and either hepatitis C (HCV) or non-alcoholic fatty liver disease (NAFLD). METHODS: Resting cardiorespiratory measures were gathered as part of two prospective research protocols in patients with CLD undergoing cardiopulmonary exercise testing (N=17, age=45.0 ± 11.2 years, 52.9% male, 58.8% Caucasian, 11.8% African American, 23.5% Latin American, 5.9% Asian, body mass index (BMI)=32.5 ± 5.8, Waist=39.7 ± 6.0, 52.9% NAFLD, 47.1% HCV (genotype 1a=60%, 5a=40%), diabetes= 3, hypertension=4, hyperlipidemia=2, hypercholesterolemia=2, ALT=53.5 ± 22.1, AST=41.9 ± 18.5, cirrhosis=3, VO2=3.26 ± .59 mL/kg/min). Age and BMI were co-varied as predictors in subsequent regression analyses comparing resting VO2 in subjects with HCV and NAFLD due to previously documented confounding effects. RESULTS: T-test comparisons showed that the NAFLD group had significantly higher % fat mass (39.2% vs. 27.4%, p=0.014) and significantly lower VO2 (3.54, p=0.017) than subjects with HCV. Subjects with NAFLD and HCV did not differ significantly from one another on age (p=0.233), BMI (p=0.110), or waist circumference (p=0.061). Regression modeling of VO2 controlling for age and BMI (R=0.239, R2=0.57, SEE= 0.616) found no significant differences between CLD subjects and population norms for resting VO2 (p=0.663).
South Asian (SOU) individuals are recognised as having excess cardiovascular risk in comparison to Caucasian (CAUC) individuals due to unfavourable risk factor prevalence’s. Resistance training (RT) has been shown to improve risk factor profiles; however recent evidence has shown that the magnitude of improvements may be racially specific. No data exist concerning the effects of RT on cardiac metabolic health between CAUCs and SOUs. PURPOSE: To evaluate the effects of RT on biomarkers of cardometabolic health in CAUC and SOU males. METHODS: CAUC (n=15, 25 ± 4 yrs) and SOU (n=13, 25 ± 7 yrs) males completed a progressive RT protocol 3 x week for 6 weeks. Glucose, insulin, insulin sensitivity (HOMA-%S, HOMA-%B), triglycerides (TRIG), high density lipoprotein (HDL), total cholesterol (TC) and C-reactive protein (CRP) were established at baseline and following RT. The linear progressive protocol involved 5 compound exercises to achieve maximum increases in muscular strength. Differences between ethnic groups, time points and their interaction were established by mixed methods repeated measures ANOVA. Statistical significance was set at α=0.05. All data are presented as percentage change (Δ) ± SD. RESULTS: No difference in baseline glucose, insulin, TRIGS, LDL, HDL, TC or CRP (P=0.05) were evident between groups. Fasting glucose concentrations significantly reduced in the CAUC (Δ -15 ± 13.9 %, P<0.05), without any change in the SOU group (Δ -7 ± 6.8 %, P=0.05 following RT. Insulin concentrations, HOMA-%S, HOMA-%B, TRIGS or CRP remained unchanged in both groups following RT (P>0.05, for all measures). LDL decreased significantly in the CAUC (Δ -32 ± 19.3 %, P<0.05) and the SOU group (Δ -35 ± 17.8 %, P<0.05) following RT. HDL significantly increased in both the CAUC (Δ +27 ± 29.3 %, P<0.05) and SOU group (Δ +24 ± 26.5 %, P<0.05) following RT. TC significantly decreased in the CAUC (Δ -18 ± 16.3 %, P<0.05) and the SOU group (Δ -23 ± 14.3 %, P<0.05) following RT. No significant differences in any measure were evident between ethnic groups at any time point (P>0.05). CONCLUSION: Short-term RT has a positive impact on some cardometabolic risk factors in young Caucasian and South Asian males.

Although obesity is a central component of the metabolic syndrome (Mets) diagnostic criteria, it is also recognized that normal-weight obesity in which body mass index is in the normal range yet adiposity is elevated and other risk factors are present can also lead to adverse health outcomes. This scenario may be more prevalent in young adults. Thus, the identification of MetS components in non-obese young adults is an important strategy to understanding the development of chronic disease later in life. PURPOSE: To quantify the prevalence of MetS components in non-obese young adults and determine self-reported weekly physical activity (PA), sedentary behaviour times (SB) and the ratio of PA/SB (the proportion of active to sedentary time) are associated with having one or more MetS components. METHODS: 77 young (20 ± 2 yrs), non-obese (BMI 22.5 ± 3.0 kg/m²) adults were assessed for MetS components, PA and SB. Participants were grouped as either having no components or one or more components of the MetS. A one-way ANOVA was used to establish differences in participant characteristics with and without MetS components and logistic regression was performed to determine the relationship between PA, SB and PA/SB with having one or more MetS components. RESULTS: 30 participants (39%) had at least one MetS component. The most prevalent MetS component was low HDL (n=21), followed by high blood pressure (n=18), large waist circumference (n=5), high triglycerides (n=3) and high fasting blood glucose (n=2). Participants with a MetS component had higher blood pressure, BMI, waist circumference, triglycerides and a lower level of HDL (all p<0.05). There was no significant relationships between having a MetS component and PA, SB or PA/SB ratio (all p>0.05). CONCLUSION: Two out of five young, non-obese participants had at least one MetS component and this was not influenced by levels of weekly PA and SB. These findings highlight that MetS components are established early in adulthood and can occur independently of obesity, PA, SB or PA/SB.
Supervised exercise training reduces liver fat and improves endothelial function, a surrogate of cardiovascular disease risk, in non-alcoholic fatty liver disease (NAFLD). Purpose: To investigate whether exercise-mediated improvements in liver fat and endothelial function are sustained 1-year following the cessation of supervision in NAFLD patients. Methods: Ten NAFLD patients (5 males, 51±13yrs, 31±3kg/m²) underwent a 16-week supervised exercise intervention. Brachial artery flow-mediated dilation (FMD), cardiorespiratory fitness, liver fat and MRI-derived abdominal fat volume were assessed at baseline, following supervised exercise training and 1-year following the cessation of supervision. Results: Exercise-mediated improvements in cardiorespiratory fitness [6.5ml.kg⁻¹.min⁻¹ (2.6, 10.3); P=0.005] and waist circumference [-5cm (-8, -2); P=0.004] reversed 1-year following the cessation of supervision [-5.6ml.kg⁻¹.min⁻¹ (-9.0, -2.1); P=0.005; & 4cm (1, 8); P=0.04 respectively]. FMD [2.8% (1.2, 4.5); P=0.004] improved following supervised exercise training but returned to baseline values 1-year following cessation of supervision [-2.9% (-5.1, -0.63); P=0.02]. Exercise-mediated reductions in liver fat [-10.4% (-20.6, -0.1); P=0.04] reversed 1-year following the completion of supervision [11.9% (0.05, 23.8); P=0.04]. There was no difference in viscera, subcutaneous or total abdominal fat between the three time points (P=0.20). Conclusion: Improvements in liver fat and endothelial function following supervised exercise training are not sustained 1-year following the cessation of supervision in NAFLD patients. This finding that continuous exercise supervision appears necessary to sustain the cardio-metabolic benefits of intervention presents a significant public health challenge.

**Supervised exercise training reduces liver fat and improves endothelial function, a surrogate of cardiovascular disease risk, in non-alcoholic fatty liver disease (NAFLD).**
CONCLUSION: There were no significant within group changes in FRS during a 16-week intervention, however, following the intervention, RSIT had better FRS, TC, VLDL-C and TG when compared to MIT. Additionally, RSIT demonstrated greater change in LDL-C and VA. Further research is needed to determine if RSIT or MIT will improve FRS.

1952  Board #104  June 2, 2:00 PM - 3:30 PM  
Post-exercise Recovery Among HIV+ And Hiv-
Hispanic Adults: Role Of Metabolic Syndrome And Lipidostrophy Status  
Maria C. Pacheco-Pares1, Jorge Santana-Baguir2, Michael J. Joyner, FACSM3, Jorge Rodriguez-Zayas2, Farah A. Ramirez-Marrero, FACSM3. 1University of Puerto Rico-Rio Piedras Campus, San Juan, Puerto Rico. 2University of Puerto Rico-Medical Sciences Campus, San Juan, Puerto Rico. 3Mayo Clinic, Rochester, MN.  

(No relationships reported)

Cardiovascular and metabolic responses to graded exercise tests (GXT) and exercise recovery have been used as markers of cardiovascular disease risk in HIV infection; however, the comparison by metabolic syndrome (metsyn) and lipidostrophy (lipo) status has not been explored.  

Purpose: To compare VO2, heart rate (HR), minute ventilation (VE), and lactate (Lac) change from peak exercise 6-min recovery in a group of Hispanic adults by metsyn status (yes vs. no) according to the NCEP-ATPIII, and HIV-lipidostrophy status (HIV-lipo, HIV-lipo-no-lipo, and HIV+).  

Methods: A group of 32 HIV-lipo (22 with, 10 without metsyn), 29 HIV-no-lipo (11 with, 18 without metsyn), and 30 HIV- (11 with, 19 without metsyn) completed a GXT using the modified Bruce protocol and 6 min recovery (3 min slow walking and 3 min sitting) while measurements of VO2, HR, VE, RER, and lactate were obtained. Two-way ANOVAs were conducted to detect differences by metsyn and lipo status, and logistic regressions to determine the influence of lipo and metsyn on exercise recovery.  

Results: Percent change from peak to 6-min recovery in VO2, VE, and lactate were not different by metsyn and lipo status. HR recovery was not different by metsyn (39.6 vs. 42.7 %, P=0.13); however, HIV-Lipo and HIV-no-lipo had a slower HR recovery compared to HIV- (39.0, 39.3 vs. 47.7 %, respectively, P=0.01) only in the group without metsyn.  

Conclusion: Similar to other studies, HR recovery appeared impaired in HIV+ Hispanic adults regardless of lipidostrophy status. However, different from other studies, our results do not support the influence of metsyn on HR recovery in this population. Supported in part by: NIH/CTSA KL2-RR024151, NIH/NCRR U54 S06014.

1954  Board #106  June 2, 3:30 PM - 5:00 PM  
The Effects of Succinate Treatment on Obesity, Insulin Resistance, and Skeletal Muscle Mitochondrial Respirasion  
Skidmore College, Saratoga Springs, NY.  
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(No relationships reported)

Obesity is a major public health problem that affects approximately 35% of US adults. Identifying novel interventions that can reduce adiposity are essential to decrease the burden of obesity on our health care system. Since obesity is associated with mitochondrial dysfunction, interventions targeting the mitochondria may be effective anti-obesity treatments.  

Purpose: We sought to determine the effect of succinate, a mitochondrial complex II electron donor, on adiposity, insulin resistance, and mitochondrial muscle respiration.  

Methods: C57Bl6 male mice were assigned to a low fat diet (LFD) or a high fat diet (HFD) for 20 weeks. After 14 weeks of the dietary intervention, mice from were assigned to a control or succinate (0.75 mg/ml in drinking water) group. Caloric intake and body mass were assessed weekly, while glucose tolerance (GT), insulin tolerance (IT), and pyruvate tolerance (PT) were assessed during the last 2 weeks of succinate treatment. Measurements of mitochondrial respiration in soleus muscle were performed using permeabilized fiber respirometry.  

Results: The HFD significantly increased body mass (48.5±0.9 vs. 31.0±0.6 g), epididymal white adipose tissue (EWAT) mass (1.9±0.2 vs. 0.87±0.2 g), and reduced the area under the curve (AUC) for GT (5973±1741 vs. 4711±1308), IT (26547±2214 vs. 15425±1650), and PT (37846±1972 vs. 25470±540). The HFD did not significantly alter soleus muscle mitochondrial respiration. Succinate treatment had no effect on caloric intake and body mass, but significantly reduced EWAT mass (1.9±0.2 vs. 1.3±0.1) in HFD mice. Although succinate treatment did not improve GT or IT, PT was significantly improved in HFD mice (AUC: 37846±1972 vs. 32513±1525). Finally, there was a trend for succinate treatment to increase complex I+II driven state 3 respiration, and complex IV activity, but these changes did not reach statistical significance.  

Conclusion: We observed no effect of succinate treatment on body mass; however, EWAT mass was significantly lower in mice treated with succinate. In the soleus muscle, there was a tendency for increased state 3 respiration, owed to greater mitochondrial content, suggestive of a succinate-induced mitochondrial biogenesis. Furthermore, succinate treatment significantly improve PT, indicating a reduction in hepatic gluconeogenesis.

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BMI 23.5±1.8, 20.2±2.5 %fat and 8.0 (28.7±4.7yr, BMI 34.8±3.2, 38.4±5.1 %fat) subjects. Body composition was obtained by Dual-energy X-ray Absorptiometry. From the hours of 0900 to 1700, subjects were fasted and wore a sleeveless T-shirt and tight-fitting shorts and stayed in a climate-controlled whole-room indirect calorimeter at randomized temperature conditions 27.0±0.5C (warm) and 21.3±0.5C (cold). Regional Tsk was continuously recorded, averaged in 15-minute intervals, and compared using independent t-tests. RESULTS: At 27C, deltoid Tsk was similar between L and O (p=0.28). At 5C, Tsk was about 2C lower (p=0.01) in the lean in the first hour, but similar afterwards. Pectoral Tsk in L was consistently higher than the O at all time points (0.7C, p<0.05). At 21C, deltoid Tsk was similar at all time points between L and O (p=0.92). However, hand Tsk was significantly lower in lean than in O at the onset of cooling (29.5±1.5C vs. 31.8±1.2C, p<0.05), and remained different until t=1.5 hr (25.2±1.6vs. 27.8±1.4C, p<0.01). Hand Tsk in O gradually decreased in a linear trend over the study duration, whereas it rapidly dropped and stabilized in L, resulting similar Tsk at t=4.5 hr (24.2±2.9 vs. 25.0±1.4C, p=0.48). Pectoral Tsk in L was higher than O at the onset of cooling (33.1±0.6vs. 32.3±0.6C, p<0.05), and remained steady over time (t=4.5 hr: 32.8±0.5C). Pectoral Tsk in O reduced linearly with time and reached 31.9±0.9C at t=4.5 hr. CONCLUSION: Our data evaluated different regional skin temperature responses in the lean vs. obese healthy young men at warm vs. cold ambient temperatures, thus suggesting adipose tissue thickness may serve as a heat insulator in the torso which delays the need for peripheral vasconstriction. Such differences may play a role in altering cold-induced thermogenesis between lean and obese men.

1956

Board #108
June 2, 3:30 PM - 5:00 PM
Associations Between Parent BMI and Obesity Related Parenting Behaviors
Joel E. Williams, Sarah G. Griffin, Clemson University, Clemson, SC.
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Purpose: The purpose of this study was to examine the relationship between parental BMI and the family environment and determine if differences exist in child diet and physical activity parenting behaviors by parental BMI in a community sample.

Methods: Parents from 10 elementary schools in a county adjacent to our university were selected using a random sampling technique. The inclusion criteria were parents of children enrolled in grades 1–5. The sample included 403 parents (66% female; 94% mothers). A parental BMI questionnaire was used to assess parental behavior related to child diet and physical activity. The Family Assessment Device (Family) was used to assess parental behavior related to child diet and physical activity parenting behaviors by parental BMI in a community sample. An additional validated measure was used to assess parental behavior related to child diet and physical activity.

Results: Parental BMI and the family environment and determine if differences exist in child diet and physical activity parenting behaviors by parental BMI in a community sample.

Conclusion: Parent BMI and parenting behaviors are known to have a major impact on child diet and physical activity. However, little is known about the specific factors that contribute to these behaviors. This study aimed to investigate the relationship between parental BMI and child diet and physical activity parenting behaviors in a community sample.

1959

Board #110
June 2, 3:30 PM - 5:00 PM
Regional Distribution of Body Composition: Associations with Metabolic Health in Overweight and Obese Adults
Katie R. Hirsch, Meredith G. Mock, Eric T. Trexler, Malia N.M. Blue, Abbie E. Smith-Ryan. University of North Carolina at Chapel Hill, Chapel Hill, NC.
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Purpose: Despite associations between excess body fat and metabolic dysfunction, there is growing recognition of metabolically healthy obese individuals. Assessment of other indicators of metabolic health beyond excess fat may provide further insight into understanding metabolic health. PURPOSE: To assess associations between total and regional body composition (fat mass [FM], lean mass [LM], percent body fat [%fat], visceral adipose tissue [VAT], and abdominal subcutaneous adipose tissue [SAT]), resting metabolic rate (RMR), and arterial function at rest (RER) and blood lipids were all significantly improved following 12-week WL phase (BMI: 37.5±0.9 vs. 33.7±0.8 kg/m²; waist circumference: 116.3±2.3 vs. 100.8±2.0 cm, p<0.001) (DLD: 145.9±11.5 vs. 96.6±7.0 mg/dl, total cholesterol: 116.9±4.6 vs. 102.7±4.2 mg/dl, p<0.01); (HR: 64.9±6.1 vs. 76.0±1.5 bpm, p<0.01; systolic BP: 125.2±1.7 vs. 116.1±1.8 mmHg, diastolic BP: 79.5±1.8 vs. 70.3±1.2 mmHg, p=0.001). Funding was provided to PJA from Isagenix International LLC (No.1307-347).

Exercise is a component of physical activity that can combat and treat metabolic disease despite little to no weight loss, however, exercise is effective at reducing fat storage in the visceral adipose tissue (VAT) depot. The distribution of body fat may be more important for the development of metabolic disease than overall adiposity as evidence suggests that the amount of VAT is more closely related to morbidity and mortality. PURPOSE: To determine the effect of interval training on body composition and VAT in overweight and obese men and women. METHODS: Overweight and obese men and women (n = 6) performed interval training 3x/wk for 8wks. Each training session was performed on a treadmill and included a 10min warm-up at 70% heart rate max (HRM) and 4 intervals at 88-92% HRM for 4min followed by 3min at 70% HRM. VO2max, body composition (DXA), and VAT mass/ volume (DIA) were measured at baseline and after the interval training program. RESULTS: Interval training resulted in a significant increase in VO2max (31.7±3.2 to 33.6±3.1 ml/kg/min, p<0.05). Exercise is a component of physical activity that can combat and treat metabolic disease despite little to no weight loss, however, exercise is effective at reducing fat storage in the visceral adipose tissue (VAT) depot. The distribution of body fat may be more important for the development of metabolic disease than overall adiposity as evidence suggests that the amount of VAT is more closely related to morbidity and mortality. PURPOSE: To determine the effect of interval training on body composition and VAT in overweight and obese men and women. METHODS: Overweight and obese men and women (n = 6) performed interval training 3x/wk for 8wks. Each training session was performed on a treadmill and included a 10min warm-up at 70% heart rate max (HRM) and 4 intervals at 88-92% HRM for 4min followed by 3min at 70% HRM. VO2max, body composition (DXA), and VAT mass/volume (DIA) were measured at baseline and after the interval training program. RESULTS: Interval training resulted in a significant increase in VO2max (31.7±3.2 to 33.6±3.1 ml/kg/min, p<0.02). Body fat percentage (34.5±4.1 to 34.3±4.2%, p = 0.1174) and android fat mass (2545.5±469 to 2570.8±527.9 g, p = 0.8048) did not change significantly with interval training. CONCLUSION: 8wks of interval training in overweight and obese men and women does not result in a decrease in overall body fat but may provide a stimulus for a reduction in VAT storage.

1958

Board #111
June 2, 3:30 PM - 5:00 PM
The Effect Of Interval Training On Body Composition And Visceral Adipose Tissue
Joseph White, Gabriel Dubis, Robert Hickner, FACSM. East Carolina University, Greenville, NC.
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Purpose: Exercise is a component of physical activity that can combat and treat metabolic disease despite little to no weight loss, however, exercise is effective at reducing fat storage in the visceral adipose tissue (VAT) depot. The distribution of body fat may be more important for the development of metabolic disease than overall adiposity as evidence suggests that the amount of VAT is more closely related to morbidity and mortality. PURPOSE: To determine the effect of interval training on body composition and VAT in overweight and obese men and women. METHODS: Overweight and obese men and women (n = 6) performed interval training 3x/wk for 8wks. Each training session was performed on a treadmill and included a 10min warm-up at 70% heart rate max (HRM) and 4 intervals at 88-92% HRM for 4min followed by 3min at 70% HRM. VO2max, body composition (DXA), and VAT mass/volume (DIA) were measured at baseline and after the interval training program. RESULTS: Interval training resulted in a significant increase in VO2max (31.7±3.2 to 33.6±3.1 ml/kg/min, p<0.05). Exercise is a component of physical activity that can combat and treat metabolic disease despite little to no weight loss, however, exercise is effective at reducing fat storage in the visceral adipose tissue (VAT) depot. The distribution of body fat may be more important for the development of metabolic disease than overall adiposity as evidence suggests that the amount of VAT is more closely related to morbidity and mortality. PURPOSE: To determine the effect of interval training on body composition and VAT in overweight and obese men and women. METHODS: Overweight and obese men and women (n = 6) performed interval training 3x/wk for 8wks. Each training session was performed on a treadmill and included a 10min warm-up at 70% heart rate max (HRM) and 4 intervals at 88-92% HRM for 4min followed by 3min at 70% HRM. VO2max, body composition (DXA), and VAT mass/volume (DIA) were measured at baseline and after the interval training program. RESULTS: Interval training resulted in a significant increase in VO2max (31.7±3.2 to 33.6±3.1 ml/kg/min, p<0.02). Body fat percentage (34.5±4.1 to 34.3±4.2%, p = 0.1174) and android fat mass (2545.5±469 to 2570.8±527.9 g, p = 0.8048) did not change significantly with interval training. CONCLUSION: 8wks of interval training in overweight and obese men and women does not result in a decrease in overall body fat but may provide a stimulus for a reduction in VAT storage.

Abstracts were prepared by the authors and printed as submitted.
Phenotype in Visceral WAT from Obese Rats. Methods: Sprague-Dawley rats were voluntary physical activity (VPA) and endurance training (ET) induce brown-adipocyte phenotype has been associated with greater whole-body energy expenditure. However, the role of circulation in response to exercise and might induce brown adipocytes-in-WAT, which white adipose tissue (WAT). The recently discovered FNDC5/irisin is secreted into Exercise-stimulated myokines have pleiotropic effects in several tissues, including patients. Such as Type-2 Diabetes. The majority of public health messaging around physical Purpose. Many sedentary adults possess not only a high body fat percentage (BFP), but also low lean body mass (LBM). The latter may predispose metabolic disease such as Type-2 Diabetes. The majority of public health messaging around physical activity centers on habitual (e.g., walking) or purposeful (e.g., jogging) aerobic activity. However, few positive effects on muscle mass result from such activities. Whilst resistance training (RT) is an obvious solution, its effectiveness in public health settings is not demonstrated. We report two community-based RT studies, Study 1 delivered to a sedentary population, Study 2 to overweight and pre-diabetic patients. Methods: In Study 1 (48-weeks), participants (n=364) were allocated to either program/exercise (PROG), un-programmed use of a community gym (FREE), or monthly physical activity counseling (PAC). A wait-list control (CONT) was employed. In Study 2 (12-weeks), overweight and pre-diabetic patients (n=141) were randomly assigned to 12 sessions of either supervised exercise (SUP), PAC, or the two combined (COMB). A wait list control was employed. Results. In Study 1, ANOVA indicated significant differences between treatments. PROG performed significantly better than CONT on strength (p=0.004) and LBM (p=0.036) and BFP (p=0.006), whilst improvements in strength only were observed in FREE (p=0.01) and PAC (p=0.014). In Study 2 ANOVA indicated no significant differences between treatments. However paired-sample t-tests indicated that SUP improved significantly pre-post on strength (p=0.001), LBM (p=0.036) and BFP (p=0.006), whilst improvements in strength only were observed in FREE (p=0.01) and PAC (p=0.014). In both studies, whilst statistically significant increases in strength were observed across all treatments, significant improvements in both strength and body composition were observed only in programmed and/or supervised conditions. Collectively data suggest that the programming and supervision of resistance training is beneficial in community settings when improvements in body composition are desired.

Conclusions. ET-related increase in skeletal muscle FNDC5 protein could, at least, mediate brown-like adipocyte phenotype in eWAT from obese rats, which was associated with reduced visceral fat accumulation.

Purpose: Low birth weight has been linked to adult obesity and poor metabolic profiles, as well as abdominal adiposity in later childhood. However, the lasting impact of low birth weight on adult body composition is unclear. Few studies have prospectively examined this relationship into adulthood using criterion measures of body composition. The purpose of this study was to assess whether birth weight influences adult adiposity and fat free mass (FFM).

Methods: We prospectively examined the relationship between birth weight and adult body composition in a cohort of Iowa Bone Development Study participants at age 19. Participants (n=147 females; 116 males) were recruited at birth. Birth weight and gestational age were verified from participant medical records at the time of recruitment. Covariates and body composition measures were collected at age 19. DEXA was utilized to measure body composition (kg fat mass [fat]), kg FFM; g visceral adipose tissue (VAT)). Gender-specific linear regression was used to assess the association between birth weight (exposure) and adult body composition (outcomes). Models controlled for age, height, fat or FFM, gestational age, and lifestyle factors including Healthy Eating Index and objectively measured moderate-to-vigorous intensity physical activity (MVPA). Fat, VAT, and MVPA were transformed due to non-normal distributions.

Results. Participants had an average birth weight of 3.51 kg (range: 0.65 - 5.17). Low birth weight, independent of gestational age, is associated with high VAT (B = -0.670; SE = 0.027; p < 0.001) and low FFM (B = 4.188; SE = 1.174; p < 0.001) in males. In females, low birth weight, independent of gestational age, is associated with high FFM (B = -2.216; SE = 0.728; p < 0.01).

Conclusions. Males born of lower birth weight may have rapid weight gain during the first years of life. This catch-up weight gain may alter the bodies’ ability to store fat, ultimately leading to higher adiposity and lower FFM in adulthood. Results for females suggest other factors may be more influential on body composition, such as genetics or lifestyle factors.

Exercise-stimulated myokines have pleiotropic effects in several tissues, including white adipose tissue (WAT). The recently discovered FNDC5/irisin is secreted into circulation in response to exercise and might induce brown adipocytes-in-WAT, which has been associated with greater whole-body energy expenditure. However, the role of exercise on FNDC5/irisin levels remains unclear. Purpose: To investigate whether voluntary physical activity (VPA) and endurance training (ET) induce brown-adipocyte phenotype in visceral WAT from obese rats. METHODS: Sprague-Dawley rats were allocated into sedentary, VPA and ET groups fed with a standard (STD, 35%Kcal-derived fat) or high-fat diet (HFD, 71% Kcal-derived fat) during 17 weeks. VPA-animals had free access to running wheel during the study. After 9 wks of hypercaloric-diet feeding, ET-animals were submitted to 8-wks treadmill while maintained dietary treatments. Gastrocnemius muscle was removed for FNDC5 protein determination by Western Blot. Visceral WAT depots were weighed and epididymal (eWAT) was used to determine mRNA levels of Bmp7 and Cidea by qPCR. Diet and exercise effects were performed using two-way ANOVA. RESULTS: The caloric intake and body weight did not differ significantly between diet groups (p<0.05). HFD-induced increase in visceral adiposity (90.0±2. vs. 10.±0.4%, p<0.05). VPA had no impact either on gastrocnemius FNDC5 protein or on eWAT Bmp7, Tmem26 and Cidea gene expression (p>0.05). Although no alterations in Bmp7 and Tmem26, ET induced an increase of Cidea expression in obese animals (43.2±17.7 vs. 216.9±20.1%, p<0.01), which was positively associated with gastrocnemius FNDC5 (p<0.001; r=0.7) and negatively associated with visceral adiposity (p<0.001; r= -0.79). CONCLUSIONS: Taken together, ET-related increase in skeletal muscle FNDC5 protein could, at least, mediate brown-like adipocyte phenotype in eWAT from obese rats, which was associated with reduced visceral fat accumulation.
Official Journal of the American College of Sports Medicine Vol. 48 No. 5 Supplement S421

were taken before, 1 day after (R+1) and 14 days after (R+14) the bed rest using magnetic resonance imaging. The cross-sectional area (CSA) of IntraMAT, SAT and skeletal muscle were measured. IntraMAT and skeletal muscle were consist of quadriceps, adductors and hamstrings.

RESULTS: After the bed rest, IntraMAT CSA was significantly decreased in the TR group (before: 25.8 ± 10.5 cm² vs. R+1: 15.1 ± 6.2 cm², p<0.010) and unchanged in CTR group. SAT CSA after the bed rest was not changed in TR and CTR groups. Skeletal muscle CSA after bed rest was significantly decreased in the CTR group and unchanged in TR group. SAT CSA at R+14 increased compared to measurements taken immediately following the before bed-rest in CTR (before: 47.5 ± 18.6 cm² vs. R+14: 57.2 ± 17.7 cm², p<0.009) and TR groups (before: 42.8 ± 24.5 cm² vs. R+14: 48.5 ± 24.7 cm², p<0.021), but was unchanged for IntraMAT and skeletal muscle CSA.

CONCLUSIONS: Resistance training during 8-week bed rest decreased IntraMAT, prevented muscle atrophy and had no effect on SAT. These results demonstrate that resistance training has a depot location specific effect on adipose tissue in bed rest.

Similarly, IL-15 stimulated (>0.05) mitochondrial activity, as indicated by increases in CS activity (43%), and GSK combined with IL-15 stimulation blunted these effects. Conclusions: Here we show, for the first time, that inhibition of PPARδ blocks the positive effects of IL-15 signaling on mitochondrial activity in SMK cells. Overall, it is clear that the IL-15-PPARδ signaling axis holds potential as a treatment for obesity.

In the management of obesity, exercise has been proposed as one of the first line strategies and skeletal muscle a key organ in energy expenditure. However, the role of exercise in biogenesis and oxidative stress, both key mechanisms in obesity development, remain unclear.

PURPOSE: Analyze the effect of exercise on mitochondrial biogenesis and oxidative stress alterations-induced by obesity in gastrocnemius muscle.

METHODS: Male Sprague-Dawley rats (n=24) were divided in two groups: a standard diet (SS, n=11) and a high-fat diet sedentary group (HS, n=13). Following 9 weeks of diet treatment, half of SS and HS group were engaged in an exercise program on treadmill for 8 weeks, 5 days/week and 1 hour/day (ST, n=5, HT, n=7). Skeletal muscle oxidative damage markers (MDA and SH) and pro-oxidant signaling proteins (SIRT3 and P66shc) content were evaluated. The content of biogenesis-related proteins (Tfm and PGC-1α) and mitochondrial complex sub-units were also assessed.

RESULTS: High-fat diet treatment (HT) induced an increase of thiols groups (0.041±0.003 vs. 0.031±0.005 mmol mg-1 protein-1, p<0.05), Sirt3 (161±19.99 vs. 100±33.06%, p<0.05), PG-1α (195±41.04 vs. 100±28.57%, p<0.05) and complex III (195±70% vs. 143 vs. 100±48.34%, p<0.05) content compared to SS. The HT animals showed a decreased Sirt3 (85.41±10.65 vs. 161±19.99%, p<0.05), PG-1α (85.10±21.66 vs. 195±41.04%, p<0.05) and complex III content (99.35±18.39 vs. 195.7±13.43%, p<0.05) compared to HS, whereas complex IV was significantly increased (20.32±8.94 vs. 93.14±7.17%, p<0.05). No changes were observed in MDA levels or P66shc and Tfm content.

CONCLUSIONS: Obesity might induce skeletal muscle mitochondrial biogenesis as an attempt to increase fatty acid oxidation, ultimately contributing to ameliorate redox pressure. In turn, the increased expression of complex IV in HT group, might have contributed to improve the oxidation of mitochondrial substrates.

The decrease of skeletal muscle performance is a major health risk in postmenopausal women. Loss of skeletal muscle mass is associated with a loss of strength but also with the development of metabolic syndrome. Isotrofine (ISO) supplementation and physical activity have shown some beneficial effects on muscle maintenance.

PURPOSE: To determine functional and metabolic adaptations of the skeletal muscle to a specific high-intensity exercise in ovary intact and ovariectomized (OVX) animals as well as its combination with an ISO-enriched diet. METHODS: Female Wistar rats were assigned to five groups: (1) sham-operated (SHAM); (2) SHAM with exercise (SHAM+EX); (3) OVX; (4) OVX+EX; (5) OVX with ISO enrichment (OVX+EX+ISO). A high intensity exercise protocol was designed for the exercise groups. Rats were trained 10 min/time, twice/day, a rest day every four days on a treadmill with an incline of 25°for 61 days and a gradually increasing velocity from 12 to 20 m/min. Lipid (cholesterol and LDL) and leptin levels in serum were also measured. Gene expression in soleus muscle was investigated by Real-time PCR. RESULTS: Body weight, visceral fat mass and serum leptin level were about 54%, 20% and 87% increased by OVX compared with SHAM (p<0.05). Exercise significantly decreased all three parameters both in SHAM (37%, 28% and 40%) and in OVX (42%, 31% and 55%) groups (p<0.05). ISO supplementation showed no additive effects. The values of cholesterol and LDL were reduced by 54% and 64% higher than those of the SHAM rats. Exercise or ISO resulted in no additional effect. Exercise increased Pparα and Myd mRNA expressions both in SHAM and OVX groups in soleus muscle. In OVX rats, the gene expression of IGF-1 was also up-regulated by exercise. Additionally, the highest expressions of Mydα and IGF-1 in OVX rats were observed in OVX+EX+ISO group (p<0.05). CONCLUSION: Estrogen deficiency resulted in effects like increasing body weight, visceral fat mass, leptin, cholesterol and LDL. The designed exercise antagonized all increasing effects except for the lipid levels.

Abstracts were prepared by the authors and printed as submitted.
In soleus muscle, the exercise enhanced gene expressions of PPARγ as a marker for regulation of insulin sensitivity. MyoD and IGF-1 gene expressions, as markers for myogenesis, were increased by exercise and its combination with ISO in O VX rats. Supported by DFG Di 716/12-1.

1968
1969

### Board #120
June 2, 3:30 PM - 5:00 PM
**The Effects Of A High-fat Diet And Exercise On The Pgc-1α-fndc5/irisin Pathway In C57bl/6 Mice**

Briannne L. Guilford, Jake C. Parson, Stephanie N. Vick, Caleb W. Grote, Janelle M. Ryals, Douglas E. Wright. 1Southern Illinois University Edwardsville, Edwardsville, IL. 2University of Kansas Medical Center, Kansas City, KS.

(No relationships reported)

**PURPOSE:** The aim of this study was to evaluate the effects of diet and exercise on FNDC5 and associated proteins.

**METHODS:** C57BL/6 mice were randomized into three groups for the 4 wk intervention: Mice were fed a standard diet (Std, n = 12), a high-fat diet (HF, n = 14), or a high-fat diet and housed individually with free access to a running wheel (HFEX, n = 14). At end stage, mice were sacrificed, the gastrocnemius was harvested, and FNDC5, UCP1, and FNDC5-1c levels were measured by western blot and normalized to α-tubulin and reported as integrated density units.

**RESULTS:** Body weight was greater in HF compared to Std (p = 0.001) and HFEX (p = 0.001) after the 4 wk intervention. (Std: 27.1 ± 1.7; HF: 30.4 ± 2.3; HFEX: 27.1 ± 1.9 g). There was a trend (p = 0.09) toward increased FNDC5 levels in HF compared to HFEX (HF: 0.73 ± 0.08 vs. HFEX: 0.51 ± 0.08). UCP1 levels were significantly lower (p = 0.05) in the HFEX (0.66 ± 0.11) compared to both Std (1.0 ± 0.19) and HF (1.1 ± 0.24). There were no significant differences among groups in PGC-1α (Std: 0.93 ± 0.17, HF: 0.67 ± 0.13, HFEX: 1.2 ± 0.36).

**CONCLUSION:** Although there were no statistically significant differences in FNDC5 levels, the trend toward increased FNDC5 in HF compared to HFEX suggests increased FNDC5 may be a compensatory mechanism to offset HF diet-induced weight gain by increasing energy expenditure. Exercise prevented excess weight gain in HF fed mice, but these effects do not appear to be mediated by increased FNDC5 levels. Further investigation, including assessment of FNDC5, PGC1-α, and UCP1 levels in adipose from these mice will be performed to confirm the effects of HF feeding on the FNDC5/irisin pathway.

**D-31**
June 2, 2:00 PM - 3:30 PM
**Differences In Peak Mets Calculated Using Standard Mets Or Rmr In Normal And Overweight/obese Adults**

Mark A. Sarzyński,1 Clemens Drenowatz,1 Madison Demello,1 Gregory A. Hand, FACSM1,2, Steven N. Blair, FACSM1,2.

1University of South Carolina, Columbia, SC. 2West Virginia University, Morgantown, WV. (Sponsor: Steven N. Blair, FACSM).

Email: sarz@mailbox.sc.edu

(No relationships reported)

**PURPOSE:** To examine differences in peak metabolic equivalents (METs) achieved calculated using standard METs (1 MET = 3.5 ml/kg/min) or resting metabolic rate (RMR; in ml/kg/min) in a large sample of adults.

**METHODS:** Participants were 419 healthy adults (51% female, 67% white, mean age 27.6 yrs) from the Energy Balance Study. RMR was measured using indirect calorimetry and fitness via maximal treadmill test with recorded gas exchange. We analyzed males and females stratified by weight status (obese/overweight: BMI ≥ 25 kg/m²; normal weight: BMI < 25 kg/m²).

**RESULTS:** Irrespective of sex, overweight/obese participants had significantly (p<0.0001) lower mean values of RMR, VOpeak, and peak standard METs achieved compared to normal weight participants (Table). However, when peak METs was calculated using measured RMR (VOpeak/RMR; both in ml/kg/min), no difference (P=0.10) in peak METs was observed between overweight/obese (14.2±2.3) and normal weight males (14.7±2.3), whereas peak RMR-based METs remained lower in overweight/obese compared to normal weight females (Table). The difference between peak METs measured via RMR or standard METs was significantly larger in overweight/obese participants, reflecting their lower RMR values (Table). **CONCLUSIONS:** As expected, overweight individuals had lower mean values of RMR, VOpeak, and peak standard METs achieved than normal weight individuals. However, when using RMR to calculate peak METs achieved, mean values were higher in all groups and similar between normal and overweight/obese males, but not females. These results highlight the limitations of quantifying maximal exercise capacity using the standard MET value.

Supported by a grant from the Coca-Cola Company.

Table: Met values for resting metabolic rate and maximal exercise capacity across sex and weight groups.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overweight/obese</td>
<td>Normal weight</td>
</tr>
<tr>
<td>n</td>
<td>VOpeak (ml/kg/min)</td>
<td>VOpeak (ml/kg/min)</td>
</tr>
<tr>
<td>80 (49)</td>
<td>23.9 (9.3)</td>
<td>31.3 (9.0)</td>
</tr>
<tr>
<td>50 (58)</td>
<td>26.6 (8.3)</td>
<td>38.0 (8.3)</td>
</tr>
<tr>
<td>Delta METs/ RMR (ml/kg/min)</td>
<td>0.41 (0.9)</td>
<td>0.08 (1.0)</td>
</tr>
<tr>
<td>VOpeak/peak METs (ml/kg/min)</td>
<td>0.10 (1.0)</td>
<td>0.09 (1.0)</td>
</tr>
<tr>
<td>Peak standard METs</td>
<td>11.7 (2.2)</td>
<td>13.4 (2.3)</td>
</tr>
<tr>
<td>Peak RMR-based METs</td>
<td>14.2 (2.3)</td>
<td>14.7 (2.3)</td>
</tr>
<tr>
<td>Peak RMR-based METs/peak standard METs</td>
<td>2.5 (1.4)</td>
<td>1.3 (1.1)</td>
</tr>
</tbody>
</table>

1 MET = 3.5 ml/kg/min, Peak standard METs = VOpeak/peak METs, Peak RMR-based METs = VOpeak/RMR (both in ml/kg/min). Data shown as mean (SD). p-values derived by students t-test.

### Board #121
June 2, 3:30 PM - 5:00 PM
**Effect Of Reduced Energy Availability By Either Diet Or Exercise On Muscle Force.**

Daniel E. Martin,1 Maria Papageorgiou,1 Hannah Colgan,1 William D. Fraser,1 Julie P. Greeves,1 Craig Sale,1 Simon B. Cooper,1 Kirsty J. Elliott-Sale.1, 1Nottingham Trent University, Nottingham, United Kingdom. 2University of East Anglia, Norwich, United Kingdom. 3Headquarters Land Forces, Andover, United Kingdom.

Email: daniel.martin@nttu.ac.uk

(No relationships reported)

Athletes often undergo periods of low energy availability (EA) and it is important to know whether muscle function is compromised as a consequence. **Purpose:** To determine the differential effects on muscle force production when low EA is attained by reduced dietary energy intake (DEI) or increased exercise energy expenditure (EEE). **Methods:** Using a randomised, counterbalanced design, 22 females (mean ± SD age: 26 ± 5 y; 11 oral contraceptive [OC] users, 11 eumenorrheic [EU]) were assessed for body composition using DEXA. They then completed three 3-day experimental conditions consisting of: controlled energy balance (EB); dietary-induced energy restriction (ER-D); and exercise-induced energy restriction (ER-E). EB was achieved by a DEI of 45 kcal kg LBM⁻¹ day⁻¹ with 0 kcal kg LBM⁻¹ day⁻¹, EER-D was achieved by a DEI of 15 kcal kg LBM⁻¹ day⁻¹ and an EEE of 0 kcal kg LBM⁻¹ day⁻¹, resulting in an EA of 15 kcal kg LBM⁻¹ day⁻¹. The same level of EA was achieved in ER-E with DEI of 45 kcal kg LBM⁻¹ day⁻¹ and treadmill running at 70% aerobic capacity until 30 kcal kg LBM⁻¹ day⁻¹ was expended. Body mass and maximal voluntary isometric force (MVIF) of the quadriceps and first dorsal interosseus (FDI) muscles were measured in the morning prior to and following each 3 day condition. Muscle force data were analysed using three way mixed-model ANOVA and body mass %change from pre to post in each condition was analysed using a one-way repeated measures ANOVA, with Bonferroni adjusted post hoc t-tests. **Results:** There was no group (OC vs. EU) effect for any measure (P=0.05). ER-D (-1.8 ± 0.6%) and ER-E (-0.9 ± 0.6%) resulted in a greater reduction in body mass than EB (0.6 ± 0.5%), with ER-D resulting in a greater reduction in body mass than ER-E (P>0.05). MVIF of the DFI muscle was maintained from pre to post in the EB, ER-D and ER-E conditions (P=0.05).Quadriiceps MVIF was maintained from pre to post in the EB and ER-D conditions, however there was a 13.1% decline in quadriceps MVIF from pre (372.6 ± 84.7 N) to post (323.9 ± 99.2 N) (P=0.017). **Conclusion:** Low EA achieved through dietary restriction had no effect on MVIF of the quadriceps or DFI muscle, however low EA caused by increased EEE resulted in a decline in MVIF of the fatigued quadriceps, which was not observed in the fresh DFI muscle. These effects were similar for both the OC and EU groups.
The table shows the average counts per 5-s for both the VA and VM.

### Results:

<table>
<thead>
<tr>
<th>Speed (km/hr)</th>
<th>Hip VA</th>
<th>VA 5.0 Hz</th>
<th>VA 9.0 Hz</th>
<th>VM 5.0 Hz</th>
<th>VM 9.0 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>94</td>
<td>246</td>
<td>306</td>
<td>386</td>
<td>238</td>
</tr>
<tr>
<td>5</td>
<td>190</td>
<td>246</td>
<td>306</td>
<td>386</td>
<td>238</td>
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<tr>
<td>7</td>
<td>226</td>
<td>246</td>
<td>306</td>
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<td>10</td>
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<td>306</td>
<td>386</td>
<td>238</td>
</tr>
</tbody>
</table>

The total sedentary time (ST) and breaks in ST with physical activity energy expenditure (PAEE) from doubly-labeled water (DLW) were used. Further, results based on accelerometer counts from only the vertical axis (VT) and from all three axes (VM3) were compared.

### Methods:

Participants wore the Actigraph GT3X+ accelerometer on the hip during waking hours for seven days twice during the study about 6 months apart. Using the average of the two measurements, total ST was estimated using cut-points of 100 (VT) and 200 (VM3) counts/min. A break in ST was defined as at least one minute of higher activity count within a sedentary bout. PAEE (kcal/day) was estimated by subtracting resting metabolic rate and the thermic effect of food from total energy expenditure derived from one DLW measurement, with a small subsample having a repeat.

Partial Spearman correlations and linear regression models were used to determine associations between total ST and breaks per sedentary hour with PAEE. Correlations and models were adjusted for age, weight, fat free mass, accelerometer wear time and moderate-to-vigorous physical activity (MVPA).

### Results:

Partial Spearman correlation coefficients between ST and PAEE ranged from -0.25 to -0.44 and correlations between breaks per sedentary hour and PAEE ranged from 0.27 to 0.34. After adjustment for within-person variation in PAEE, correlations for ST ranged from 0.38 to -0.68 and correlations for breaks per sedentary hour from 0.35 to 0.51. In adjusted models, each hour of ST was associated with lower PAEE (β = -0.66 to -0.103 kcal, p < .0001) and each break per sedentary hour was associated with higher PAEE (β = 0.21 to 0.39 kcal, p < .0001). Estimates were slightly higher for VT vs. VM3.

### Conclusions:

This study found that total ST was inversely associated and breaks in ST was positively associated with PAEE in both men and women independent of body composition and MVPA. Replacing ST with light physical activity and more frequent movement throughout the day may have an impact on an individual’s PAEE.
METHODS:
Ten subjects performed 2 hours of exercise on a treadmill using six different work to rest cycles. Subjects performed in a random order the following six isocaloric protocols:

A: 3.0 mph, 1.7% grade; 30 min rest, 30 min work
B: 3.5 mph, 3.8% grade; 20 min work, 40 min rest
C: 3.0 mph, 1.7% grade; 30 min work, 30 min rest
D: 2.5 mph, 1.1% grade; 40 min work, 20 min rest
E: 2.0 mph, 1.0% grade; 50 min work, 10 min rest
F: 1.5 mph, 1.0% grade; 60 min work, 0 min rest

Oxygen consumption was measured every minute using a metabolic cart.

RESULTS:
The measured caloric cost for protocols A and F were not significantly different than predicted (p > .05). However, in protocols B, C, D, and E the measured caloric cost was significantly greater than predicted. Specifically, the measured caloric cost for the 2 hour exercise bouts were 7-15% higher than predicted from ACSM metabolic equations. When the total caloric cost for each two hour period was separated into working and resting components, the measured versus predicted working components were not significantly different. However, the measured resting components were significantly higher than the predicted values by 24-46% for protocols B, C, D, and E (p<.05).

CONCLUSIONS:
The increased caloric cost during the resting component is believed to be due to excess post-exercise oxygen consumption. These results suggest that predictive formulas significantly underestimate the total caloric cost during work/rest exercise. Work/rest cycles utilized in an occupational setting may underestimate the total amount of work performed and result in chronic caloric deficits.

Comparison of Measured versus Predicted energy expenditure during 2 hours of work and rest

<table>
<thead>
<tr>
<th>Workload</th>
<th>Measured Energy Expenditure (kcal)</th>
<th>Predicted Energy Expenditure (kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>402.7 ± 101.3</td>
<td>388.18 ± 76.1</td>
</tr>
<tr>
<td>B</td>
<td>436.38 ± 100.4</td>
<td>387.7 ± 74.8</td>
</tr>
<tr>
<td>C</td>
<td>432.6 ± 101.1</td>
<td>385.26 ± 77.0</td>
</tr>
<tr>
<td>D</td>
<td>414.4 ± 91.4</td>
<td>386.22 ± 77.0</td>
</tr>
<tr>
<td>E</td>
<td>445 ± 113.2</td>
<td>386.0 ± 77.5</td>
</tr>
<tr>
<td>F</td>
<td>414.3 ± 114.3</td>
<td>387.8 ± 77.4</td>
</tr>
</tbody>
</table>

1976 Board #128 June 2, 2:00 PM - 3:30 PM
VALIDATION OF THE EQUIVITAL LIFIMONITOR FOR PHYSIOLOGICAL MONITORING IN AN EQUINE ENVIRONMENT
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No relationships reported

The physiological demands of horse racing remain relatively unknown, causing difficulty when prescribing specific nutrition and training guidelines for these unique weight category athletes. Physiological devices that are valid and reliable yet light in weight and robust are essential for the assessment of the physiological demands in a horse racing environment. Limited information is available on valid and reliable physiological monitoring devices to use in a real-life horse racing environment.

PURPOSE: To determine the validity of the Equivital physiological monitoring system for the assessment of heart rate (HR) and estimated energy expenditure (EE) in a horse racing environment.

METHODS: Ten male trainee jockeys (age 17 ± 1yr, height 1.74 ± 0.04m; body mass 60.4 ± 4.6kg; BMI 19.9 ± 0.9 kg·m⁻²; sum of skinfolds 44 ± 7.1mm; body fat percentage 7.8 ± 1.2%; VO₂peak 55.26 ± 4.14 ml/kg/hr; HRpeak 191 ± 8 beats/min) completed a race simulation trial on a horse racing simulator for the typical time duration to cover a race distance of 1600m. Participants wore the portable gas analysis system (Cosmed K4b²) and the Equivital simultaneously during the trial in which mean and peak HR and total estimated EE were assessed and compared.

RESULTS: During the simulated race over 1600m, peak oxygen consumption (VO₂peak) was 62 ± 9% of VO₂peak while peak heart rate (HRpeak) was 85 ± 5% HRmax as previously assessed during a maximal incremental test on a cycle ergometer. No significant differences were apparent between the portable gas analysis system and the Equivital for the measures of mean HR (133 ± 9 vs. 131 ± 18 beats/min, p=0.492), peak HR (163 ± 11 vs. 161 ± 24 beats/min, p=0.086) and total estimated EE (9.2 ± 1.2 vs. 11.3 ± 2.7 kcal; p=0.070) during the simulated race. CONCLUSION: The Equivital device provides a viable means of assessing HR and estimated EE in a horse racing environment. This may allow for the assessment of the physiological demands in real-life horse racing environments including riding out and competitive racing. Further research is required to assess the physiological demands of various racing conditions and horses to gain a greater understanding of the specific demands of the sport.

1977 Board #129 June 2, 2:00 PM - 3:30 PM
RESTING METABOLIC RATE OF SPECIFIC POPULATION SUBGROUPS IN COMPARISON TO THE STANDARD METABOLIC EQUIVALENT (MET)
Katarina Melzer1, Juliane Heydenreich1, Yves Schutz2, Anne Renaud Renaud1, Bengt Kayser3, Urs Mäder1,1 Federal Institute of Sport, Macolin, Switzerland. 2Faculty of Biology and Medicine, Fribourg, Switzerland. 3Faculty of Biology and Medicine, Lausanne, Switzerland.
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No relationships reported

PURPOSE: Metabolic equivalent (MET) represents a standard amount of oxygen consumed by the body under resting conditions that is 3.5 mlO₂/kg/min or ~1 kcal/kg/h. It is used to express the energy cost of physical activity in multiples of MET. However, universal application of the 1-MET standard was questioned, as it does not apply well to all individuals. We compared resting metabolic rate (RMR) of several population subgroups to the standard 1-MET value.

METHODS: Height, weight and RMR (indirect calorimetry) were measured in: adolescent males (n=50) and females (n=50) (15±2yr), women (31±5yr) during pregnancy (35-41 gestation week) (n=46) and 24-53 weeks postpartum (n=27) and active (physical activity level (PAL) = 1.9) men (30±7yr) (n=30). PAL (physical activity level-total energy expenditure (TEE)/RMR) was estimated analyzing 7 full day (24h) recordings of heart rate and body movement.

RESULTS: The RMR of adolescent males (1.28 kcal/kg/h (95% CI=1.24-1.33)) was significantly higher than that of adolescent females (1.11 kcal/kg/h (95% CI=1.07-1.14)), with or without the effects of puberty stage and PAL (p<0.0001). The RMR of adolescent males and females were significantly higher than the RMR of other adult subgroup (all p<0.01, respectively), or the 1-MET-value (p<0.0001, respectively). The RMR of both, underweight and normal weight male adolescents were significantly higher than the 1-MET-value (p<0.0001). The RMR of the normal weight female
1978 Board #130 June 2, 2:00 PM - 3:30 PM Validation of Physical Activity Estimated Using Wearable Devices under Free-living Conditions Haruka Murakami1, Ryoko Kawakami2, Satoshi Nakae1, Yosuke Yamada1, Yoshio Nakata1, Kazuko Ishikawa-Takata, Shigeo Tanaka1, Motohiko Miyachi1, NIBOHYN, National Institute of Health and Nutrition, Tokyo, Japan. 2Waseda University, Saitama, Japan. 1University of Tsukuba, Ibaraki, Japan. Email: haruka-m@nih.go.jp (No relationships reported)

**PURPOSE:** Higher physical activity (PA) in daily life is associated with a decrease in the risk of all-cause mortality and in prevalence of non-communicable diseases (NCDs). Thus, accurate estimation of PA is important for increasing PA and promoting the NCDs prevention. This study was performed to examine the validity of PA energy expenditure (PAEE) and PA level (PAL) estimated using twelve wearable devices under free-living conditions.

**METHODS:** Nineteen healthy adults (9 men and 10 women) aged 21-50 years wore 12 wearable devices simultaneously (five wearable devices on the waist, five on the wrist and two in the pocket including those for the consumer and the research) for consecutive 15 days in a free-living condition. PAEEs were calculated by subtracting the basal metabolic rate (BMR) from the total energy expenditure (TEE) obtained from each device application. PALs were calculated by dividing the TEE by BMR. Because some devices did not show BMR in device applications, TEE values in a day when the devices were stationary were used as BMRs. The reference PAEE and PAL were calculated by using the TEE measured by doubly labeled water (DLW) method during 15 days worn 12 wearable devices and the BMR estimated on the sleeping metabolic rate (SMR) by the metabolic chamber method on a different day.

**RESULTS:** The mean value of reference PAEE and PAL for 15 days were 1064 ±196 kcal/d (6954 to 1541 kcal/d) and 1.88 ±0.51 (1.21 to 2.32), respectively. Spearman’s rank correlation coefficients between the reference PAEE and the estimated PAEE were significant in four wearable devices (r=0.498-0.579, p < 0.05), those for PAL were significant in neither wearable devices.

**CONCLUSIONS:** The accurate ranking among individuals based on PAEE and PAL seems difficult. These results suggest that the estimation of PA using wearable devices needs to be cautiously considered.

This research was supported by the Japan Agency for Medical Research and Development (AMED).

1979 Board #131 June 2, 2:00 PM - 3:30 PM Evaluation Of Energy Intake At A Range Of Energy Flux Derived From Self-report, Doubly Labeled Water, And Activity Monitors Robin Shook1, Gregory Hand, FACSM2, Daniel O’Connor3, Clemens Drenowatz4, Gregory Welk, FACSM5, Daniel Reis6, Alicia Carriquiry7, Steven Blair, FACSM8, 1 Iowa State University, Ames, IA. 2West Virginia University, Morgantown, WV. 3University of Houston, Houston, TX. 4University of South Carolina, Columbia, SC. (Sponsor: Steven Blair, FACSM) Email: rshook@iastate.edu (No relationships reported)

**Purpose:** Self-report estimates of energy intake (EI) are adversely affected by measurement error. Recently, a simple equation has been developed and validated to estimate EI based on the energy balance equation (EI = energy storage + energy expenditure). Our goal was to compare self-report estimates of EI against two alternative approaches of evaluating EI from the energy balance equation. Methods: Body composition of participants (N=195, mean age=27.9 years, 46% female) was measured at the beginning and end of a two-week assessment period. The primary exposure was energy expenditure (EE) estimated using doubly-labeled water technique. The primary exposure was energy expenditure (EE) estimated using doubly-labeled water technique and an arm-based activity monitor (Sensewear® Mini, SWA). Reporting bias for self-reported EI was measured against self-reported EI, DLW EE, and SWA EE as follows: -22.9% ±1.7±15.5%, and 0.2±20.8%, respectively. Goldfield Cut-offs for self-reported EI, DLW EE, and SWA EE are as follows: 1.39±0.39, 1.77±0.38, and 1.77±0.38, respectively. When examined by tertiles of EE, bias of EI derived from self-report, DLW, and SWA varied between low (-17.4±27.5%, -23.9±18.1%, and 4.5±22.3%, respectively) and high groups (<25.6±19.5%, 0.4±17.5%, and 4.8±17.6%, respectively). Conclusion: These results suggest that estimation of EI based on the energy balance equation can provide reasonable estimates of group mean EI. When compared by different levels of energy flux, estimates from all methods varied by EE level, indicating a potential source of bias that requires further investigation.

For convenience, health practitioners and clinicians are inclined to classify people/patients as overweight or obese based on body mass index (BMI) cut-off points of 25 and 30 kg/m^2 respectively, irrespective of age and gender. **PURPOSE:** To identify whether, for the same levels of adiposity, BMI is the same across different age groups and gender. **METHODS:** A random sample of 4316 healthy participants were selected, aged 16 years and over, from thirty English parliamentary constituencies. A sub-sample took part in a physical appraisal yielding BMI (kg/m^2) and estimates of BF% data for 2993 healthy people (male n=1420; female n=1573). Estimates of BF% were determined using the methods based on skin fold thicknesses at four sites; the biceps, triceps, sub-scapular and supra-iliac. **RESULTS:** A two-way ANCOVA revealed significant differences in BMI between different age groups and gender (plus an interaction), using body fat (%) as the covariate. Younger males in their 20’s had greater BMI’s (by 4 kg/m^2) than older males in their 50’s for the same levels of adiposity. Similarly, younger females in their 20’s had greater BMI’s (by 3 kg/m^2) than females in their 50’s also for the same levels of adiposity. **CONCLUSIONS:** If BMI thresholds for overweight (BMI≥25 kg/m^2) and obese (BMI>30 kg/m^2) are to reflect the same levels of adiposity across all gender and age groups within a population, age- and gender-specific BMI adjustments outlined above are necessary to more accurately/fairly reflect the same critical levels of adiposity.

Abstracts were prepared by the authors and printed as submitted.
RESULTS:
In the overall analysis, CI had the better R2 value than BMI and WC. After it was broken down by gender, CI’s better correlation was better than both BMI and WC. In females, no statistical significant was noted. After the male dataset was broken down by race, CI also proved to better have a better correlation with percent body fat in blacks, whites, and Mexican-Americans. However, in Hispanics and other/multi-racial they was no statistically significant difference. Female dataset was broken down by race, and again there was no statistical difference between the measures. CI had a higher sensitivity in both males and females. If females, CI also had

CONCLUSIONS:
1. CI had a better performance for diagnosing obesity than did BMI or WC.

Two compartment (2C) models of physique assessment contain assumptions that can be overcome by a three compartment (3C) model, where total body water (TBW) is measured rather than assumed, or a four compartment (4C) model, where TBW and bone mineral content (BMC) are measured. However, as TBW is the most variable component of fat free mass (FFM) the impact of athlete presentation on measurement error in 2C models has not been established.

PURPOSE: To evaluate the impact of standardised versus non-standardised athlete presentation on technical and biological error on 2C and 3C models of physique assessment compared with the reference 4C model, over thirty six hours.

METHODS: Thirty two athletic males underwent five test sessions using dual energy x-ray absorptiometry (DXA), bioelectrical impedance spectroscopy (BIS) and air displacement plethysmography (BOD POD) to measure body composition, with combinations of these used to establish 3C and 4C models. Tests were conducted after an overnight fast (in duplicate) and ~7 hrs later after ad libitum food/ fluid and physical activity, then repeated at 24 hrs replicating the initial test, and finally~15 min after ingestion of a standardised meal. Magnitudes of changes in the mean and typical errors of measurement were assessed by standardisation.

RESULTS: Mean change scores for TBW assessment were trivial for standardised presentation tests (0.2%, -0.3%) and large for non-standardised tests (~7 hrs post ad libitum) (3.4%). Standardised presentation mean change scores for fat mass (FM) were trivial for all models but substantially large for non-standardised tests (~7 hrs post ad libitum) in BIS, 3C, and 4C models (-15.1%, -6.9% and -6.7%) and post meal (9.8%, 5.7% and 5.2%). For FFM, mean change scores for standardised presentation tests were trivial for all models but non-standardised test (~7 hrs post ad libitum) produced large changes for BIS, 3C and 4C models (3.4%, 2.3% and 2.2%), small for DXA (1%) and trivial for BOD POD (0.9%).

CONCLUSIONS: Models that included a measured TBW value from BIS (3C and 4C) were more sensitive to TBW changes in non-standardised conditions than 2C models in FM and FFM measurements. Biological error via acute hydration change in FFM is minimised over 24 hours. CI had a higher sensitivity in both males and females. If females, CI also had

1982 Board #134
June 2, 2:00 PM - 3:30 PM
Impact Of Standardised Versus Non-standardised Athlete Presentation On Technical And Biological Error In Physique Assessment Methods
Ava Kerr1, Gary J. Slater2, Nuala Byrne3.1 University of the Sunshine Coast, Sippy Downs, Australia. 2 Bond University, Robina, Australia.
Email: akerr@usc.edu.au

(No relationships reported)

1983 Board #135
June 2, 2:00 PM - 3:30 PM
A New Specific Equation for the Assessment of Body Fat Percentage in Adolescent Soccer Players
Gabriel Lozano-Berges, Ângel Matute-Llorente, Alejandro Gómez-Bruton, Jorge Marin-Puyalto, Alejandro González-Agirre, Germán Vicente-Rodriguez, José A. Caşopis. UNIVERSITY OF ZARAGOZA, ZARAGOZA, Spain.

(No relationships reported)

PURPOSE: To determine whether the commonly used anthropometric equations or a new developed specific anthropometric equation are adequate to estimate body-fat percentage (BF%) in adolescent soccer players.

METHODS: Ninety-eight players (65 males / 33 females; 13.4 ± 0.6 years) from different Spanish soccer clubs participated in the present study. Following the recommendations of the International Society of the Advancement of Kinaanthropometry (ISAK), biceps, triceps, subscapular, supraspinale, iliac-crest, abdominal, front thigh and medial calf skinfolds were measured and inserted in the following prediction equations to estimate BF%: Johnston et al., Slaughter et al., Carter et al., Faulkner et al. and Deurenberg et al. Dual energy X-ray absorptiometry (DXA) was used as a reference method to evaluate BF%. Several 2-paired samples t-test were used to compare BF% from DXA and the different equations. The validity and presence of heteroscedasticity of these equations was assessed by Bland-Altman analyses. Stepwise linear-regression was used to develop the soccer-specific equation. A cross-validation for the new anthropometric equation was performed using Stein’s equation.

RESULTS: The developed equation resulted as follows: %BF = 11.115 + 0.775*(triceps skinfold) + 0.193*(iliac-crest skinfold) - 1.606*(sex; being sex=0 for female and sex=1 for male). The present study showed that Johnston et al. equation was the only one without differences with DXA, but with tendency towards homoscedasticity. However, the proposed equation demonstrated high cross-validation prediction power (R2=0.85).

CONCLUSIONS: The specific equation developed in the present study may be the most appropriate for estimating BF% in adolescent soccer players.

1984 Board #136
June 2, 2:00 PM - 3:30 PM
Discrepancies Between Cross-calibrated DXA Scanners: Pediatric And Adult Female Body Composition
Jodi N. Dowthwaite1, Kristen A. Dunsmore2, Paula F. Rosenbaum1, Tamara A. Scarpellina1. SUNY Upstate Medical University, Syracuse, NY. 2 Syracuse University, Syracuse, NY.

Email: dowthwaj@upstate.edu

(No relationships reported)

PURPOSE: Consistency of DXA scan results is critical for data integrity. For pediatric subjects, the extent to which cross-calibration of DXA scanners alleviates model to model scanner differences is unclear. This study compared body composition measurements from cross-calibrated DXA scanners to test for systematic inter-scanner differences.

METHODS: In the current study, DXA body composition outcomes were compared for same-day whole body scans (132 females, age range: 8yrs to 24 yrs), using cross-calibrated Hologic Discovery A (DISCO) and QDR4500W (QDR) scanners. Whole body and regional lean mass (LM), non-bone lean mass (nBLM), fat mass (FM) and percent fat (PF) were evaluated (regions: sub-head, trunk, arm, leg, sum arms, sum legs). Spearman Rank tests evaluated inter-scanner correlations. Wilcoxon Signed Rank tests evaluated inter-scanner differences. Bland-Altman plots evaluated patterns of overall agreement between scanner results.

RESULTS: Spearman rank correlations were excellent (rho= 0.957 to 0.998, p<0.001). Compared to Discovery A results, QDR scans systematically underestimated LM and nBLM for all regions of interest (Wilcoxon signed rank, Z= -5.52 to -9.93, p<0.001); QDR scans systematically underestimated single arm (Z= -4.65) and leg FM (Z= -7.63) but overestimated trunk FM (Z=7.93) (p<0.001). QDR and Discovery A results were not significantly different for whole body or sub-head FM (p=0.40). Accordingly, QDR scans systematically underestimated whole body, sub-head and trunk PF, relative to Discovery A scans (Z= 2.30 to 7.90, p<0.002). Despite systematic differences, Bland-Altman plots indicated excellent overall agreement between scan results for whole body and sub-head LM, nBLM and FM. Agreement was weaker for smaller sub-regions (single arm or single leg LM, nBLM, FM; trunk PF); summing data for both limbs improved agreement (sum arms, sum legs). Percent fat results did not agree as strongly as raw mass data.

CONCLUSIONS: In pediatric and young adult subjects, systematic differences were noted between body composition results obtained on DISCO and QDR scanners, despite cross-calibration. Although inter-scanner agreement is good for most variables, most outcomes are systematically higher for Discovery A than QDR4500W.

Funding: NIH R01 AR54145; UW Madison

1985 Board #137
June 2, 2:00 PM - 3:30 PM
A Novel Equation to Assess Percent Body Fat in Human
Yair Lahav1, Yoram Epstein, FACSM. 1 Sheba Medical Center, Tel Hashomer; the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel. 2 Sheba Medical Center, Tel Hashomer; the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel.
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(No relationships reported)

Assessing correctly body fat (BF) content is important for the risk assessment of patients with cardiac-metabolic diseases and important for athletes, who have to tightly control body composition. Various methods to assess BF are practiced by clinical dieticians, sports physiologists and sports physicians. Most of them are equipment dependent or need to be measured by an experienced personnel. PURPOSE: To suggest a validated simple equation to assess %BF that is based on basic anthropometric measures. METHODS: A database of 476 non-athletes individuals (61% males, 39% female), age 20-58 years, whose anthropometric and demographic parameters were available to us served to construct the equation. Additionally, all the participants’ had
their body composition measured by DEXA (Lunar, General Electric), which served as a gold standard for BF, to which we compared our equation. Multicollinearity and Durbin-Watson for residuals analysis with Hierarchical regression were used to define the parameters that will best fit the model. RESULTS: The suggested models, for both male and females, are based on height (H) and circumferences of the abdomen (A) and neck (N) (all measurements are taken in cm): For males: %BF = 10.111 -0.239H+0.0808A+0.518*N For females: %BF = 10.951 -0.539H+0.0808A+0.518*N These linear models in the range of 10-50 %BF highly correlate with %BF measured by DEXA (r=0.79; r<0.001), no better results have been achieved with a polynomial model. The validity of the models was tested on a group of 66 individuals who registered to a health club and the measurements were taken as part of their registration protocol. The group mean (±SD) of %BF based on DEXA measurements was 33.87±10.44. The calculated %BF was 33.71±10.44 and highly correlated with the DEXA values (r=0.921, p<0.001). In comparison to DEXA values the suggested equations assessed %BF better than calculated by 4 sites skin-folds measurements (r=0.895), waist-to-hip ratio (r=0.126), bioelectrical impedance (r=0.916) and is good as 3 or 7 sites skin-folds measurements (r=0.927, r=0.936, respectively), and Bod-Pod (r=0.929) CONCLUSION: A novel valuable and very simple tool to assess accurately %BF was developed that can be applied very easily at any clinic or field studies.

1986
Board #138
June 2, 2:00 PM - 3:30 PM
Thoracic Gas Volume Changes after Weight Loss and Regain Associated with Body-Fat Measurement in Wrestlers
Emi Kondo1, Keisuke Shiose2, Keiko Motonaga2, Takuya Osawa2, Hiroiyuki Sagayama1, Yosuke Yamada2, Kohei Nakajima3, Akiko Kamei2, Hideyuki Takahashi.1 Osaka University of Health and Sport Sciences, Osaka, Japan. 2Japan Institute of Sports Sciences, Tokyo, Japan. 3University of Wisconsin, Madison, WI. 4National Institute of Health and Nutrition, Tokyo, Japan. (No relationships reported)

PURPOSE: The measurement of the thoracic gas volume (V(TG)) affects the accuracy of body composition estimation using air displacement plethysmography (ADP). A previous study reported that the V(TG) increased after 16-month mild weight loss (WL) program in overweight and obese women. However, little is still known about the effects of rapid WL and weight regain (WR) on the V(TG) regarding body composition assessment in athletes who have low body fat. We examined the effect of rapid WL and WR on the V(TG) and investigated the accuracy of ADP after rapid WL and WR in wrestlers.

METHODS: Eight male collegiate wrestlers completed 53-hour rapid WL (6% of body weight, BW) based on each wrestler’s own method, and followed by 13-hour WR with a prescribed diet. The BW, V(TG), body volume (BV), body density (D) were assessed at post-WL (from 3.5 ± 0.16 L) was not significantly different from post-WL (from 3.5 ± 0.69 L, P > 0.05) and then decreased at post-WR (from 3.9 ± 0.69 L, P < 0.01), but the predicted V(TG) did not significantly change. Compared with FM estimated using actual V(TG), the reduction in the FM during WL was significantly underestimated 0.8 ± 0.6 kg (P < 0.05) when either the V(TG) or the predicted V(TG) was used. The overestimated change in the FM was beyond the physiological adaptation of energy imbalance during the short-term experiment.

CONCLUSIONS: The V(TG) changes during rapid weight loss and regain in wrestlers. The changes in FM were underestimated when either the V(TG) or the predicted V(TG) was used. Therefore, the V(TG) should be measured with ADP during weight loss or gain programs.

This work was supported by JISS internal funding sources for research.

D-32 Free Communication/Poster - Epidemiology of Physical Activity and Health in Older Adults
Thursday, June 2, 2016, 1:00 PM - 6:00 PM
Room: Exhibit Hall A/B

1987
Board #139
June 2, 3:30 PM - 5:00 PM
Muscle-Strengthening Activity and Mortality in Older Women: A Prospective Cohort Study
Masamitsu Kamada1, Eric J. Shirota2, I-Min Lee, FACSM1, Brigham & Women’s Hospital, Harvard Medical School, Boston, MA. 1National Institute on Aging, National Institutes of Health, Bethesda, MD. (No relationships reported)

Few data exist on the association between muscle-strengthening activity (MSA) and mortality rates.

PURPOSE: To examine prospectively the association between muscle-strengthening activity and mortality from all causes, cardiovascular disease (CVD), and cancer in older women, and to evaluate the shape of any dose-response.

METHODS: In 2001, 28,882 women (average (SD) age 62.2 (6.8) years) from the Women’s Health Study who were free of CVD, diabetes, and cancer reported their physical activities, including MSA. They were followed through 2014 for mortality. Cox proportional hazards models estimated hazard ratios for mortality and restricted cubic splines were used to investigate dose-response.

RESULTS: During an average follow-up of 11.6 years, 2591 deaths occurred (360 from CVD and 706 from cancer). After adjusting for covariates including time in moderate to vigorous aerobic activities, the cumulative average time per week in MSA showed a quadratic association with all-cause mortality (P, linear trend=0.14; P, quadratic trend=0.01); hazard ratios across 5 categories of time in MSA (0; 1 to 19; 20 to 59; 60 to 149; 150+ minutes/week) for all-cause mortality were 1.0 (referent), 0.76 (95% confidence interval 0.68 to 0.86), 0.72 (0.62 to 0.84), 0.77 (0.63 to 0.95), and 1.04 (0.70 to 1.52). A significant quadratic association was also observed for CVD death (P, linear trend=0.42; P, quadratic trend=0.01) but not cancer death (P, linear trend=0.98; P, quadratic trend=0.37). Spline models also indicated a J-shaped non-linear association for all-cause mortality (P=0.02); hazard ratios of <1.00 were observed between 1 to 142 min/week of MSA, compared with none, while hazard ratios of >1.00 were seen with >142 min/week of MSA.

CONCLUSIONS: Time in MSA showed a J-shaped association with all-cause mortality in older women.

Funded by NIH grants CA047988, CA182913, HL043851, HL080467, and HL099355.

1988
Board #140
June 2, 3:30 PM - 5:00 PM
Is Cardiorespiratory Fitness Still as Relevant for Mortality Risk in the Statin Era?
Stephen W. Farrell, FACSM1, Nina B. Radford2, Laura F. DeFina1, David S. Leonard3, Carrie E. Finley1, Carolyn E. Barlow1, Benjamin L. Willis1, William L. Haskell, FACSM2. 1The Cooper Institute, Dallas, TX. 2The Cooper Clinic, Dallas, TX. 3Stanford University, Palo Alto, CA. Email: sfarrell@cooperinst.org (No relationships reported)

Risk factor prevalence, screening guidelines, and the treatment milieu for various causes of mortality have changed significantly over the past several decades.

PURPOSE: To determine if the relationship between cardiorespiratory fitness (CRF) and all-cause mortality has changed over this time period METHODS: Participants in the present study included 44,063 apparently healthy men between the ages of 20 and 80 years who completed a baseline examination including a maximal treadmill exercise test at the Cooper Clinic in Dallas, Texas between 1971 and 2005. Participants were divided into two groups: Men in Cohort 1 were examined during 1971-1987 and followed for mortality through 1992 (pre-statin era), while men in Cohort 2 were examined during 1988-2005 and followed for mortality through 2010 (statin era). All-cause mortality incidence curves across CRF levels (maximal METS) for both cohorts were developed. RESULTS: The distributions of maximal MET level were very similar in both cohorts. Additionally, an inverse relation between CRF and mortality incidence was observed in both cohorts. However, smoking and BMI-adjusted mortality incidence was significantly higher in the earlier cohort for men who achieved 5-15 METS (p=0.05). Beyond 15 METS, there was no significant difference in mortality incidence between the cohorts. CONCLUSION: Despite significant changes in risk factor prevalence, screening guidelines, and the treatment milieu for various causes of mortality, CRF remains a strong and independent risk factor in men. All men are urged to maintain a healthy level of CRF by meeting public health guidelines for physical activity.

Abstracts were prepared by the authors and printed as submitted.
PURPOSE
Obesity is a risk factor for coronary heart disease (CHD), but studies indicate that for subjects with established CHD the mortality risk is lower when body mass index (BMI) is above normal. Few studies exist on the joint effect of BMI and physical activity level on mortality in CHD. Our aim was to examine the independent and joint association of body mass index and physical activity with mortality in subjects with CHD, as well as the impact of longitudinal changes in BMI or physical activity on mortality risk.

METHODS
We did a prospective cohort study with data from 5385 subjects with CHD from the Nord-Trøndelag Health study (HUNT) in 1986-1986, 1995-1997, or 2006-2008. Of these, 3515 participated in two or more HUNT waves. BMI was classified into 3 groups: normal weight (85.25-9 kg/m2), overweight (25.09-29 kg/m2), and obese (≥ 30 kg/m2). Change in BMI (in kg/m2/year) was categorized as loss (< -0.10), stable (-0.10 to 0.09), and gain (≥ 0.10). Physical activity level was categorized as inactive, low, or high. Low and high were merged in some analyses. Changes in physical activity were categorized as stable inactive, stable active, inactive-active, and active-active. The first five years of follow-up were excluded from the analysis.

RESULTS
There were 2649 deaths during 25 (median 15.1) years of follow up. Compared to normal weight, the hazard ratio (HR) with (95% confidence interval (CI)) for mortality was for overweight 0.91 (0.83-0.99), and for obese 0.95 (0.85-1.02). Low and high physical activity was associated with reduced mortality (HR: 0.88 (0.81-0.96) and 0.82 (0.74-0.92), respectively. Compared to normal weight inactive, obese high had a HR of 0.62 (0.48-0.81). Overall, the HR for weight loss was 1.25 (1.07-1.44), compared to stable weight. For obese subjects, loss was not associated with increased risk, whereas weight gain was (HR: 1.38 (1.06-1.79)). Compared to stable active, stable inactive (HR: 1.47 (1.28-1.69) and active inactive (HR: 1.25 (1.08-1.44) had increased risk, whereas inactive-active (HR: 1.13 (0.96-1.32) had not.

CONCLUSION
Maintained or increased level of physical activity associated with improved survival in subjects with CHD. In obese, further weight gain was associated with increased risk, while for normal weight and overweight subjects weight loss was associated with risk.

1990
Board #142
June 2, 3:30 PM - 5:00 PM
Accelerometer-assessed Physical Activity, Sedentary Behavior And All-cause Mortality In The Women's Health Study
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Email: ilee@rics.bwh.harvard.edu
(No relationships reported)

A large body of epidemiologic data shows that higher levels of physical activity (PA) are associated with lower mortality rates, and an emerging body of literature suggests that higher levels of sedentary behavior (SB) are related to higher mortality rates. However, almost all these studies assessed PA and SB using self-reports.

PURPOSE: To investigate the associations of accelerometer-assessed PA and SB with all-cause mortality.

METHODS: Between 2011 and 2014, 17,418 women from the Women's Health Study wore an accelerometer (ActiGraph GT3X+) on the hip during waking hours for 7 days. Of these, 15,632 had data on at least 4 days, of at least 10 hours wear each day. Women were categorized into quartiles of time in light-intensity (LPA) and moderate-to-vigorous intensity PA (MVPA), as well as SB, using vector magnitude cutpoints developed by Sasaki et al and Aguilar-Farías et al. They were followed through 2014 for mortality, and Cox proportional hazards regression estimated hazard ratios (95% confidence intervals) associated with PA and SB.

RESULTS: Women (mean age, 72 y) were followed for an average of 1.6 years, during which 102 died. After adjusting for potential confounders and mutually adjusting for PA and SB, the hazard ratios (95% confidence intervals) for all-cause mortality associated with quartiles of time in LPA from lowest to highest were 1.00 (referent), 0.83 (0.46-1.48), 0.99 (0.53-1.82), and 0.96 (0.47-1.97), p trend = 0.75; for time in MVPA, they were 1.00 (referent), 0.83 (0.32-0.97), 0.77 (0.43-1.37), and 0.32 (0.14-0.74), p trend = 0.02. For quartiles of time in sedentary behavior, the hazard ratios were 1.00 (referent), 1.09 (0.54-2.18), 1.72 (0.86-3.41), and 1.43 (0.67-3.05); p trend = 0.35.

Although physical inactivity, cigarette smoking, and an unhealthy diet are significant underlying risk factors for cardiovascular disease (CVD), the favorable effects of not having these risk factors on CVD and chronic disease mortality in the US populations remains less explored.

PURPOSE: We investigated the combined effects of a healthy lifestyle behavior (never smoking, physically active, and healthy diet) on CVD and chronic disease mortality in the US populations.

METHODS: We followed up 15,060 men and women, aged 20 to 80 years, who participated in the Third National Health and Nutrition Examination Survey. All participants completed baseline lifestyle behavior questionnaires. A healthy lifestyle profile was defined as never smoking, physically active, and a healthy diet defined by the American Heart Association. There were a total of 1868 chronic disease deaths (967 CVD) during an average of 14.1 years of follow-up (211,667 person years).

RESULTS: After adjustment for age, sex, race, and multiple risk factors, there was an inverse association between a greater number of healthy-lifestyle behaviors and CVD mortality (P-value for trend <0.001) and chronic disease mortality (P-value for trend <0.001). Persons who were physically active, never smoked, and had a healthy diet had a 54% lower risk of CVD mortality (95% CI: 37% to 64%) and a 60% lower risk of chronic disease mortality (95% CI: 48% to 76%) compared with persons with none of the healthy lifestyle behaviors. Persons with all 3 healthy lifestyle behaviors had a 7.8 year (95% CI: 4.8 to 10.4) and a 9.8 year (95% CI: 7.5 to 11.9) longer life expectancy from CVD and chronic disease mortality, respectively, compared with
Previous epidemiologic studies have shown that physical activity is associated with a lower risk of mortality among elderly individuals. However, most of these studies measured physical activity using self-reports, and limited data are available on the associations between objectively measured physical activity and mortality in the elderly, particularly in Asian populations.

**CONCLUSION:** Eating a healthy diet, being physically active, and never smoking is significantly associated with lower risk of dying from CVD and chronic diseases in US men and women. Public health agencies should emphasize the importance of developing these healthy lifestyle behaviors across the lifespan.

**METHODS:** Data comprise the National FINRISK Prospective Study Cohort 1972-2007 with endpoints on all-cause and cause-specific mortality data from the Finnish National Register of Causes of Death over a follow-up from 3 to 38 years. A total of 62,204 participants reported information on perceived physical fitness level and a subsample of 4,947 persons underwent a non-exercise test on maximal oxygen uptake. The participants were followed up over a mean period of 9.8 years (1999-2010) for all-cause mortality. The hazard ratios for death across the quartiles of steps/day (lowest to highest) were 1.0 (referent), 0.78 (95%CI 0.41-1.47), 1.22 (95%CI 0.67-2.20), 0.43 (95%CI 0.21-0.90) (P for trend=0.035). Participants in the highest quartile had a significantly lower risk of death, compared with the lowest quartile.

**CONCLUSIONS:** A high level of pedometer-determined physical activity was significantly associated with a lower risk of all-cause mortality in physically-independent Japanese elderly individuals.

**THURSDAY, JUNE 2, 2016**

**Board #147**

**June 2, 3:30 PM - 5:00 PM**

**Self-rated Physical Fitness and Estimated Maximal Oxygen Uptake In Relation To All-cause And Cause-specific Mortality**

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(No relationships reported)

**PURPOSE:** To investigate longitudinal associations of self-rated physical fitness and estimated maximal oxygen uptake with all-cause and cause-specific mortality risk, taking into account the modifying effects of age, gender, physical activity and chronic conditions. **METHODS:** Data comprise the National FINRISK Prospective Study Cohort 1972-2007 with endpoints on all-cause and cause-specific mortality data from the Finnish National Register of Causes of Death over a follow-up from 3 to 38 years. A total of 62,204 participants reported information on perceived physical fitness level and a subsample of 4,947 persons underwent a non-exercise test on maximal oxygen uptake in 2002. From the analyses, we excluded persons with prevalent severe diseases at baseline or persons who died within two years or who developed dementia within 5 years after the follow-up had started. Cox proportional hazards models were used with adjustments for sex, education, body mass index, physical activity, smoking, severe chronic conditions and study year. **RESULTS:** During the mean follow-up of 20.0 (SD±11.2) years, altogether 14,723 (23.7%) participants died. Mortality rates per 1000 person-years for participants with good, satisfactory and poor self-rated fitness were 7.5, 12.7 and 19.6, respectively. In the fully adjusted models, poor (HR 1.9, 95%CI 1.8-2.0) and satisfactory (HR 1.4, 95%CI 1.3-1.5) self-rated fitness predicted all-cause mortality when compared to the reference group of good fitness level. Poor and satisfactory fitness levels associated directly with mortality due to cardiovascular, cerebrovascular and respiratory diseases, trauma, infections, dementia and cancer when compared to good fitness level in the fully adjusted models. In men, higher estimated maximal oxygen uptake associated with lower risk of lung cancer mortality (HR 0.8, 95%CI 0.7-0.96) when compared to low fitness in the fully adjusted models.

**CONCLUSION:** Self-rated fitness reflects a combination of unfavorable biological and lifestyle-related factors that increase mortality risk. Self-rated fitness is a feasible non-invasive method for the entire population and thus should be used more actively for preventive activities in health care.
Body fatness and decreased physical activity are associated with low serum vitamin D in children, adolescents, and adults. However, little is known regarding the etiology of vitamin D deficiency in older adults, especially in Korea.

**Purpose:** To investigate the relationships between serum vitamin D deficiency with physical activity and body fatness in older Korean adults. Methods: In a cross-sectional design, 39 men and 194 women aged >65 years underwent accelerometer-based monitoring of daily physical activity and body fatness assessment. Serum vitamin D levels were determined by using the LIASON 25(OH) Vitamin D TOTAL Assay. Based on serum vitamin D levels, subjects were classified as deficiency (>30 ng/ml), insufficiency (20–29 ng/ml), and deficiency (15–20 ng/ml) and were used to classify the subjects either active (met the recommendations) or inactive (did not meet the recommendations).

Logistic regression analyses were used to determine the odds ratio (OR) for having serum vitamin D inadequacy. Statistical significances were tested at P = 0.05. Results: Vitamin D levels were positively associated with daily step (r = 0.411 and P = 0.001), low- (r = 0.343 and P = 0.001), moderate- (r = 0.351 and P = 0.001), high-intensity physical activity (r = 0.293 and P = 0.001) and negatively associated with body mass index (r = -0.223 and P = 0.001), percent of body fat (r = -0.182 and P = 0.005) and waist circumference (r = -0.196 and P = 0.003). Compared to the active group (OR = 1), the inactive group had a significantly higher OR (OR = 4.157; 95% confidence interval = 1.688–10.235; P = 0.001) for having vitamin D deficiency even after adjusting for covariates such as age, sex, and body fatness. Conclusion: The current findings suggest that physical activity along with vitamin D supplementation should be promoted as a preventive measure against vitamin D deficiency in elderly Koreans. Supported by The National Research Foundation Grant funded by the Korean Government (2014R1A1A2056473).
lower risk of cognitive impairment than the lowest quartile (HR: 0.65, 95% CI: 0.45-0.94). Quartiles of HiLPA were inversely associated with change over time in executive function and memory z-scores (P<0.01).

**Conclusion:** Higher levels of objectively measured HiLPA were independently associated with lower incidence of cognitive impairment, and better maintenance of memory and executive function in older adults. Future PA guidelines may need to be modified to include HiLPA in addition to MVPA to sustain cognitive health in older adults.

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**PURPOSE:** sedentary behavior (SB) has been described as an independent risk factor for health problems and mortality, regardless of the amount of moderate-to-vigorous physical activity (MVPA). However, the critical roles of SB and MVPA on risk of falls was poorly investigated by objective measure of physical activity (PA). We aimed to compare the associations between SB and MVPA, and the occurrence of falls in older adults. **METHODS:** We enrolled 379 subjects aged 40-80 years that wore an ActiGraph GT3x+ accelerometer over the hip during 7 days to measure PA. Participants were inquired as follows: “Have you had a fall in the past 12 months”. Self-reported cardiovascular risk factors were recorded. We registered SB (i.e., PA < 1.5 METs) and MVPA. We also assessed isokinetic peak torque (PT) of the quadriiceps femoris, peak oxygen uptake (V’O2) on a treadmill, and lean and fat body masses (LBM; FBM) by bioelectrical impedance. We compared critical roles of SB and MVPA on the occurrence of falls by multiple logistic regression adjusted by age, sex, obesity, arterial hypertension, diabetes, dyslipidemia, smoking, LBM, peak V’O2, and quadriiceps PT. **RESULTS:** Forty-eight participants reported at least one fall (14.5%). Fallers presented lower SB and higher MVPA. They were predominantly women and older and presented higher FBM and lower peak V’O2 and quadriiceps PT (p < 0.05). MVPA, but not SB, was selected as independent predictor, increasing the odds of having a fall in 18% (Table 1). **CONCLUSION:** In older adults without mobility limitations, high MVPA increased the risk of falling. Interventions to promote MVPA should be designed including falls prevention strategies.

**Significant predictors of falls after multiple regression analysis**

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Coefficient</th>
<th>SE</th>
<th>Wald</th>
<th>p</th>
<th>Odds ratio</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVPA (%)</td>
<td>0.169</td>
<td>0.078</td>
<td>4.702</td>
<td>0.030</td>
<td>1.184</td>
<td>1.016 - 1.379</td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>1.838</td>
<td>0.550</td>
<td>11.170</td>
<td>0.001</td>
<td>6.281</td>
<td>2.138 - 18.452</td>
</tr>
<tr>
<td>Quadriceps PT (N.M)</td>
<td>-0.025</td>
<td>0.008</td>
<td>10.825</td>
<td>0.001</td>
<td>0.976</td>
<td>0.961 - 0.990</td>
</tr>
<tr>
<td>Age 60 to 80 years</td>
<td>1.326</td>
<td>0.641</td>
<td>4.271</td>
<td>0.039</td>
<td>3.765</td>
<td>1.071 - 13.235</td>
</tr>
</tbody>
</table>

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**Walking outcomes included reported walking ability scored from 0 to 9, usual gait speed as the faster of 2 trials over 6m, time to walk 400m as quickly as possible and the energetic cost of walking (ml O2/kg/meter) assessed over ground using a Cosmed K4b2 during 2.5 minutes of usual paced walking. Generalized linear regression models adjusted for age, sex, race, height and weight were used to compare mean values of the walking outcomes across the three levels of LPP RESULTS: LPP was present in 59.7% with 30.4% reporting moderate to severe pain. Greater LPP was associated with worse reported walking ability (p<0.001), a longer time to walk 400m (p<0.002) and higher energetic cost of walking (p=0.012), but not usual gait speed. Patterns of association varied - for the 400m walk those with moderate to severe pain needed more time than those with either mild or no pain (293s vs 283s; p=0.019 and 278s; p<0.001, respectively); whereas, for the energetic cost of walking, those with any LPP had higher cost (1.165 vs. 1.157; p=0.006) than those with no LPP. CONCLUSION: Among well-functioning older persons (all completed 400m without stopping), LPP within the past year was common and associated with a greater energetic cost of walking regardless of its severity. This greater cost manifests as both poorer perceived and observed walking endurance which may reflect diminishing compensatory capacity and/or increasing fatigability. Future work should evaluate how lumbo pelvic pain and pain severity may impact gait mechanics and contribute to greater energetic cost of walking and/or its consequences.
Purpose. To assess the impact of completing a 164-km road cycling event performed in a hot environment (Wichita Falls, TX in August), on endothelial markers in men and women. Methods. A total of 37 participants, 28 men and 9 women, mean age of 51.8 ± 9.5 y completed the ride. Plasma samples were collected the morning before (Pre) and immediately after (IP) completing the ride. We examined associations between changes in pre- and post-rise concentrations of endothelial cell markers - endothelin-1 (ET-1), p-selectin, and intercellular adhesion molecule 1 (ICAM-1) - as a function of race time and participant characteristics. Results. All of the endothelial cell markers (ET-1, p-selectin, and ICAM-1) increased significantly from Pre to IP. Controlling for Pre values: completion time was positively correlated with ET-1 (r=0.42, p<0.01) and negatively related to p-selectin (r=-0.42, p<0.001); percent body fat was negatively correlated with p-selectin (r=-0.40, p<0.01) and I-CAM-1 (r=-0.35, p<0.05). In addition, males had greater concentrations of I-CAM-1 (d=1.32, p<0.01) and p-selectin (d=0.84, p<0.05) than females. Conclusion. Completing a 164-km ride in the heat resulted in increased concentrations of selected endothelial cell markers in both men and women. Whereas this may suggest endothelial cell injury, it is unclear whether this activation leads to an increased risk of blood clot formation.

2004 Board #156 June 2, 2:00 PM - 3:30 PM Central Cardiovascular Adjustments in Burn Survivors Performing Steady-state Exercise in the Heat
Steven A. Romero, Daniel Gagnon, Amy N. Adams, Naomi Kennedy, Hai Ngo, Paula Y.S. Poh, Craig G. Crandall, FACSM. University of Texas Southwestern Medical Center and the Institute for Exercise and Environmental Medicine, Dallas, TX. (Sponsor: Craig Crandall, FACSM) Email: stevenromero@texashealth.org

Relative to norotemmia, cutaneous blood flow is greater during exercise performed in hyperthermic conditions in order to facilitate heat dissipation. Likewise, heart rate and cardiac output are elevated to maintain arterial blood pressure despite significant cutaneous vasodilation. However, it is unclear if these central cardiovascular adjustments occur in burn survivors exercising in hyperthermic conditions given that whole-body cutaneous vasodilation is significantly attenuated in grafted skin. Purpose: To test the hypothesis that, relative to normothermic conditions, heart rate and cardiac output are greater when burn survivors exercise in hyperthermic conditions. Methods: Ten well-healed burn survivors (6 females; age 35 ± 12 years; weight 80 ± 24 kg; mean ± SD), with an average of 51 ± 21% (range: 22 - 85%) of their body surface area burned, participated in this study. Subsequent to a 30 min rest period in the respective climate conditions, subjects performed steady-state cycling at 50W and 75W in hyperthermic (40°C, 30% relative humidity) and normothermic conditions. Oxygen uptake, heart rate, cardiac output (inert gas rebreathing), and arterial blood pressure were measured throughout. Results: Prior to exercise, oxygen uptake, heart rate, cardiac output, and arterial blood pressure were similar between thermal conditions (data not shown). Oxygen uptake was similar between thermal conditions at both workloads (P > 0.2). At 50W, heart rate (normothermia 111 ± 7 beats min⁻¹ vs. hyperthermia 125 ± 6 beats min⁻¹), and cardiac output (normothermia 9.0 ± 0.71 min⁻¹ vs. hyperthermia 10.7 ± 0.81 min⁻¹), were greater in the hyperthermic condition (both P < 0.05). At 75W, heart rate was similar between thermal conditions (normothermia 132 ± 10 beats min⁻¹ vs. hyperthermia 139 ± 7 beats min⁻¹; P = 0.27), however cardiac output was greater in the hyperthermic condition (normothermia 9.7 ± 0.91 min⁻¹ vs. hyperthermia 11.1 ± 0.81 min⁻¹; P = 0.07). Arterial blood pressure was similar between thermal conditions throughout exercise. Conclusions: Despite attenuated whole-body cutaneous vasodilation in grafted skin, the magnitude of the increase in heart rate and cardiac output are generally greater when burn survivors exercise in hyperthermic conditions.

Supported by NIH Grant R01 GM068865.

2005 Board #157 June 2, 2:00 PM - 3:30 PM Effect Of Localized Cooling On Thermo-physiological Responses To Cycling-induced Hyperthermia During Recovery In Thermally-challenging Conditions
Alton Seeley1, Christopher Cheatham2, Ross Sherman1, Yuanlong Liu1, Western Michigan University, Kalamazoo, MI. 2Grand Valley State University, Allendale, MI. (Sponsor: Kevin Jacobs, FACSM) Email: ads120@miami.edu

PURPOSE: To determine the effects of a phase changing ice-vest and a palm-cooling device on rectal and mean skin temperatures, heart rate (HR), and perceived thermal comfort during a 60 minute recovery period following exercise in the heat. METHODS: Ten recreationally active men and women (25 ± 3 years, VO2 peak: 43.6 ± 7.5 mL kg⁻¹ min⁻¹) cycled for 60 minutes at 50% VO2 peak on a friction-braked cycle ergometer while exposed to hot environmental conditions (36°C; 45% relative humidity). Following exercise, each subject donned an ice vest, used a palm-cooling device, or sat passively, in randomized order for 60 additional minutes while in hot environmental conditions. Rectal (T R) and four-site (chest, tricep, quadriceps, calf) skin (T SK) temperatures, heart rate (HR), and perceived thermal comfort (TC) were measured every 5 min throughout exercise and recovery. RESULTS: Sixty minutes of cycling in hot environmental conditions elicited an elevation in T R from baseline across all exercise bouts (PostTR: 38.29 ± 3.2°C). Significant T R gain (1.11 ± 3.4°C). Reduction in mean T R during the recovery period was significantly greater with the ice vest than the non-cooling condition (MD = 1.20 ± 0.39°C, p = 0.004), with specific differences at 10-30, 45, and 55 min of recovery (p < 0.05). Reduction in HR during recovery was found to be significantly greater with the ice vest than the non-cooling condition (MD = 8.5 ± 1.5 m/min, p = 0.001) with differences recorded at 5, 15, and 25-60 min of recovery (p < 0.05). Despite T R and HR differences, no significant T C (p = 0.61) or perceived TC (p = 0.24) effects were found between the three recovery conditions. Use of the palm-cooling device was not statistically different than the non-cooling control in any variable measured. CONCLUSION: The use of a phase-changing ice vest following exercise, while still exposed to environmental heat stress, augmented T R and HR recovery. This may be attributed to the larger surface area exposed to the cooling stimulus compared to the palm-cooling device. However, this cooling technique was not effective in lowering T R more than a non-cooling control, which arguably may play a greater role in hyperthermic fatigue. Furthermore, the use of palm-cooling was ineffective in providing thermo-physiological benefit during post-exercise recovery in a hot environment.

2006 Board #158 June 2, 2:00 PM - 3:30 PM Repeated Immersion in Cold Water Does Not Alter Physiological Responses to Exercise in the Heat
Douglas M. Jones1, Kaitlyn A. Rostomily1, Carina M. Pautz2, Danica W. Ito1, Stephen P. Bailey, FACSM2, Bart Roelands1, Romain Meeusen, FACSM3, Michael J. Buono, FACSM4, San Diego State University, San Diego, CA. 1Elon University, Elon, NC. 2Vrije Universiteit Brussel, Brussels, Belgium. (Sponsor: Michael J. Buono, FACSM)

Repeated cold stress induces physiological changes such as decreased skin temperature and a delayed onset of shivering in an effort to reduce heat loss and conserve energy during subsequent cold exposures. What remains unknown is whether repeated cold stress alters physiological and perceptual responses to exercise in the heat. Changes that occur in response to cold acclimation to attenuate heat loss could potentially result in increased body temperatures and higher thermal perceptions when exposed to a hot environment. PURPOSE: To determine if physiological and perceptual responses to exercise in the heat are influenced by repeated immersions in cold water. METHODS: Twelve healthy volunteers (age: 25.6 ± 5.2 years, height: 174.0 ± 8.9 cm, weight: 75.6 ± 13.1 kg) performed two heat trials consisting of 120 minutes of treadmill walking at 3.3 mph, 4.0% grade in 40°C and 40% RH. The first heat trial (pre-CA) was performed prior to seven 90-minute cold water immersions in 10°C water. Each immersion was separated by 24 hours. The second heat trial (post-CA) was performed 24 hours after the final immersion. Heart rate (HR), core temperature (T R), mean skin temperature (T SK), perceived exertion (RPE), thermal sensation (TS), and skin blood flow (SBF) were collected during each heat trial. Sweat rate and body heat storage were calculated for each trial. RESULTS: Significantly reduced skin temperature and a delayed onset of shivering were observed during immersion 7 when compared with immersion 1, suggesting that acclimation to cold occurred.
Findings from the heat trials revealed that mean ± SD pre-CA vs post-CA end of test values for HR (145 ± 19 vs 147 ± 21 bpm, p = 0.58), $T_e$ (38.6 ± 0.3 vs 38.5 ± 0.4°C, p = 0.11), $T_{skm}$ (36.6 ± 0.5 vs 36.5 ± 0.4°C, p = 0.36), $SHF$ (90.3 ± 27.2 vs 82.2 ± 33.5 PU, p = 0.46), RPE (12.8 ± 2.0 vs 12.8 ± 1.5, p = 1.00), $T_{skm}$ (2.9 ± 0.8 vs 2.8 ± 0.4, p = 0.59) were not negatively impacted by repeated immersion in cold water. Additionally, similar responses for SR (1.3 ± 0.3 vs 1.3 ± 0.5 L/hr, p = 0.49), and HS (32.4 ± 14.9 vs 27.6 ± 11.9 W/m², p = 0.12) were observed.

**CONCLUSION:** Findings suggest that repeated immersions in cold water do not alter physiological or perceptual responses to exercise in the heat. Future studies should seek to determine if longer adaptations to cold elicits changes when subsequently exposed to hot environments.

**2007 Board #159 June 2, 2000 PM - 3:30 PM Thermoregulatory Response of Obese and Lean Adolescent Boys Cycling at the Same Metabolic Heat Production**

Paulo L. Schi, Carolina A. Rodrigues, Tâgíl Henrique, Flavia Messias, Federal University of Rio Grande do Sul, Porto Alegre, Brazil. (Sponsor: George J.F. Heigenheiser, FACSM) Email: pschil@hotmail.com

(No relationships reported)

Adiposity is considered a factor which impairs thermoregulation during exercise in the heat. In adolescents, previous studies showed either similar or greater increase in rectal temperature (TR) in obese compared to lean. The differences amongst studies may be due to lack of controlling factors such as metabolic heat production ($H_{met}$), aerobic fitness and hydration levels. **PURPOSE:** To test the hypothesis that obese, compared to lean, adolescent boys with similar aerobic fitness and hydration levels will have greater $T_e$ increase when exercising in the heat at the same $H_{met}$. **METHODS:** Subjects were 11 heat-acclimatized boys (age 12.8 ±1.5 yrs, Tanner II-IV), five obese and six lean (%fat 38.8±12.4 vs. 15.5±3.6), with similar VO2peak by total muscle mass (70.3±10 vs. 67.7±10.5 mL.kg.min⁻¹). They performed two 25-min exercise bouts, separated by 10-min rest in a controlled hot environment (35°C, 40-45% RH). Subjects cycled at a power output that was clamped at a $H_{met}$ of 5.5W/kg calculated by VO2 and VCO2, that were measured continuously. $T_e$ and skin (Tes) temperatures were measured continuously. Body mass was measured before, and after each bout to calculate sweat volume. Boys were kept hydrated as water volume intake at rest between the exercise bouts was similar to fluid loss from the 1st bout. Results are expressed as mean±SD. **RESULTS:** The increase in $T_e$ was not different in obese (0.18±0.3°C) and lean (0.25±0.22°C) boys at the end of exercise. Pooling all boys, no significant relationship was observed between $T_e$ and fat % ($r$ = 0.25±0.22°C) boys at the end of exercise. **CONCLUSION:** The increase in same $H_{met}$ in the heat and controlled hydration and fitness levels, no difference was found in $T_e$ increase between groups despite differences in adiposity.

**2008 Board #160 June 2, 2000 PM - 3:30 PM Effect of Precooling On Cardiovascular Drift And Maximal Oxygen Uptake: A Pilot**

Charlie P. Katica¹, Jonathan Wingo, FACSM², Robert L. Herron², Greg A. Ryan², Stacy H. Bishop³, Mark Richardson². ¹Pacific Lutheran University, Tacoma, WA. ²The University of Alabama, Tuscaloosa, AL. ³Canisius College, Buffalo, NY. (Sponsor: Craig Crandall, FACSM) Email: jay.h.heaney.civ@mail.mil

(No relationships reported)

Hot environmental conditions result in substantial cardiovascular drift (CV drift) during exercise, which is proportional to reductions in maximal oxygen uptake (VO2max). Continuous cooling during exercise has been shown to mitigate the magnitude of CV drift and concomitant reduction in VO2max during prolonged, constant-rate, submaximal exercise. **PURPOSE:** To determine if precooling blunts the magnitude of CV drift and accompanying decrement in VO2max during prolonged, constant-rate, submaximal exercise in the heat. **METHODS:** After a control VO2max test, 5 men cycled on separate days at 60% VO2max for 45 min in 35°C after being cooled for 20 min (45C) or after no cooling treatment (45NC). After the 45 min, they completed a graded exercise test to measure VO2max. VO2max was also measured after 15 min of cycling at 60% VO2max on a different day (15max), so that CV drift and VO2max could be measured over the same points in time. **RESULTS:** Precooling successfully lowered mean skin temperature just before the start of exercise (+SD; 32.9 ± 0.4 °C vs. 34.5 ± 1.3 °C for 45C and 45NC, respectively, P < 0.05), but rectal (37.0 ± 0.3 °C and 36.7 ± 0.1 °C for 45C and 45NC, respectively, P = 0.51) and mean body temperatures (36.3 ± 0.4 °C and 36.3 ± 0.4 °C for 45C and 45NC, respectively, P = 0.98) were unaffected. During subsequent exercise, the magnitude of CV drift was unaffected by precooling (P > 0.05), and VO2max also was unaffected (45C = 2.49 ± 0.2 L·min⁻¹ vs. 45NC = 2.41 ± 0.2 L·min⁻¹, P = 0.53). **CONCLUSIONS:** Precooling of the head, neck, quadriceps, calves and torso has no effect on the magnitude of CV drift and decrease in VO2max during subsequent exercise in the heat.

**2009 Board #161 June 2, 2000 PM - 3:30 PM A Passive Hyperthermia Bout on Glucose Tolerance and Leptin Responses in Obese Type 2 Diabetics**

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(No relationships reported)

**BACKGROUND:** Acute and chronic hyperthermia treatments in animal diabetic models have repeatedly resulted in improved insulin sensitivity and glycemic control. **PURPOSE:** This study tested the hypothesis that an acute 1 h bout of hyperthermic treatment would improve glucose, insulin, and leptin responses to an oral glucose challenge (OGTT) in obese type 2 diabetics and healthy humans. **METHODS:** Nine obese (45±7.1% fat mass) type 2 diabetics (DM2: 50.1±12y, 7.5±1.8% HbA1c) absent of insulin therapy and nine similar aged (41±13.7y, P = 0.185) healthy non-obese controls (33.4±7.8% fat mass, P = 0.009; 5.3±0.4% HbA1c, P = 0.007) participated. Using a randomized design, subjects underwent both a whole-body passive hyperthermia treatment via head-out warm water immersion (1 hr resting in 39.4 ± 0.4 °C water) that increased internal body temperature by ~1.6 °C and a non-immersion control resting trial. Twenty-four hours post treatment trials, a 75 g OGTT was administered to evaluate changes in plasma glucose, insulin, C-peptide, and leptin concentrations. **RESULTS:** Warm water immersion resulted in similar increases in internal body temperature (ΔTear, 1.6 ± 0.4 °C), mean skin temperature (ΔTsk, 6.5 ± 0.8 °C), and heart rate (ΔHR from rest, 33.5 ± 8.3 bpm) between groups. The hyperthermic exposure did not alter area under the curve responses for plasma glucose, insulin, or C-peptide during the OGTT in either group, relative to the control trial. Fasted absolute and normalized (per kg fat mass) plasma leptin significantly increased (P < 0.009) in both DM2 and control groups 24 hours after hyperthermic treatment, and remained elevated at 120 min post OGTT (P < 0.001) when compared to the control trial. **CONCLUSIONS:** These data indicate that 1 h hyperthermic treatment does not improve glucose or insulin responses to a glucose challenge 24 h post treatment in moderate metabolic controlled obese DM2 or healthy individuals. However, hyperthermia elevated plasma leptin levels independent of fat mass which may alter appetite in both populations. Thus, chronic hyperthermia treatments may be an avenue for reducing caloric intake, reducing fat mass, and thus improving metabolic control.

**2010 Board #162 June 2, 2000 PM - 3:30 PM Reproducibility of a Heat Tolerance Test: Evaluating Return to Duty Status in Heat Injured Warfighters**

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(No relationships reported)

**PURPOSE:** Certain Military Occupational Specialty Specialty populations require thermoregulatory capacity be evaluated for warfighters who have experienced a heat stroke injury as part of their “Return to Duty” determination. Within the Navy and Marine Corp, the NHRC Heat Tolerance Test (HTT) is utilized, requiring the completion of a 120 min HTT with a core temperature ($T_{e}$) ≤38.6°C. Data are presented evaluating the reproducibility of the NHRC HTT performed by warfighters recovering from a heat stroke injury. **METHODS:** Forty male, active-duty volunteers with a prior heat stroke injury (age 24.9 ± 4.8 yrs; ht 179.6 ± 6.9 cm; wt 86.0 ± 8.0 kg) completed two HTT trials of continuous treadmill walking (3.3 mph, 4% grade) exposed to 40°C, 40% RH. $T_{e}$ and HR were recorded every minute during each trial. There was a minimum of 3 days separating the repeat trials. A repeated measures ANOVA was used to test for significance (p = 0.05) between trials. **RESULTS:** Of the 80 simulated HTTs (0-120 min) that were evaluated, 31 subjects (62 trials) passed both HTT trials. Six subjects failed both trials and 3 subjects failed trial 1 but passed trial 2. Analysis of $T_{e}$ values between trial 1 (1.1 ± 0.6 °C) and trial 2 (1.1 ± 0.4 °C), respectively, revealed no significant differences (p > 0.05).
The progressive increase in heart rate (HR) and decrease in stroke volume (SV) — known as cardiovascular (CV) drift — is associated with a reduction in maximal oxygen uptake (VO₂max). External body cooling by fan airflow mitigates the decrease in VO₂max associated with CV drift during cycling in hot conditions. It remains unknown whether internal body cooling via ice slurry ingestion elicits a similar response.

PURPOSE: To investigate the effect of ice slurry ingestion on CV drift and VO₂max during heat stress.

METHODS: Eight men (mean ± SD; age = 22 ± 4 y, height = 182.2 ± 6.0 cm, mass = 76.3 ± 11.2 kg, body fat = 9.1 ± 3.9%; VO₂max = 52 ± 7.9 mL·kg⁻¹·min⁻¹) completed a graded exercise test on a cycle ergometer in 22 °C to measure VO₂max. Then on 3 separate counterbalanced occasions, they cycled at 60%VO₂max in hot conditions (35 °C, 40% RH) for either 15 min, 45 min with tepid (23 °C) fluid ingestion, it did not mitigate the decline in VO₂max in heat stress.

RESULTS: The increase in HR was twice as large in 45FL (8.4%) compared to 45ICE (P ≤ 0.05). VO₂peak decreased by 8.8% but was not different between conditions (P > 0.05).

CONCLUSIONS: While ice slurry ingestion attenuated CV drift more than fluid ingestion, it did not mitigate the decline in VO₂max. Further research is warranted to determine if ice slurry ingestion mitigates the decline in VO₂max during exercise at higher intensities and/or in more extreme heat stress.

**References**

During ultra-endurance events, thermoregulation plays an important role in guaranteeing physical performance and avoiding health problems (i.e. heat stroke). Hyperthermia occurs when the core temperature rises above 38.5°C. Weather conditions (heat & humidity) or training level of athletes may affect thermoregulation. PURPOSE: To measure core temperature (Tcore) in high-level triathletes during the Ironman World Championship (Hawaii) under thermal stress conditions. METHOD: Tcore of fifteen triathletes (age: 36.11±7.36 years, weight: 71.14±7.12 kg, height: 179:±0.04 cm, fat %: 8.48±0.085) who classified for the Ironman World Championship in Kailua-Kona were measured using an ingestible pill telemetry system before competition, upon completion of the event (marathon) and after 60 minutes of recovery. Event mean ambient temperature was 29.1 °C (range 20-36 °C) and relative humidity was 76% (range 71-88%). Body Mass Index (BMI) and exercise perceived exertion (Borg Scale and Visual Analog Scale-Pain) were measured before the event and 60 minutes after the event. Performance variables were extracted from their own GPS and official race times and splits. Statistical analysis was performed using Repeated Measures Test, ANOVA. RESULTS: Finish time (hh:mm:ss) was 10:06:56 ± 0:48:30. Initial Tcore was 36.62 ± 0.17 °C, increasing at the end of the event (38.55 ± 0.50 °C), and remaining high 60 minutes after the event (38.65 ± 0.41°C). BMI significantly decreased after the event (22.85 ± 1.11 vs. 21.73 ±1.36 p<0.05) while exercise perceived exertion - Borg Scale (10.2 ± 1.64 vs. 18.60 ± 1.67 p<0.03) and perceived muscle pain - VAS Pain (2.75 ± 1.59 vs. 9.08 ± 1.13 p<0.001) increased significantly after the event. CONCLUSION: High-level triathletes competing under thermal stress conditions in the Kona Ironman reached a state of hyperthermia during the event. After 60 minutes of recovery, when exercise perceived exertion was at a maximum, the hyperthermic state persisted. Strategies to aid cooling and recovery, especially after the race, should be considered by both triathletes and event organizers.

**References**

**S434**

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**2011**

**Board #163**  
June 2, 2:00 PM - 3:30 PM

**Effect of Ice Slurry Ingestion on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress**

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**CONCLUSIONS:** As displayed in the above graph, Tcore response demonstrated a similar response for each of the two trials. Of the 3 subjects who had different pass/fail responses, values were just over the failing threshold in trial 1 and just under the passing threshold in the trial 2. These results demonstrate that NHRC's HTT produced similar physiological responses among repeat trials amongst 92%Hwarfighters with a heat stroke injury.

**2012**

**Board #164**  
June 2, 2:00 PM - 3:30 PM


Yuki Murata1, Yuri Hosokawa1, Kumiyo Kai1. 1Chukyo University, Toyota, Japan. 2Korey Stringer Institute, University of Connecticut, Storrs, CT. 3Nagoya Women’s University, Nagoya, Japan.

(No relationships reported)

Tokyo, Japan, is the host city for the XXXII Olympic Summer Games in 2020. The average temperature and humidity in Tokyo is over 25°C and 80%, with more than 3,000 patients taken to emergency rooms for heat illnesses every summer. Environmental considerations should be made to ensure the health and safety of athletes and spectators from heat injuries. Environmental data suggests that the average wet-bulb globe temperature (WBGT) in Tokyo (29.6 ± 1.1 °C) was significantly higher (p < 0.01) than previous Summer Olympic cities (London, 20.3 ± 0.8 °C; Beijing, 27.0 ± 0.9 °C; Rio de Janeiro, 23.4 ± 0.9 °C). CONCLUSION: Historical data suggest that average WBGT in Tokyo is “cancel level for EHS risk” according to the ACSM’s guideline for continuous activity and competition. Tokyo Olympic Games in 2020 may experience one of the hottest climate conditions in the Olympic history. The Japanese Olympic Committee should work closely with sports scientists to implement institutional strategies to ensure the health and safety of athletes and spectators from heat injuries.

**2013**

**Board #165**  
June 2, 2:00 PM - 3:30 PM

**Core Temperature In Triathletes During The Ironman World Championship - Kailua Kona (Hawaii)**

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**CONCLUSIONS:***

- The average temperature and humidity in Tokyo was significantly higher than in other Olympic locations from 2008, 2012, and 2016.
- The progressive increase in heart rate (HR) and decrease in stroke volume (SV) — known as cardiovascular (CV) drift — is associated with a reduction in maximal oxygen uptake (VO₂max).
- External body cooling by fan airflow mitigates the decrease in VO₂max associated with CV drift during cycling in hot conditions.
- It remains unknown whether internal body cooling via ice slurry ingestion elicits a similar response.

**PURPOSE:**

To investigate the effect of ice slurry ingestion on CV drift and VO₂max during heat stress.

**METHODS:**

Eight men (mean ± SD; age = 22 ± 4 y, height = 182.2 ± 6.0 cm, mass = 76.3 ± 11.2 kg, body fat = 9.1 ± 3.9%; VO₂max = 52 ± 7.9 mL·kg⁻¹·min⁻¹) completed a graded exercise test on a cycle ergometer in 22 °C to measure VO₂max.

**RESULTS:**

The progressive increase in heart rate (HR) and decrease in stroke volume (SV) — known as cardiovascular (CV) drift — is associated with a reduction in maximal oxygen uptake (VO₂max).

**CONCLUSIONS:**

While ice slurry ingestion attenuated CV drift more than fluid ingestion, it did not mitigate the decline in VO₂max. Further research is warranted to determine if ice slurry ingestion mitigates the decline in VO₂max during exercise at higher intensities and/or in more extreme heat stress.
rest and during exercise. Whole body sweat rate (WBSR) was determined from pre-post nude body weight corrected for fluid intake. Metabolic heat production (Hmet) and evaporative heat balance requirements (Eevap) as well as dry heat loss (Hdry) and evaporative heat potential (Eevap) were measured. Calculations: Absolute Total Metabolic Heat ($H_{met}$): (376 ± 97 W; CON: 511 ± 108 W) and Hdry, per unit mass (HF: 4.5 ± 0.9; CON: 6.5 ± 1.0 W/kg) were lower (p < 0.05) for HF compared to CON. Despite a difference in Hdry, Hevap in HF compared to CON; however, the relative difference in $E_{req}$ to $H_{met}$ (HF: 70 ± 23; CON: 70 ± 22 W/kg) was similar (p = 0.05) between the two groups (HF: 69 ± 18 W; 9.0 ± 3.0 W/kg; CON: 72 ± 20 W, 9.0 ± 2.0 W/kg). 

CONCLUSIONS: Despite exercising with a lower $H_{met}$ per unit mass, HF patients had a similar rise in $T_c$ compared to CON. These results suggest that from a thermoregulatory perspective, HF patients are limited in their ability to manage a thermal load and distribute internal body heat among various tissues in the body, secondary to poorer circulation to the periphery.

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60 Days Of Mild Heat Stress Reduces Inflammation & Carbohydrate Metabolism Bias In C2C12 Myotubes


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(NO relationships reported)

PURPOSE: Heat acclimation stimulates metabolic adaptations in skeletal muscle that improve work performance in hot environments. While organismal heat responses are well-characterized, less is known about the molecular adaptations that coordinate these responses. This work investigated the effect of repeated heat exposure in vitro using C2C12 myotubes as a model system. METHODS: C2C12 myotubes were incubated for 2 hr at 40°C for 6 d (heat treatment) or maintained at 37°C (control). Protein expression of heat shock proteins, inflammatory markers, and several regulators of glycogenic and lipid metabolic pathways were measured via western blot. Group comparisons were made using student’s t-tests, statistical significance was set at p < 0.05. RESULTS: Heat treatment led to an induction of the heat shock response, as indicated by increased expression of HSF-1, HSP-60, and HSP-70 by 35%, 142%, and 104%, respectively. This coincided with repression of markers along the NF-kB pathway, including a 24% reduction in p-IKKa and a 20% reduction in pNFKB p65. Interestingly, while GLUT-4 was unchanged, p-GSK-3β (repressor of GS) was increased by 79% and GSK-3β (activator of GS) was reduced by 38%, suggesting suppressed GS activity. p-Acetyl-CIT was also elevated by 26% in heat-treated cells, however FAS expression was not significantly altered. CONCLUSION: Thermal preconditioning appears to bias C2C12 myobios to away from glycogen storage towards lipid synthesis; actions which coincide with reduced inflammation and activation of the heat shock response. We propose that the reduction in NF-kB signaling and altered substrate storage both contribute to the benefits that prior heat exposure affords upon subsequent stress.

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Postural Sway In Persons With Multiple Sclerosis During Passive Heat Exposure

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PURPOSE: Multiple sclerosis (MS) is a neurological disease marked by demyelination and axonal loss within the central nervous system. This pathology often results in poor postural stability, which underlies the increased risk of falls. Additionally, individuals with MS often experience transient increases in clinical signs and symptoms during heat exposure (Uthoff’s Phenomenon). PURPOSE: To test the hypothesis that heat exposure compromises postural stability in MS patients.

METHODS: Seven individuals with relapsing-remitting MS (mean ± SD: age, 49 ± 10 y; and 6 healthy controls (47 ± 10 y) participated in this study. Following a 30 min baseline period in a thermoneutral environment (25°C, 30% relative humidity (RH)), three 30 sec steady-state tests, with eyes closed, were performed on a force plate to measure distance travelled from the center of gravity, an index of postural sway. Subjects were randomly exposed to a 40°C, 30% RH environment (HYPER) or a 25°C, 30% RH environment (NEUT). Stand tests were repeated at 15 and 60 min during each thermal condition. Hemodynamic and thermal variables were measured continuously.

RESULTS: In both groups, skin temperature was elevated during the HYPER trial (P < 0.001), whereas no differences in internal temperature were observed for HYPER or NEUT trials (P = 0.55). In MS patients, the distance travelled from the center of gravity at 15 min (23.9 ± 14.7 cm; P = 0.04) and 60 min (27.4 ± 20.8 cm; P = 0.005) of HYPER exposure was greater relative to pre-heating baseline (19.6 ± 3.8 cm). Also in MS patients, this index of sway was unchanged relative to baseline (17.5 ± 0.8 cm) at the 15 (16.8 ± 6.1 cm; P = 0.96) and 60 min (16.8 ± 6.1; P = 0.79) time points during NEUT. No differences in the index of sway were observed in the healthy controls across either thermal condition.

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Abstracts were prepared by the authors and printed as submitted.
CONCLUSIONS: In the absence of vision, HYP increased postural sway relative to NEUT in MS patients. These findings suggest that MS patients have decreased postural stability during heat exposure, which can potentially increase their risk of falling. Project funded by the National Multiple Sclerosis Society.

The Extracellular Heat Shock Protein 72 Response To A 7-day Desert-based Ultra-marathon

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Extracellular heat shock protein 72 (eHsp72) concentration has been shown to significantly increase in response to extreme stress. Ultra-endurance events are becoming increasingly popular and place individuals under a prolonged duration of exercise stress, which is exacerbated when undertaken in extreme environmental conditions, particularly extreme heat. The extreme stress imposed on the body under such conditions places individuals at increased risk of heat illness and cellular damage. The eHsp72 response to ultra-endurance events in extreme environmental conditions has received little attention and thus research is required to understand the heat shock response to such stress.

PURPOSE: To investigate the effect of a desert based ultra-marathon (the 2015 7-day Desert Race; 700 km) on eHsp72 response in healthy males (n = 12).

METHODS: Thirteen (three female) competitors (age 42, range: 23–60 years, height 1.74 ± 0.10 m, mass 77.29 ± 12.92 kg, VO2max 55.25 ± 11.96 mL·kg·min-1) provided blood samples via venepuncture for the measurement of eHsp72 concentration on two occasions prior to the race: i) 12 weeks (baseline), and ii) 7 d (pre-race) prior to departure for the MDS, and two further occasions post-race: iii) 6 h post-race and iv) 7 d post-race. The MDS 2015 consisted of 7 consecutive stages, over 7 d, across the Sahara Desert, Morocco, equating to a total distance of 249.4 km. eHsp72 was determined using a commercially available ELISA kit and is displayed as a percentage change from baseline values. RESULTS: Participants completed the ultra-marathon in an average total time of 3043 ± 1002 min. Post-race (~ 6 h) eHsp72 concentration was 122%, 117% and 108% greater than baseline, pre-race and 7 d post-race, respectively (F3, 45 = 63.348, p < 0.001). CONCLUSION: eHsp72 concentration is significantly elevated in response to 7 consecutive days of prolonged exercise stress in extreme environmental conditions and returns to near baseline values within 7 d post race completion.

The Effects of Cooling during Constant Power Non-steady State Cycling in Endurance Trained Athletes

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PURPOSE: The aim of this study was to compare the effects of different cooling methods on thermoregulatory and energetic responses during constant power, non-steady state cycling in thermoneutral conditions. METHODS: Endurance trained males (n = 12) performed a graded exercise test to determine lactate threshold power (1 mL·kg·min-1·W-1). The test was followed by an all-out, constant power, non-steady state cycling bout (~ 60 min) carrying dumbbells over steps (~60 W) and a final performance (PER) carrying dumbbells over steps. A final performance (PER) was also performed without any external cooling. RESULTS: Gross efficiency decreased over time from baseline in all conditions (p < 0.01), but cooling with waterpersued vests and sleeves circulating ice-cooled water (COOL), a synthetic shirt embedded with an active particle technology blunted the rise in core temperature by 1.66 ± 0.45 °C, p < 0.05). Sweat rate was reduced during COOL and CON (1.44 ± 0.45 vs. 1.52 ± 0.43 vs. 1.66 ± 0.45 °C, p < 0.05). Heat storage (HS) was reduced with COOL from post W1 (<0.001) of REC. Heart rate was lower in the COOL trial (P<0.001) than in the CON trial after baseline measures and replaced pre-PER, while the control (CON) trial remained elevated above baseline values throughout the rest periods. Heat storage reduction with COOL was greater than CON (CON 36.9 ± 0.6°C, CG 39.2 ± 1.2°C, P<0.001). HS was reduced with COOL (27.0 ± 7.6W·m-2) compared to CON (42.7 ± 9.9W·m-2, P<0.001). Perception of exertion was decreased with COOL from W2 (P<0.001) than in the CON trial after baseline measures and replaced pre-PER, while the control (CON) trial remained elevated above baseline values throughout the rest periods. CONCLUSION: The cooling intervention attenuated thermal, physiological, and perceptual stress during work in the heat. This COOL could increase safety, facilitate performance, and reduce heat illness risk in occupational settings. Funded by PreventaMed, Inc.

Assessing Warm Weather Race Preparedness Using the Heat Stress Score

Yuri Hosokawa, Rachel K. Katch, Robert A. Huggins, Rebecca L. Stearns, Douglas J. Casa, FACSFM. University of Connecticut, Storrs, CT. (Sponsor: Douglas Casa, FACSFM) Email: yuri.hosokawa@uconn.edu (No relationships reported)

Successful heat acclimatization optimizes one’s exercise performance in the heat and requires direct physiological measures such as rectal temperature (TREC) and heart rate. However, these methods are not expedient for recreational runners who are preparing for a warm weather road race. PURPOSE: To investigate the use of the heat stress score (HSS), an index to quantify heat exposure, to determine one’s preparedness to perform in a warm weather road race. METHODS: Twenty-seven runners (n=15, men; n=12, women) competing in the 2015 Falmouth Road Race (mean±SD; age, 43±13y; body mass, 66.8±9.5kg; body fat, 17.3±4.7%; VO2max, 47.5±8.2mL·kg·min-1) performedVO2max testing in 15 days of 15ºC ± 5ºC temperature. HSS was calculated to measure the average heat exposure per exercise bout where HSS=HI (°C) × ED (min) × (number of exercise bouts). Heat exposure on the race day (HSS) was assessed during exercise bouts using an online weather database (Weather Underground). RESULTS: Heat exposure on the race day (HSS) was significantly greater than training supported by a donation of 37.5 Technology.
Acute cold exposure results in impaired cognitive function by diverting attention away from the primary task and reducing vigilance. Repeated exposure to cold stress induces physiological changes such as decreased skin temperature and a delayed onset of shivering in an effort to reduce heat loss and conserve energy during subsequent cold exposures. It is unclear if repeated exposure to cold attenuates the decrease in cognitive function typically seen during acute cold exposure.

PURPOSE: To determine if cognitive function during acute cold exposure is changed following repeated immersions in cold water.

METHODS: Eight healthy volunteers (age: 25.9 ± 6.4 years, height: 172.7 ± 6.3 cm, weight: 74.9 ± 11.4 kg) completed seven 90-minute cold water immersions in 10°C water. Subjects completed the psychomotor vigilance task (PVT) during the 1st, 4th, and 7th cold water immersion at several time points (pre, 5 min, 30 min, 60 min, 90 min). Core temperature, heart rate, skin temperature (Tsk), thermal sensation, and skin blood flow were collected during each heat trial.

RESULTS: Significantly reduced skin temperature and a delayed onset of shivering were observed during the 7th cold water immersion when compared with the 1st, suggesting that acclimation to cold occurred. Reaction time (RT) (pre=263±7 msec, 5 min=268±12 msec, 30 min=278±10 msec, 60 min=294±7 msec, 90 min=291±8 msec; p<0.001) and variability of RT (VRT) (pre=40±6 msec, 5 min=43±5 msec, 30 min=46±4 msec, 60 min=51±3 msec, 90 min=49±4 msec; p<0.03) worsened during the initial cold exposure. In comparison, RT (pre=25±515 msec, 5 min=28±515 msec, 30 min=285±12 msec, 60 min=293±10 msec, 90 min=289±9 msec; p<0.05) and VRT (pre=43±35 msec, 5 min=44±5 msec, 30 min=44±3 msec, 60 min=50±4 msec, 90 min=47±4 msec; p=0.72) during the 7th cold water immersion were not different than the 1st cold water immersion.

CONCLUSIONS: Although impairment in RT and VRT was observed on both the first and final immersions, these findings suggest that repeated immersions in cold water over 7 days do not attenuate the decline in cognitive function typically seen during acute cold stress.
RESULTS: Working time ranged from as low as 20 minutes in the hot-dry condition to 60 minutes (the maximum) in the moderate climate, especially at the lowest walking speed. The overall results from all experiments showed fluid loss ranged from 0.2 liter to 2.2 liter. Although this range was large, the average fluid loss was 0.8 L with 56% of the data between 0.5 liter and 1 liter of fluid loss. Further analysis showed that drinking 0.7 Liter would safely hydrate over 50% of responders after one work-rest cycle. Applying this fluid volume over three work-rest cycles would only put 11% of the body mass at risk of dehydration versus the 37% at risk if they consumed nothing.

CONCLUSIONS: Advising to drink one 0.7 l bottle of water after each work period is easy to implement and would provide sufficient fluid replacement for most firefighters in all conditions, irrespective of exact working time. Fitness level seemed the only individual parameter associated with an increase in work times. This project was funded by the US Department of Defense, executed in collaboration with the Netherlands Organization for Applied Scientific Research (TNO).

METHODS: To determine the effect of sports drink consumption on the hydration status of acclimatised Australian Football players.

PURPOSE: To determine the effect of sports drink consumption on the hydration status of acclimatised Australian Football players in a tropical environment.

METHODS: Total Body Mass (TBM) and Urine Specific Gravity (USG) of two opponent teams were measured one hour before and immediately after the game using a standard digital scale (A&D, Australia) and a handheld refractometer (Atago, Japan) respectively. Dry, wet, globe temperature and air velocity was measured during each quarter using QUESTemp 36 (3M detection solutions, USA). During the warm up phase both teams had access to cool water, however during the game the one team consumed Staminade (Stergic, Australia) whilst the other team had access to cool water only. The overall results from all experiments showed fluid loss ranged from 0.2 liter to 2.2 liter. Although this range was large, the average fluid loss was 0.8 L with 56% of the data between 0.5 liter and 1 liter of fluid loss. Further analysis showed that drinking 0.7 Liter would safely hydrate over 50% of responders after one work-rest cycle. Applying this fluid volume over three work-rest cycles would only put 11% of the body mass at risk of dehydration versus the 37% at risk if they consumed nothing.

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RESULTS: Working time ranged from as low as 20 minutes in the hot-dry condition to 60 minutes (the maximum) in the moderate climate, especially at the lowest walking speed. The overall results from all experiments showed fluid loss ranged from 0.2 liter to 2.2 liter. Although this range was large, the average fluid loss was 0.8 L with 56% of the data between 0.5 liter and 1 liter of fluid loss. Further analysis showed that drinking 0.7 Liter would safely hydrate over 50% of responders after one work-rest cycle. Applying this fluid volume over three work-rest cycles would only put 11% of the body mass at risk of dehydration versus the 37% at risk if they consumed nothing.

CONCLUSIONS: Advising to drink one 0.7 l bottle of water after each work period is easy to implement and would provide sufficient fluid replacement for most firefighters in all conditions, irrespective of exact working time. Fitness level seemed the only individual parameter associated with an increase in work times. This project was funded by the US Department of Defense, executed in collaboration with the Netherlands Organization for Applied Scientific Research (TNO).
Several factors are known to influence the hydration potential of drinks such as: volume ingested, ingestion rate, macronutrient composition, water content, electrolyte and caffeine content. However, relatively little is known about the impact of fluid composition on fluid balance during normal daily living / office working situations.

**PURPOSE:** To investigate the effect of 4 different commonly consumed drinks on urine output and net fluid balance over 3 hours in office-workers.

**METHODS:** Twenty-three participants (euhydration, males (n=7), and females (n=16), age: mean(SD) males 31.3(10.4) y; females 33.1(9.8) y, BMI: males 29.9(4.4); females 27.4(3.7), arrived at work in a euhydrated state. After emptying their bladder and recording body mass they ingested 1 L of fluid over the following hour as either water, coffee, orange juice or semi-skimmed milk. Energy content of the drinks was 0 kcaL (water), 4 kcaL (coffee), 470 kcaL (orange juice) and 500 kcaL (milk). Urine output was collected immediately, and each hour for 2 hours, following fluid ingestion for volume and electrolyte analysis. On completion a final body mass was obtained.

**RESULTS:** Mean(SD) total urine mass loss over 2 hours for still water was 1007(108) g and was significantly different to milk 979(181) g (p<0.05). Urine losses with orange juice (953(246) g) and coffee (1067(164) g) were not different to water, but coffee was also different to milk (p<0.05). Net fluid balance was positive at 2 hours after milk ingestion (+203(181) ml) and was significantly different (p<0.05) from water (+7(108) ml) and coffee (+67(164) ml) but not different from orange juice (+48(246) ml). Net Na+ balance was significantly different from water (+495(207) mg) after ingestion of orange juice (-973(298) mg) and milk (-295(253) mg). Net K+ balance was significantly different from water (-315(64) mg), after ingestion of orange juice (+576(171) mg) and milk (+901(118) mg).

**CONCLUSIONS:** A variety of drinks can be ingested during normal daily living / working to help maintain fluid balance. Ingestion of milk led to a reduced urine output and net fluid balance compared to the other drinks. It was noted this was more pronounced in men. The differences in the fluid balance observed between the drinks may be responsible for the reduction in F2-isoprostanes immediately post exercise.

**Oxidative stress is known to be involved in many adverse mechanisms. Few studies have examined the effects of dehydration on oxidative stress. **

**PURPOSE:** To investigate the effect of a single bout of prolonged aerobic exercise on plasma oxidative stress and antioxidant capacity in collegiate athletes.

**METHODS:** Eighty-two athletes (56 male, 26 female) were recruited to undergo an acute dehydration (3% body weight), rehydration protocol. Subjects reported to the lab for baseline anthropometrics and blood sampling. The dehydration protocol required subjects to participate in their respective training until 3% of pre-weight body mass was lost. They reported back to the lab where a blood sample was immediately collected. Subjects then drank Gatorade until body weight was reestablished to baseline values. Plasma was collected at 80 min post full re-hydration (PFR) and snap frozen in liquid nitrogen and stored at -80 degrees Celsius until analysis. Oxidative stress was determined by measuring F2-isoprostane lipid oxidation via EIA kit. Ferric reducing ability of plasma (FRAP) was used to measure plasma antioxidant potential. Plasma osmolality was determined by freezing point depression by an osmometer. Statistical analysis consisted of 1-way ANOVA. All values are reported as mean ± SD. **RESULTS:** Plasma osmolality (280.9 mOsm ± 14.2) significantly elevated (286.2 mOsm ± 15.8) post exercise (p<0.05), but returned to below normal values (282.1 mOsm ± 15.3) PFR. Plasma FRAP (µM ascorbate equivalents) values also increased post dehydration (pre: 0.237 ± 0.068, post: 0.286 ± 0.279), and decreased to near baseline levels PFR (0.247 ± 0.150) but only exhibited a statistical trend (P=0.08). Mean concentrations of F2-isoprostanes (pg/mL) declined from (437.6 ± 125.5) at baseline to (77.5 ± 496) post dehydration, and then rose to (699.7 ± 154.2) PFR (p<0.001). **CONCLUSIONS:** This study indicates that dehydration causes dramatic increases in plasma osmolality and antioxidant potential. Increased concentrations of antioxidants might be responsible for the reduction in F2-isoprostanes immediately post exercise. This decrease is followed by a large increase at 80 min post full rehydration despite normalization of plasma osmolality. The reasons for the decrease post dehydration and increase after rehydration in F2-isoprostanes warrants further examination.

**Prolonged bouts of aerobic exercise have been shown to decrease body mass, however, there is conflicting data as to whether the decrease of body mass comes from a decrease in fat mass (FM), total body water (TBW), or a combination of FM and TBW.**

**PURPOSE:** To investigate the effect of a single bout of prolonged aerobic exercise on body composition and water composition following an 27km or 50km trail race.

**METHODS:** 14 27k and 50k runners (age = 40.1 (11.8) years, race time = 6.5 (1.9) hours) completed the RJL BIA measured FM, TBW, intracellular water (ICW), and extracellular water (ECW). Body mass was measured using a Seca digital scale. These measurements were used to determine the body composition and the water composition of the subjects. Statistical analysis was performed using paired t-test and Pearson product-moment correlations. Significance was set to p<0.05.

**RESULTS:** Body mass decreased by 1.3 kg (p=0.032), FM decreased by 0.4 kg (p=0.031), and ECW decreased by 0.7 kg (p=0.041). TBW decreased by 1.3 kg (p=0.088) and ICW decreased by 0.6 kg (p=0.132). Change in BM was significantly correlated with change in ECW (r=0.592, p=0.026). Change in body mass was not correlated with race completion time. The American College of Sports medicine (ACSM) recommends BM loss during exercise not exceed 2% of an athletes starting mass. There was 1.5% decrease in body mass, which was with in the ACSM guidelines.

**CONCLUSIONS:** These data suggest that in highly trained adults, body mass, fat mass and extracellular water are significantly decreased following a prolonged bout of aerobic exercise. The change in body mass was correlated with the change in extra cellular water.
Voluntary fluid intake is known to be impacted by the palatability of fluid. Beverage content, including flavor, nutrient content, and acidity are potential impacting factors of palatability, however it is unknown how these may impact fluid intake.

**PURPOSE:** To describe the influence of beverage content on voluntary fluid consumption during exercise.

**METHODS:** Nine studies were included with adults (>18 y.o.) human subjects (n=190). Experimental beverages with flavor or nutrient content were compared to water and unrestricted consumption during exercise. Cohen’s d effect sizes (ES) were calculated to compare consumption of beverages with various contents differing from plain water, and mean difference (MD) and 95% confidence intervals (CI) were calculated for meta-analysis. **RESULTS:** A large effect (ES=9.81; p<0.001) represented a 37% greater total fluid consumption of a carbohydrate-electrolyte beverage over water (n=6; MD[CI]=0.54 L [0.43-0.65]). A large effect (ES=11.01; p<0.001) represented a 34% higher fluid consumption rate of a carbohydrate-electrolyte beverage over water was revealed (n=6; MD[CI]=26 L/h [0.21-0.30]). A large effect (ES=12.67; p<0.001) represented a 51% lower body mass loss with the consumption of a carbohydrate-electrolyte beverage over water (n=5; MD[CI]=0.41 kg [0.20-0.29]). Various flavors of carbohydrate-electrolyte beverages were preferred to water during exercise (p<0.005), and acidified beverages were less preferred than water during exercise (p<0.05). **CONCLUSION:** Flavored or nutrient containing beverages, such as sports drinks, are shown to be consumed at both a higher volume and faster rate than plain water during exercise. When fluid consumption needs are high, utilization of a flavored or nutrient containing beverage improves fluid consumption and mitigates dehydration during exercise.
normoxia (537±14 vs 513±13 ms; p<0.05). CONCLUSIONS: Prefrontal oxygenation was reduced during exercise and cognitive engagement in hypoxia despite greater MCA blood flows during exercise and cognitive engagement vs normoxia. Cognitive slowing during hypoxic exercise may be related to reductions in prefrontal oxygenation rather than macrovascular cerebral blood flow.

Supported by a Foundation Research Grant from ACSM

2038 Board #190 June 2, 3:30 PM - 5:00 PM
Tissue-specificity Of Mitochondrial Adaptations After 4 Weeks Of Normobaric Hypoxia In Rats
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Results: Fifty mm and 75mm rats were randomly assigned to either normobaric hypoxia (HYP) or normoxia (NORM). Following euthanization, mitochondrial respiration was determined in permeabilized muscle fibres from left (LV) and right (RV) ventricles, the SOL, and the EDL. Citrate synthase (CS) activity was also analysed, along with the content of protein with mito-biogenesis (HIF-1a, PGC-1a, CS, and representative subunits of complexes I to V of the mitochondrial respiratory chain).

Results: Compared to NORM, there was a greater (+48% and +25%, p<0.05) maximal mass- and mitochondria-specific respiration (i.e. mass-specific respiration normalized to CS activity) in the SOL and LV of HYP. The RV of HYP had a greater maximal (+27%, p<0.05) mass-specific respiration than NORM, but when normalised to CS the mitochondria-specific respiration was not different from NORM. In the EDL, there were no significant differences between the two groups for either mass- or mitochondria-specific respiration. There were contrasting results for CS activity in the SOL and EDL, with a higher activity in EDL (0.41 ± 0.08 vs 0.63±0.05 μmol/min/g in NORM vs HYP respectively) and a lower activity in SOL (0.87 ± 0.20 vs 0.65±0.17 μmol/min/g in NORM vs HYP respectively) after hypoxic exposure. There was a lower relative protein abundance of PGC-1α (-25%, p<0.05) in RV of HYP compared to NORM, with few changes for protein content in the other muscles.

Discussion: Our results show a muscle-specific response to 4 weeks of normobaric hypoxia. Depending on the fibre type, and the presence of muscle remodelling, muscles respond differently to the same degree of environmental hypoxia.

2039 Board #191 June 2, 3:30 PM - 5:00 PM
Impact of Endurance Exercise on Hypoxia on Metabolic and Muscle Damage Response and Performance Recovery
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Results: Fifty male Wistar rats were randomly assigned to either normobaric hypoxia (HYP) or normoxia (NORM). Following euthanization, mitochondrial respiration was determined in permeabilized muscle fibres from left (LV) and right (RV) ventricles, the SOL, and the EDL. Citrate synthase (CS) activity was also analysed, along with the content of protein with mito-biogenesis (HIF-1α, PGC-1α, CS, and representative subunits of complexes I to V of the mitochondrial respiratory chain).

Results: Compared to NORM, there was a greater (+48% and +25%, p<0.05) maximal mass- and mitochondria-specific respiration (i.e. mass-specific respiration normalized to CS activity) in the SOL and LV of HYP. The RV of HYP had a greater maximal (+27%, p<0.05) mass-specific respiration than NORM, but when normalised to CS the mitochondria-specific respiration was not different from NORM. In the EDL, there were no significant differences between the two groups for either mass- or mitochondria-specific respiration. There were contrasting results for CS activity in the SOL and EDL, with a higher activity in EDL (0.41 ± 0.08 vs 0.63±0.05 μmol/min/g in NORM vs HYP respectively) and a lower activity in SOL (0.87 ± 0.20 vs 0.65±0.17 μmol/min/g in NORM vs HYP respectively) after hypoxic exposure. There was a lower relative protein abundance of PGC-1α (-25%, p<0.05) in RV of HYP compared to NORM, with few changes for protein content in the other muscles.

Discussion: Our results show a muscle-specific response to 4 weeks of normobaric hypoxia. Depending on the fibre type, and the presence of muscle remodelling, muscles respond differently to the same degree of environmental hypoxia.
However, an acute bout of exercise has a positive effect on vigor in NH. Future studies could examine the effect of graded exercise intensities and different exercise modalities on mood state in hypoxia.

### 2042 Board #194 June 2, 3:30 PM - 5:00 PM

**Acute Activation of the Peripheral Chemoreceptors Briefly Induces Cutaneous Vasodistortion**

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Recent evidence indicates that five minutes of breathing hypoxic gas elicits cutaneous vasodilation. However, it is unclear if skin blood flow is influenced by a brief hypoxic exposure.

Purpose We tested the hypothesis that cutaneous vasodilation is increased following a brief hypoxic exposure.

Methods Seven healthy participants (2 women, 25 ± 2 years, BMI 26 ± 3 kg/m2) breathed 4-6 breaths of 100% nitrogen. We continuously measured skin blood flow on the ventral side of the forearm (laser Doppler), arterial oxygen saturation (finger pulse oximeter), mean arterial pressure (Finometer), and heart rate (ECG) at baseline and following the hypoxic exposure for one minute, during which data were analyzed in 15 s time bins. Skin blood flow was also normalized to mean arterial pressure (MAP) and expressed as a percentage of the local heating induced maximal cutaneous vascular conductance (%VCVMax).

Results Arterial oxygen saturation was lower at 45 s (89 ± 7%; P < 0.05) and 60 s (90 ± 5%; P < 0.05) vs. baseline (97 ± 1%). Skin blood flow was lower 15 s after the hypoxic exposure when compared to baseline (4.2 ± 0.9 vs. 5.1 ± 0.9 Pu; P < 0.001). MAP was greater at 15 s vs. baseline (94 ± 7 vs. 88 ± 7 mmHg; P < 0.05) and returned to baseline values at 30 s. %VCVMax was reduced within the 1st 15 s following the hypoxic exposure compared to baseline (4.3 ± 1.0 vs. 5.6 ± 1.2%; P < 0.05). Skin blood flow and %VCVMax returned to baseline values 30 s following the hypoxic exposure. Heart rate was significantly greater than baseline (64 ± 9 bpm) at 15 s (73 ± 13 bpm; P < 0.01), 30 s (76 ± 14 bpm; P < 0.001), 45 s (69 ± 11 bpm; P < 0.01), and 60 s (67 ± 11 bpm; P = 0.05).

Conclusions Contrary to our hypothesis, a brief hypoxic exposure increases cutaneous vasodilatation and attenuates skin blood flow. This suggests that activation of the peripheral chemoreceptors acutely lowers skin blood flow.

### 2043 Board #195 June 2, 3:30 PM - 5:00 PM

**Effect Of Age On Descent And Ascent Speed And Bottom Time In The Diving Alma**


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(No relationships reported)

Ama divers of Japan depend on breath-hold diving for a living. An important factor determining the efficiency of breath-hold diving is the time spent underwater, as well as the ascent time. The time lost during descent and ascent depends on diving depth, and on the speed of swimming of the individual diver.

**Purpose:** To study if age affects Ama’s diver speed of swimming and resulting bottom time.

**Methods:** We logged the dives of 12 female Ama divers in 3 age categories: 18-32 years: young, 47-55 years mid-aged, and 75-81 years older, respectively during their seasonal summer fishing at Hegurajima Japan, involving daily 4h shifts. Time-depth loggers were attached to their waists. Time and speed of descent, ascent and bottom time of the total dive time were determined. Age comparisons were made using unpaired one-way ANOVA with Bonferroni post hoc.

**Results:** Diving performance data is presented in table 1. The velocity for descent was highest in the mid-aged category while the ascent was slowest in the young category compared to both other groups. The Mid-aged category were diving the deepest.

**Table 1.** Mean(SD) duration, speed and depth for studied age groups. Significant difference at P<0.05 is indicated: *' = Mid-aged vs. young and older. **' = Young vs. mid-aged and older.

**Conclusions:** The faster descent and the greater time of the dive at the bottom of the mid-aged Ama, can be a result of more efficient duck-dive technique than in young inexperienced divers, and possibly more powerful swimming than in older divers lacking the muscle power. Descent requires efficient equalization, which could be less in young and old age groups due to technical or physiological differences. Supported by the Centre för idrottsforskning.

### 2044 Board #196 June 2, 3:30 PM - 5:00 PM

**Impact of Hypobaric Hypoxia on Repeated Sprint Performance**

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(No relationships reported)

**Purpose:** To investigate the impact of hypobaric hypoxia on sprint performance and metabolic recovery after repeated sprint bouts. METHODS: Six men (20±3yrs; 77±13kg; 181±12cm) performed three familiarization sprint sessions (decrease learning effects) at sea level (SL). Sprint sessions consisted of repeated high intensity exercise bouts (30 sec all-out sprint: 1min rest) on a self-propelled treadmill. Following familiarization, volunteers performed one sprint session per week at 250m, 200m, and 3000m (random order) carrying a load (30% body mass) in a hypobaric chamber. Sprints were repeated until peak velocity decreased by 20% of that established during familiarization. Pre- and post sprint arterial oxygen saturation (SaO2), heart rate (HR), rate of perceived exertion (RPE), and blood lactate (Hla) were measured. RESULTS: There was no difference (P > 0.05) in the # of sprints completed at SL, 250m, 200m, and 3000m (5±3; 5±2; 4±1, respectively). Post sprint session SaO2 values were lower (P < 0.05) as altitude increased (96±2%; 250m; 90±5%; 200m; 82±4%; 3000m). Post session HR, RPE, and blood lla were elevated (P < 0.05) vs. pre session values, but were not different (P > 0.05) among altitudes. CONCLUSIONS: While repeated sprint performance was not affected due to hypobaric hypoxia, post session SaO2 was reduced with each decrease in barometric pressure. It appears that the lower SaO2 values associated with the simulated altitudes tested did not alter the aerobic recovery of anaerobic pathways used during sprinting as the SaO2 values were not low enough to be a limiting factor.

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

### 2045 Board #197 June 2, 3:30 PM - 5:00 PM

**Cognitive Function During Post-Exercise in Normobaric Hypoxia**

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Acute bouts of aerobic exercise are known to induce physiological changes and effect cognitive function in both normoxia and hypoxia. However, the duration of exercise that may affect cognitive function in the hypoxic condition is currently unknown.

**Purpose:** The present study examined the duration of improved cognitive function following a steady-state acute bout of exercise in normobaric hypoxia compared to normoxia. METHODS: 11 apparently healthy subjects (7 men and 4 women) (Age: 22±3 years; Height: 171.2±7.6 cm; Weight: 74±9.8 kg) completed Automated Neuropsychological Assessment Metrics-4th Edition (ANAM4) versions of the Running Memory Continuous Performance Task (RMCP) and during following 20 min cycling on an ergometer in both NORM (20±3% O2) and HYPO (12±2% O2). In a separate session, subjects complete the same sequence of testing in a counterbalanced manner. RESULTS: Throuhgput score in RMCP was not significantly different (p>0.05 for all) between conditions (NORM vs. HYPO) across time points, prior...
Effect of Post-exercise Normobaric Hypoxia on Recovery from Resistance Exercise-Induced Fatigue

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Purpose: To investigate the influence of normobaric hypoxia on recovery after single bout resistance exercise.

Methods: In this crossover study, 10 female college athletes (20.1±0.6 y/o, 166.3±10.3 cm, 56.5±4.3 kg) were randomly divided into normobaric hypoxia group, NH (60% O2) and Normobaric normoxia group, NN (21% O2). All participants performed an acute resistance exercise and recovered under 21% or 60% oxygen for 90 min immediately after a high carbohydrate meal (2 g carbohydrate per kg body weight). Blood glucose, insulin and TBARS concentrations were measured before, immediately, 30, 60, and 90 min after exercise. Muscle strength was planned to be measured before, and 90 min and 24 h after exercise.

Results: Glucose and Insulin concentration in NH group is significantly higher than that in NN group 90 min after exercise. TBARS concentration in NH group is significantly higher than in NN group 30 to 90 min after exercise. Muscle strength of biceps brachii is significantly lower in NH group 24 h after exercise compared to NN group. Pain threshold was significantly increased 90 min after resistance exercise.

Conclusions: Recovery under Hypoxia after resistance exercise is not beneficial to muscle strength recovery. The possible mechanism might be due to the lower glucose uptake and increased oxidative stress.

To (97.4±36.2 vs. 104.8±33.7), during exercise (102.0±34.5 vs. 107.4±37.9) and recovery (Recovery 1-min: 98.5±39.8 vs. 104.4±37.0, Recovery 15-min: 101.3±35.7 vs. 105.8±37.4). Recovery was averaged during the last minute of each activity period and expressed as grouped means for both men and women.

Numerous studies have demonstrated differences in cognitive functioning and mood state between males and females when exposed to hypoxia. PURPOSE: The purpose of the current study was to investigate gender differences seen in working memory and mood state as the result of low to moderate exercise in normobaric hypoxia. METHODS: 16 apparently healthy men (24±4 years) and 11 apparently healthy women (22±3 years) volunteered for this study. During the familiarization trial, a submaximal exercise protocol to determine the VO2/Watt(W) relationship was performed on a cycle ergometer, followed by a VO2 max protocol with 20 min. rest between tests. Following a 60-min. acclimation, the experimental trial consisted of two 15-min. bouts of submaximal exercise (40% and 60% of adjusted VO2 max) in hypoxia separated by 15 min. rest. VO2, HR, Oxygen Saturation (SpO2), BP, memory and mood state were assessed during rest, 5 min. of baseline (100.7±17.1), during both exercise intensities (40%; 108.1±16.5, 60%; 102.0±16.5), and recovery. Differences between conditions (NORM vs. HYPO) across time points, prior to (19.6±5.7 vs. 24.3±11.5), during exercise (17.8±7.2 vs. 22.3±9.4) and recovery (Recovery 1-min: 20.2±6.5 vs. 21.8±6.8, Recovery 15-min: 20.2±7.8 vs. 23.8±8.0, Recovery 30-min: 20.2±7.8 vs. 21.8±6.8, Recovery 45-min: 18.8±6.4 vs. 21.2±7.6). However, peripheral oxygen saturation (PaO2) was significantly lower across all time points in HYPO compared to NORM (p<0.001, respectively). CONCLUSION: Despite the reduction in PaO2 during hypoxia, MCA velocity and RMCP were not significantly different between the two conditions. Based on these data, the MCA velocity and RMCP were not affected by hypoxia and the acute bouts of exercise (40% and 60% VO2max). Additional warranted to maintain the length of exposure and/or severity that hypoxia may impact on cognitive function.

Gender Differences in Running Memory and Mood State During Submaximal Exercise in Normobaric Hypoxia

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Residing (or “staging”) for two days at altitudes of 3000 m and 3500 m has been shown to reduce incidence of acute mountain sickness (I-AMS) in unacclimatized sea level (SL) residents during their subsequent ascent to 4300m. Additionally, I-AMS at 4300m was reduced in those who participated in daily rigorous physical activity while staging at 2500 m and 3000 m. It is unclear if a similar staging/activity strategy would likewise improve cardiorespiratory responses and exercise performance at 4500 m. PURPOSE: To determine if cardiorespiratory and time trial (TT) responses of SL residents performed at 4300 m would improve after two days of residing at 2500 m, 3000 m, 3500 m, or 4300 m with or without increased daily activity. METHODS: Sixty six volunteers (45 men, 21 women; mean ± SD; 23 ± 5 y, 173 ± 9 cm, 73 ± 12 kg; peakVO2 of 49 ± 7 ml·kg⁻¹·min⁻¹) were assigned to 1 of 4 staging groups, within each group, were designated to be sedentary (S) or active (A) during 2 days of residence at 2500 m (n=11,8A), 3000 m (n=6S, 8A), 3500 m (n=6S, 8A), or 4300 m (direct ascent; n=7S, 8A). Activity consisted of ~90 min of rigorous trail hiking twice per day at the assigned staging altitudes. At SL and 4300 m, volunteers performed 20 min of steady-state (SS) treadmill walking (45 ± 3% SL VO2peak) followed by a 5-mile, 1% grade, self-paced maximal effort TT. RESULTS: As SS exercise intensity was identical (~45% SL VO2peak), there were no differences in VO2 among staging and activity groups at SL and at 4300 m (~1.6 L·min⁻¹). Overall, compared to SL, while at 4300 m arterial oxygen saturation decreased (97% to 74%, p<0.01), while heart rate (124 to 140 bpm·min⁻¹) and ventilation (39 to 60 L·min⁻¹) increased (p<0.01). However, there were no differences in VO2 or at 4300 m among staging or activity groups. In general, TT duration increased from SL to 4300 m by 22 min (51 to 73 min, p<0.01), but there were no differences at SL or 4300 m among staging altitudes or activity groups. CONCLUSIONS: Residing for two days at 2500 m to 4300 m, with or without daily rigorous activity, did not improve cardiorespiratory responses or TT performance at 4300 m. These results are consistent with the notion that more than staging at 2500 m or without daily rigorous physical activity would likewise improve cardiorespiratory responses and exercise performance at 4300 m. Authors’ views not official U.S. Army or DoD policy.

Physiological Evaluation Of Tight- And Loose-Fitting Powered Air-Purifying Respirators

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THURSDAY, JUNE 2, 2016

Abstracts were prepared by the authors and printed as submitted.
RESULTS: PIPs ranged 24-26°C in all PAPRs. The AvgF,O₂ for each model at rest, 1L/min, 2L/min, and Max, respectively = A, 20.39, 20.38, 20.45, 20.31; B, 19.28, 18.82, 19.36, 19.33; C, 19.40, 19.33, 19.52, 19.35; D, 20.83, 20.82, 20.68, 20.56. The AvgF,O₂ for each model at rest, 1L/min, and Max, respectively = A, 0.50, 0.47, 0.46, 0.63; B, 1.43, 1.75, 1.53, 1.74; C, 1.33, 1.35, 1.32, 1.69; D, 0.06, 0.08, 0.12, 0.22. The PIPs for each model at rest, 1L/min, and Max, respectively = A, 2, -6, -14; B, 1, -1, -5, -12; C, 0, -1, -5, -12; D, 11, 7, -4, -28. Negative PIPs were observed at the mouth in every LF-PAPR worn by every participant at VO₂ ≥ 2L/min and higher; 44% of the PIP observations among the three LF-PAPRs were negative at VO₂ ≤ 1L/min. CONCLUSIONS: Inhaled breathing gases with PAPRs for a range of activities appear tolerable for healthy workers. Evidence of over-breathing the LF-PAPRs (inspiratory flow > blowout flow, resulting in a negative PIP) at the mouth during exercise (VO₂ ≥ 1L/min) suggests further research is needed to better understand the cause of this unexpected result.

2050 Board #202 June 2, 3:30 PM - 5:00 PM Treadmill Time-trial Performance of Unacclimatized Lowlanders Following Rapid Ascent to 3500 m or 4050 m Roy M. Salgado, Charles S. Fulco, Stephen R. Muza, Janet E. Staab, Sean P. Andrew, Juli E. Jones, Rob N. Demes, Marie R. Grunbeck, Beth A. Beidlemann. US Army Research Institute of Environmental Medicine, Natick, MA. Email: roy.m.salgado.ctr@mail.mil (No relationships reported)

Our group recently published a mathematical model depicting the relationship of the change in cycle ergometer time-trial (TT) performance duration as a function of increasing elevation for unacclimatized lowlanders within their first 8 hrs of exposure to elevations up to 4300 m (Beidleman et al., Med Sci Sports Exerc 2015). Whether the model is generalizable for TT performance assessments using a different mode of exercise (i.e., treadmill) and within the first 48 hrs of exposure is unknown. Purpose: Determine if the changes in treadmill TT performance durations of unacclimatized individuals measured both at sea level (SL) and 150 m or 4050 m can be estimated accurately using the published cycle ergometer TT performance model. Methods: Forty-three healthy volunteers (35 men and 8 women; mean ± SD: 22 ± 4 yrs, 74.5 ± 12.5 kg, 170 ± 71 cm, 49.8 ± 7.3 ml·kg⁻¹·min⁻¹) completed a treadmill TT lasting 8.0-11.2 km both at SL and within the first 48 hrs of arrival at either 3500 m (n = 16) or 4050 m (n = 27). The % increase in treadmill TT duration from SL to each elevation was the outcome variable which was, in turn, compared to the results estimated at the identical elevations using the cycle TT model. Results: The % increase in duration for the treadmill TT versus that estimated using the cycle TT model did not differ either at 3500 m (26.7 ± 14.8% versus 28.4 ± 6.9%, p = 0.69) or 4050 m (44.1 ± 17.5% versus 49.5 ± 17.5%, p = 0.24). Conclusion: The findings indicate that our published cycle ergometer model accurately estimates % changes for treadmill TT performance of unacclimatized SL residents during their first 48 hrs of exposure to altitudes of 3500 m and 4050 m. Further, the lack of significant difference between the treadmill and cycle TT performance outcomes at these two elevations suggest that the published predictive model can be applied to treadmill exercise. Disclaimer: Author’s views are not official U.S. Army or DoD policy.

2051 Board #203 June 2, 3:30 PM - 5:00 PM Is there a Compensatory Mechanism to Maintain Muscle Hydration and Prevent Dehydration at High Altitude? Melissa J. Benton, FACSM, Amy L. Silva-Smith. University of Colorado, Colorado Springs, CO. Email: mbenton@uccs.edu (No relationships reported)

Muscle serves as a reservoir to maintain hydration, which in turn maintains blood volume and pressure. Older adults are at risk for dehydration due to loss of fluid reserves that accompanies loss of lean mass with age. Older women, with less lean mass throughout the lifespan, are at greatest risk. High altitude is an independent risk factor for dehydration for elderly women living at high altitude may be at greater risk than those living at sea level.

PURPOSE: To evaluate hydration status in older women residing at high (≥ 1800 m) and low altitude (≤ 75 m).

METHODS: Older women living at high altitude (n = 11) were paired matched based on age and BMI with women living at low altitude (n = 11). Hydration and body composition were measured with whole body multi-frequency bioelectrical impedance analysis and postural blood pressure was measured supine, sitting, and standing.

RESULTS: There were no differences between high altitude (HA) and low altitude (LA) in age, weight, BMI, FFMI, body composition, total body water, and extracellular water. However, the relative amount of intracellular water was significantly greater in HA compared to LA (26.9 ± 0.4% vs. 24.7 ± 0.4%, p < 0.05). Furthermore, systolic blood pressure was significantly higher in HA compared to LA in the sitting (145.4 ± 7.7 mmHg vs. 124.6 ± 5.1 mmHg, p < 0.05) and standing (140.7 ± 8.1 mmHg vs. 119.1 ± 5.5 mmHg, p < 0.05) positions, and a trend was observed for significantly greater diastolic blood pressure in HA versus LA in sitting (78.9 ± 4.0 mmHg vs. 70.0 ± 1.9 mmHg, p = 0.06) and standing (80.3 ± 4.0 mmHg vs. 71.3 ± 3.1 mmHg, p = 0.08). When rise in diastolic blood pressure were evaluated, there was a trend for significant differences. Between supine and sitting, systolic blood pressure increased in HA by +6.4 ± 2.9 mmHg and decreased in LA by -2.7 ± 3.7 mmHg (p = 0.06) while diastolic blood pressure increased in HA by +4.5 ± 1.8 mmHg and decreased in LA by -2.4 ± 3.4 mmHg (p = 0.08).

CONCLUSION: Although preliminary, our findings suggest a compensatory mechanism of muscle at high altitude by which intramuscular hydration increases as a physiologic buffer to decrease risk of dehydration. As a downstream effect, this mechanism may also promote stability in postural blood pressure. More research in this area is needed.

2052 Board #204 June 2, 3:30 PM - 5:00 PM Effects of Acute Hypoxia and Hyperoxia on Oxygen Uptake, Brain and Muscle Oxygenation during Incremental Exercise Jin Uchimaru, Hidekazu Takemura, Hirohiko Takahashi, Shozo Suzuki. Sendai University, Shibata, Japan. Email: jn-uchimaru@sendai-u.ac.jp (No relationships reported)

Changes in inspired oxygen concentration will affect the peak oxygen uptake compared with normoxia. These underlying mechanisms are not fully understood, but central and peripheral mechanisms have been proposed.

PURPOSE: Our study focuses on the effect of acute hypoxia and hyperoxia on oxygen uptake, brain and muscle oxygenation during exercise.

METHODS: Eight healthy male subjects performed on incremental maximal exercise test (15W/min step) under normoxia (Norm: 20.9 FIO₂, acute hypoxia (Hypox: 14.5% FIO₂) and acute hyperoxia (Hyper: 28.0% FIO₂) conditions. The order of each condition was randomized and trials were spaced by 5 days. We measured oxygen uptake (VO₂ peak) on incremental exercise. Near-infrared spectroscopy (NIRS) was used to monitor concentration (µM) changes of oxy- and deoxyhemoglobin (∆[O₂Hb], ∆[HHb]) in left frontal cortex region of the forehead and ipsilateral vastus lateralis muscle. Changes in total Hb and S02 were calculated (∆[THb] = ∆[O₂Hb] + ∆[HHb], ∆[S02]) and used as index of change in regional blood volume. Metabolite measures ANOVA were performed across treatments.

RESULTS: VO₂ peak decreased in Hypox (38.6±0.4ml/kg/min, p<0.05) and slightly increased in Hyper (45.2±2.7ml/kg/min) compared with Norm (43.5±3.9ml/kg/min).

CONCLUSIONS: Auto-regulation of blood flow during acute hypoxia and hyperoxia may be associated with central and peripheral mechanisms.
**Introduction:** Chronic intermittent hypobaric hypoxia (CIHH) simulating high-altitude environments is a non-pharmacological strategy employed to antagonize the adverse effects caused by a variety of complications, including metabolic and cardiovascular diseases. However, the impact of CIHH on hepatic tissue and mitochondrial function has been scarcely studied.

**Purpose:** In this work, we aim to analyze the effects of CIHH exposure on hepatic markers of mitochondrial biogenesis, dynamics, autophagy signaling and oxidative stress.

**Methods:** Sixteen young-adult Wistar male rats were randomly divided into two groups: normoxia (N) and chronic intermittent hypobaric hypoxia (CIHH, simulated atmospheric pressure of 49.3 kPa) 5 h/d during 5wks. Liver markers of mitochondrial biogenesis (TFAM), fusion (OPA1, MFN1, MFN2) and apoptosis (Bcl-2, Bcl-xl, and p66shc) were measured within two hours of surfacing after the last dive (PD). No alterations were found in TFAM, MFN1 and MFN2, and SIRT3 content.

**Results:** CIHH exposure promotes alterations in liver mitochondrial markers of oxidative stress, autophagy signaling and mitochondrial dynamics, suggesting that CIHH stimulates liver mitochondrial remodeling and hepatocyte renewal. Supported by: FCT (PTDC-DES-113580-2009)

**Conclusions:**CIHH exposure promotes alterations in liver mitochondrial markers of oxidative stress, autophagy signaling and mitochondrial dynamics, suggesting that CIHH stimulates liver mitochondrial remodeling and hepatocyte renewal.

**Surface exercise performance after repeated dives at 1.35 atmospheres absolute (ata) is reduced substantially more when divers breathe 100% O2 than when they breathe air, but the studies examined performance 24 h after completion of the last dive, when plasma volume (PV) was likely to have recovered.

**Purpose:** To characterize exercise performance within two hours after completing a series of repeated air dives and to determine whether performance is fully recovered three days after diving.

**Methods:** Two healthy males (30 ± 3.7 y; VO2-max: 51.7 ± 7.5 mL/min; mean ±SD) completed a dive week (5 consecutive 6-hr dives with 18-hr surface intervals) while breathing air at 1.35 ata. Endurance time on a treadmill at 85% of VO2 max was measured 2 days after diving (BL), within 2 h of surfacing after the last dive (PD), and 3 days after the last dive (PD3). Blood samples presented an increase in VEGF (82.7%), increase in EPO (130.8%), and compared to patients with a symptom score less than 5 had a lower increase of the symptom score greater than 5, the time spent performing moderate and vigorous activity was significantly lower.

**Conclusion:** To determine if there is a difference in lactate accumulation between sea level, 24 h, and 96 h of exposure to an altitude of 3,147 meters, and after 96 h at the same altitude. Physiological measures included: lactate accumulation (La), oxygen saturation (O2), rating of perceived exertion (RPE; 0-10 Scale), and workload (kp) at the last minute of each 5 minute stage. RESULTS: At submaximal exercise intensities (60 and 70%), La was significantly lower at acute exposure (24h; 1.5 mmol/L) as compared to SL (2.0 mmol/L) (p≤.04). Lactate accumulation was observed to decrease with initial altitude exposure, however, within 96 h of exposure lactate accumulation returned toward sea level values. This would suggest that elevations of 3417 m also can induce the phenomenon of the “Lactate Paradox.”

**Acute Mountain Sickness (AMS) can develop during rapid altitude exposure. It is a subjective diagnosis that commonly consists of symptoms related to headaches, fatigue, sleeplessness and dizziness, while more severe AMS can deteriorate to conditions that can be life threatening. The role of physical activity in the development of AMS remains controversial. Individuals working at the South Pole are required to make a rapid transition to altitude and be moderately active.

**Purpose:** To compare activity patterns and biochemical factors in individuals with and without AMS or its symptoms.

**Methods:** Venous blood samples were taken from 43 healthy individuals at sea level and 2 days after high altitude exposure. Physical activity was monitored using BodyMedia activity monitors. AMS symptoms were examined using modified Louise Questionnaires. Comparisons were made using paired t-test with repeated measures and Pearson’s correlation.

**Results:** 29% of subjects displayed AMS between SP days 1-2 (D1-2). Total increase in energy expenditure on day 2 for AMS individuals was 16.8±4.1% and 10.1±4.9% for individuals without AMS. In addition, for patients with a total symptom score greater than 5, the time spent performing moderate and vigorous activity during D1-2 was greater by a factor of 1.75±0.24 that of the baseline, and compared to patients with a symptom score less than 5 had a lower increase of 1.34±0.23. Blood samples presented an increase in VEGF (82.7%), increase in EPO (27.4%), decrease in Cystatin C (5.1%), and decrease in NE (1.68%) for AMS individuals. A correlation of total symptom score and time of moderate and vigorous activity expenditure of individuals resulted in R squared value of 0.66. Comparisons were statistically significant with a p value of 0.05.

**Conclusion:** Increases in activity and evaluation of blood chemistry compared to the baseline after 48 hours of ascent are associated to the risk of AMS.

**Repetitive diving with mildly hyperbaric oxygen pressures (oxygen partial pressure (PO2) approximately 130 kPa) may cause small airway dysfunction, but the relative importance of immersion, PO2, and dive activity has not been elucidated.

**Purpose:** To differentiate effects of immersion and elevated PO2 at rest and during exercise, parameters of small airway function were measured in conjunction with five series of dives: rest or cycle ergometer exercise in a 15-foot deep pool with O2, O2 was different at rest and during immersion, 50% PO2 (≈ 130 kPa) or air (PO2 ≈ 30 kPa), and rest in a dry hyperbaric chamber with PO2 ≈ 130 kPa.

**Methods:** Each dive series consisted of five consecutive days with six hours of exposure and 18 hours between dives (same daily starting time). Forced expired...
Rapid decreases in hemoglobin mass (Hbmass) have been reported in healthy humans with spaceflight and following descent from high altitude. It has been proposed that a selective increase in the destruction of young red blood cells (RBCs) mediates these decreases but conclusive evidence demonstrating neocytolysis is lacking. Based on the proposed triggers and time course of adaptation during spaceflight, we hypothesized that 4 days of -6° head-down tilt bed rest (HDTBR) would cause a rapid decrease in Hbmass that would be associated with evidence of increased RBC destruction.

**RESULTS:** To examine changes in Hbmass before (PRE), 5 hours after (POST), and 5 days after (POST5) 4 days of HDTBR. METHODS: Seven healthy, recreationally active men (age: 21 ± 3 years, peak oxygen uptake: 50 ± 6 ml·kg⁻¹·min⁻¹) completed 4 days of HDTBR. Hbmass was assessed using the optimized carbon monoxide rebreathing method. Markers of RBC production and destruction assessed included [erythropoietin] ([EPO]), [soluble transferrin receptor] ([sTfr]), reticulocyte count, [ferritin], [haemoglobin], and [haptoglobin]. RESULTS: [EPO] decreased by 30 ± 33% from PRE to POST (p = 0.028). Contrary to our hypothesis, Hbmass was increased by 4.0 ± 4.3% from PRE to POST (p = 0.014) before decreasing to a level 3.6 ± 2.4% below PRE at POST5 (p = 0.027). From PRE to POST, [ferritin] increased 66 ± 73% (p = 0.013); [sTfr] decreased 26 ± 34% (p = 0.054); [ferritin] increased 17 ± 17% (p = 0.012), and reticulocyte count remained stable. From PRE to POST5, sTfr decreased 17% ± 5% (p = 0.018) but there were no significant alterations in [ferritin], [haemoglobin], or reticulocyte count. CONCLUSION: Our findings suggest that 4-day HDTBR results in a transient increase in Hbmass that may be influenced by decreased RBC destruction. However, since the POST measurement occurred following re-ambulation, a potential role for other factors (i.e., splenic contraction) on the increase in Hbmass cannot be excluded. The decrease in Hbmass at POST5 appears to be mediated by decreased RBC production rather than increased RBC destruction. These findings highlight the need to re-examine the time course and mechanisms of Hbmass alterations with short-term spaceflight and simulated microgravity.

**METHODS:** Six male subjects completed 2-3 trials of 5 functional tasks (walk, side step, stair climb, and upper body and full body object relocations) in each of 3 different space suits in the final 2 planned missions of the Mark III (64 kg) and Rear Entry I-suit (REI, 43 kg) and a modified intravehicular activity suit (Demonstrator, 27 kg) with enhanced mobility for contingency spacewalks. All tasks were performed in 1g. Rate of carbon dioxide (CO2) production was determined by measuring suit inlet flow and outlet CO2 concentration. Respiratory exchange ratio was assumed to be 0.85 for the conversion to kcal. Mixed-effects regression models were used to compare metabolic cost across the three different space suits, incorporating random intercept terms to accommodate within-subjects experimental design, and random variance terms to accommodate the observed heterogeneity of variance among the three suits.

**RESULTS:** MC of all functional tasks was significantly higher in the Demonstrator suit, averaging 33-66% more depending on task. MC was similar between Mark III and REI suits, except for the side step and stair climb tasks where MC was significantly lower in the REI.

**CONCLUSIONS:** Although the Demonstrator was the lightest space suit evaluated, it required the highest MC to complete all tasks, suggesting poor mobility. MC differences between the Mark III and REI were evident on tasks that required vertical travel likely due to mass differences between suits.
Heart rate monitoring is required for crewmembers during exercise aboard the International Space Station (ISS) and will be for future exploration missions. The cardiovascular system must be sufficiently stressed throughout a mission to maintain the ability to perform nominal and contingency/emergency tasks. High quality heart rate data are required to accurately determine the intensity of exercise performed by the crewmembers and show maintenance of VO2max. The quality of the data collected on ISS is subject to multiple limitations and is insufficient to meet current requirements.

**PURPOSE:** To evaluate the performance of commercially available Bluetooth heart rate monitors (BT_HRM) and their ability to provide high quality heart rate data to monitor crew health aboard the ISS and during future exploration missions.

**METHODS:** Nineteen subjects completed 30 data collection sessions of various intensities on the treadmill and/or cycle. Subjects wore several BT_HRM technologies for each testing session. One electrode-based chest strap (CS) was worn, while one or more optical sensors (OS) were worn. Subjects were instrumented with a 12-lead ECG to compare the heart rate data from the Bluetooth sensors. Each BT_HRM data set was time matched to the ECG data and ±5% threshold was applied to the difference between the 2 data sets. Percent error was calculated based on the number of data points outside the threshold and the total number of data points.

**RESULTS:** The electrode-based chest straps performed better than the optical sensors. The best performing CS was CS1 (1.6% error), followed by CS4 (3.3% error), CS3 (6.4% error), and CS2 (9.2% error). The OS resulted in 10.4% error for OS1 and 14.9% error for OS2.

**CONCLUSIONS:** The highest quality data came from CS1, but unfortunately it has been discontinued by the manufacturer. The optical sensors have not been ruled out for use, but more investigation is needed to determine how to obtain the best quality data. CS2 will be used in an ISS Bluetooth validation study, because it simultaneously transmits magnetic pulse that is integrated with existing exercise hardware on ISS. The simultaneous data streams allow for beat-to-beat comparison between the current ISS standard and CS2. Upon Bluetooth validation aboard ISS, the research team will downselect a new BT_HRM for operational use.
IL-6 levels increased with TNFα (P < 0.01) but were reduced by 24, 32 and 28% (P < 0.01) with AWA-A, -B, and -C, respectively. IL-1β level was increased by 47% with TNFα (P < 0.01) and decreased by 17% (P < 0.01) with AWA-A. No mRNA expressions were related to TNFα and other inflammatory factors. Therefore, the mRNA expressions was analyzed in AWA-TNFα cells. TNFα increased reactive oxygen species (ROS) production by 1.3-fold (P < 0.01) but ROS did not change in AWA-TNFα. E3 ubiquitin ligase Atrogin-1 mRNA level increased 23% in TNFα vs. control (P < 0.05). However, AWA-TNFα decreased Atrogin-1 mRNA by 31.41, and 47% (P < 0.01), respectively vs. control, and by 47, 35 and 55% (P < 0.01), respectively, vs. TNFα (P < 0.01). A 44% (P < 0.01) increase in MsrA-1 mRNA level was found in TNFα vs. Control whereas AWA-TNFα showed no change. The cell viability was decreased in TNFα (P < 0.01) but not in AWA-TNFα.

CONCLUSION: AVAs reduced pro-inflammatory cytokine transactivation and ROS production, and improved survival rate due to inhibition of TNFα-induced NFκB activation in C2C12 cell.

2065 Board #217
June 2, 2:00 PM - 3:30 PM
Effects of Repeated Exhaustive Exercise on mGlur5 Expression in the Rat Striate Nucleus
Meihua Su1, Duoduo Yang1, Zhaojing Chen1, Charity Cavazos2, Debra A. Bemben, FACSM3, Michael G. Bemben, FACSM4.
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No relationships reported.

Glutamate is an excitatory neurotransmitter in the central nervous system that has been related to central fatigue during exercise. Metabotropic glutamate receptors (mGlurS), which lead to metabolic changes within the cell by regulating intracellular second messengers when coupled with G protein, have drawn much attention in fields like neurology because of its effects on central fatigue without neurological side effects. PURPOSE: To investigate the changes of mGlur5 induced by repeated exhaustive exercise in the striate nucleus (subcortical part of the forebrain) of rats. METHODS: Eighteen healthy male Wistar rats aged 8 weeks and weighing 260 ± 10 g, were randomly divided into 3 groups: control (CG, n=6), immediately post exhaustive exercise (IEG, n=6) and 24-hour recovery post exercise (24EG, n=6) groups. They were trained on an animal treadmill at 0% incline and three different speeds: 8.2m/min for 15 min, 15m/min for 15 min, and 20m/min until exhaustion, and this exercise protocol was repeated daily for 7 days. Rat brain slices were analyzed using immunohistochemistry techniques and 5 vision fields were randomly selected (200×) from the striatum portions of each slice were used for positive cell counts and Integrated density option (IOD) analysis by True Color Pathological Image-Pro Plus 6.0 image analysis system to observe the expression of mGlur5. RESULTS: Compared to the control group, the indicator of mGlur5 protein IOD (4220.0 ± 348.3) and mGlur5 positive cells (8072.3 ± 641.3) in rat striatum significantly increased for both IEG (9100.0 ± 580.3, 1701.3 ± 131.8, respectively) and 24EG (7293.3 ± 460.5, 1269.3 ± 114.5, respectively) groups after exercise (p<0.05), and the increase in IEG was significantly greater than for 24EG (p<0.05). CONCLUSION: Increases in mGlur5 protein content in the rat striatum following exercise may be due to the fact that rats are unable to adapt to the stress stimulus at the beginning of acute exercise and that repeated exhaustive exercise could result in upregulation of mGlur5 receptors. It is suggested that mGlur5 may play an important role during exercise induced central fatigue.

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2066 Board #218
June 2, 2:00 PM - 3:30 PM
Effects Of Acute High-intensity Exercise In Normalobaric Hypoxia And Hyperoxia On Thoroughbred Skeletal Muscle
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No relationships reported.

PURPOSE: The purpose of this study was to examine the effects of transient hypoxia and hyperoxia during high-intensity exercise on satellite cell activation and angiogenesis in Thoroughbred skeletal muscle. METHODS: In the first experiment, six Thoroughbreds horses (6.3 ± 0.8 years old) ran on a treadmill in normoxia (N1; FIO2 = 21%) and hyperoxia (Hpo; FIO2 = 25%) at the same speed for the same duration. In the second experiment, the same horses ran in normoxia (N2; FIO2 = 21%) and hyperoxia (Hpo; FIO2 = 26%) at the same speed for the same duration. During these experiments, oxygen consumption and plasma lactate concentration was monitored, myofiber biopsy samples were obtained from the vastus lateralis muscle before exercise and immediately, 4 and 24 hours, and 3 and 7 days after exercise, and immunohistochemical analysis and relative quantitative analysis of mRNA expression using real-time RT-PCR were performed.

RESULTS: In the first experiment, the oxygen consumption was 29% lower and the plasma lactate concentration was 47% higher during exercise in Hpo than in N1. The mRNA expression was increased in satellite cell activation (IGF-1, HGF, Pax7, Myogenin) were higher, but the mRNA of factors related to angiogenesis (VEGF-A, PGC-1α, Angiopoietin 1) were slightly higher in Hpo than in N1 at 3day after exercise. In contrast to the first experiment, the oxygen consumption was 27% higher and the plasma lactate concentration was 27% lower in Hpo than in N2 in the second experiment. The mRNA expressions of satellite cell activation-related factors remained unchanged, but the mRNA of factors related to angiogenesis (VEGF-A, PGC-1α) were slightly higher in Hpo than in N2 at 4 hours after exercise.

CONCLUSIONS: These results suggest that transient exposure to Hpo during high-intensity exercise in horses increases the contribution of the glycolytic energy supply and promotes satellite cell activation in muscle, in contrast, the exposure to Hpr during exercise increases reliance on aerobic energy supply and stimulates angiogenesis in muscle.

2067 Board #219
June 2, 2:00 PM - 3:30 PM
Physical Inactivity-induced Histone Modification In The Rat Soleus Muscle
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No relationships reported.

Recently, we reported that limb immobilization-induced muscle atrophy enhances trimethylation of lysine residues 9 and 27 of histone H3, a signal for transcriptional silencing, and this is controlled by epigenetic regulation via histone deacetylase 4. However, the effects of physical inactivity on histone modification remain unclear.

PURPOSE: This study examined the effect of physical inactivity on histone modification in the rat soleus muscle

METHODS: Twenty-two 3-week-old male Wistar rats were randomly assigned into control (CT, n = 6), physical inactivity (IN, n = 8), and regular exercise training (TR, n = 8) groups. Rats in the IN group were housed in a small cage with half of the usual floor space to limit their range of movement. Rats in the TR group were exposed to treadmill exercise 5 days per week for 8 weeks. After the experiment, the soleus muscles were removed and global levels of histone modification were determined by Western blot analysis.

RESULTS: The relative muscle weight of the soleus muscle was decreased significantly in the IN group compared with the CT and TR groups. There were no significant differences in the acetylation of histone H3 among groups. However, trimethylation of lysine residue 9 of histone H3 was significantly higher in the IN group than in the CT group, while that in the TR group was significantly lower than in the IN group.

CONCLUSIONS: Physical inactivity increases trimethylation of lysine residue 9 of histone H3 in the rat soleus muscle, whereas regular physical exercise has the opposite effect.

2068 Board #220
June 2, 2:00 PM - 3:30 PM
Human Skeletal Muscle Mitochondrial Related mRNA Response to Exercise in the Cold
Robert Shute, Matthew Hoesch, Taylor La Salle, Matthew Bubak, Terence Laursen, Nicholas Dinan, Dustin Slivka, FACSM. University of Nebraska at Omaha, Omaha, NE. (Sponsor: Dustin Slivka, FACSM)

No relationships reported.

Endurance exercise in the cold with recovery in the cold has been shown to affect the expression of select genes to a greater extent than room temperature endurance exercise and recovery. However, it is not known whether the recovery period in the cold is a critical component to this response.

PURPOSE: To determine mitochondrial related gene expression response to exercise in a cold compared to room temperature environment.

METHODS: Recreationally trained males (n=11, age: 24 ± 1 year, height: 178 ± 1 cm, weight: 80.3 ± 3.7 kg, %BF: 14 ± 1.0%, VO2peak: 4.34 ± 0.24 l · min-1) completed two trials consisting of cycling in a cold (C) or room temperature (RT) environment (7 °C and 20 °C, respectively) for 1 h at 60% of Wmax followed by 3 h of subpine recovery at room temperature. Muscle biopsies were taken from the vastus lateralis pre-exercise and three h post-exercise for gene expression analysis. Heart rate (HR) and expired gases were also measured throughout the trials.

RESULTS: Exercise VO2 was lower in C than RT (2.70 ± 0.11, 2.84 ± 0.11 L · min-1, respectively, p = 0.003). HR was similar during exercise and recovery between C and RT (153 ± 2 and 156 ± 3 bpm, respectively, p = 0.284; Recovery: 74 ± 3 and
Skeletal muscle regeneration is a vital process to maintain physical function and adapt to exercise, characterized by alterations in multiple processes including inflammation, satellite cell proliferation and cell cycle alterations, and protein synthesis. The PGC-1α isoform, PGC-1α4 promotes muscle growth via IGF-1 and myostatin. However, whether PGC-1α4 plays a role in muscle regeneration following injury and by extension during myogenic differentiation, as occurs in satellite cell proliferation, is unknown. PURPOSE: To determine alterations in Pgc1α4 mRNA content during muscle regeneration and myogenic differentiation. METHODS: C57BL/6j mice (n = 7) were fed a high fat diet (HFD) for 16 wk, soleus and tibialis anterior (TA) muscles collected, and muscle damage by intramuscular injection of the myotoxin blebbistatin (BUPI) compared to PBS was not significant (P=0.09). During differentiation BUPI compared to PBS control, while 65% greater mRNA content was 70% lower in BUPI compared to PBS control, >2-fold elevated at 5d in post-injection. To examine Pgc1α4 mRNA content during myogenic differentiation C2C12 myoblasts were differentiated beginning at confluence and collected at 1d post-injection. To examine ER stress in skeletal muscle cells. Methods: C57BL/6 mice (n = 7) were fed a high fat diet (HFD) for 16 wk, soleus and tibialis anterior (TA) muscles collected, and muscle damage by intramuscular injection of the myotoxin blebbistatin (BUPI) compared to PBS was not significant (P=0.09). During differentiation BUPI compared to PBS control, while 65% greater mRNA content was 70% lower in BUPI compared to PBS control, >2-fold elevated at 5d in post-injection. To examine Pgc1α4 mRNA content during myogenic differentiation C2C12 myoblasts were differentiated beginning at confluence and collected at 1d post-injection. To examine Pgc1α4 mRNA content during myogenic differentiation C2C12 myoblasts were differentiated beginning at confluence and collected at 1d prior to confluence, and 0, 1, 2, 3, 4, 5d of differentiation. TAs and C2C12 cells were analyzed for Pgc1α4 mRNA by real time RT-PCR. For animal studies data were analyzed by t-test within each timepoint to compare PBS and BUPI groups. For cell culture, data were analyzed across time by one-way ANOVA, a was set at 0.05 for all experiments. RESULTS: Following muscle injury: 3d post-injury Pgc1α4 mRNA content was 70% lower in BUPI compared to PBS control, >2-fold elevated at 5d in BUPI compared to PBS control, while 65% greater Pgc1α4 mRNA content at 28d in BUPI compared to PBS was not significant (P=0.09). During differentiation Pgc1α4 mRNA peaked at 3d at ~11-fold greater than 0d and was significantly elevated over all other timepoints except 4d. Muscle damage factor myogenin was lower in BUPI compared to PBS control, increased at 2d differentiation (531 fold, elevated at all points after 4d) while IGF1 peaked at 4d (2.15 fold). CONCLUSION: During muscle regeneration Pgc1α4 mRNA is repressed during phases associated with elevated inflammation (3d) and is elevated at timepoints associated with muscle growth (5d). These data are concomitant with expression changes during myogenic differentiation and suggest a potentially significant role of PGC-1α4 in muscle regeneration and differentiation.
Dipeptidyl-Peptidase IV (DPP-IV) is a membrane bound myokine that is involved in converting the powerful vasoconstrictor, neuropeptide Y, into the non-vasoconstricting metabolite, neuropeptide Y. MMP2 and MMP9. These MMP’s are known to mediate the shedding of DPP-IV from adipocytes and smooth muscle cells and exist in commercially available whey protein, but not in leucine products.

**Purpose:** To determine if the shedding of DPP-IV from skeletal muscle cells is mediated by metalloproteinases. We hypothesized that when MMP2 and MMP9 were inhibited (i), the amount DPP-IV released in the presence of whey protein would be decreased.

**Methods:** C2C12 cells underwent 4-5 days of differentiation. They were treated for 6 hours with one of the following: leucine (Leu) or whey protein (WP), LEU+MMP2i, LEU+MMP9i, CP, or dimethyl sulfoxide (DMSO-vehicle for inhibitors). The media was collected for DPP-IV activity measurements, which were measured using a fluorometric assay.

**Results:** The DPP-IV activity of the control cells treated with only the inhibitors and vehicle, as well as Leu+MMP9i, Leu+complete protease inhibitor (CP), WP+MMP2i, WP+MMP9i, or WP+CP. Control plates were also run with one of the following: MMP2i, MMP9i, CP, or dimethyl sulfoxide (DMSO-vehicle for inhibitors). The media was collected for DPP-IV activity measurements, which were measured using a fluorometric assay.

**Conclusion:** The shedding of DPP-IV from skeletal muscle cells is mediated by metalloproteinases 2 and 9, which are present in whey protein. This is a possible mechanism by which milk products may affect neuropeptide Y-mediated blood flow.

**Previous work has reported a reduced mRNA response related to mitochondrial biogenesis after exercise and subsequent recovery in the heat compared to room temperature conditions. However, the continued heat exposure after exercise may have contributed to the observed heat induced mRNA repression. Purpose:** To determine mitochondrial biogenesis-related gene expression and sub-cellular location of PGC-1α protein in human skeletal muscle following exercise in a hot environment as compared to a room temperature environment. Methods: Recreational trained males (n = 11, age: 24 ± 3 y, height: 178 ± 5 cm, weight: 80.3 ± 12.8 kg, %BF: 14.6 ± 3.6%). VO2 peak: 4.3 ± 0.84 L · min^-1) completed two trials in a temperature and humidity controlled environmental chamber. The trials consisted of cycling in either a hot (H) or room temperature (RT) environment (33 °C and 20 °C, respectively) for one hour at 60% of Hmax followed by 3 h of recovery at room temperature. Muscle biopsies were taken from the vastus lateralis pre-, post-, and 3 h post-exercise for analysis of mRNA expression and PGC-1α protein subcellular location. Results: PGC-1α, ERRα, and VEGF mRNA increased following exercise in both H and RT (p = 0.002, p = 0.011, and p = 0.001, respectively). PGC-1α and VEGF mRNA were also increased following exercise in H, but to a lesser degree than in RT (p = 0.037 and p=0.008, respectively). ERRα mRNA did not increase after exercise in H and was lower following H than RT (p = 0.007). NRF-1 was unchanged following exercise in RT, but was downregulated following exercise in H (p = 0.002). GAPBA, and SIRT1 mRNA were all lower following H than RT (p = 0.046 and p = 0.021, respectively). PPARγ and TFAM mRNA were unaffected by exercise in either H or RT. Nuclear PGC-1α protein increased following exercise in both H and RT (p = 0.029), but was not different between conditions. Conclusion: These data indicate that exercise in a hot environment blunts expression of mitochondrial biogenesis-related mRNA as compared to exercise in a room temperature environment, despite similar increases in nuclear PGC-1α translocation. Supported by the Graduate Research and Creative Activity (GRACA) grant from the University of Nebraska Omaha and NE-INBRE Developmental Research Program Project (DRPP), National Institute for General Medicine Science (8P20GM103427).
Avns (AvnA, AvnB and AvnC). Interactions between Avns and Ikk kinase (IKKβ) were tested by protein-ligand docking and protein kinase assay. NFkB-mediated inflammatory pathways were evaluated.

RESULTS: The docking score correlated with IKKβ in vitro activity suggesting Avns are synergistic bioinhibitors for IKKβ pathway. Avns reduced the kinase activity in response to IBHB treatment. TNF-α and IL-1β mRNA levels were increased by 6.2- and 11-fold (P<0.01), respectively, with IBHB compared to control, but these levels were reduced by approximately 22-fold with Avns (P<0.01). Ikk protein degradation and NFkB luciferase assay, used as a marker of NFkB activation, showed that Avns suppressed iKKβ-induced NFkB activation (all P<0.01). Cyclooxygenase-2 (COX-2) protein expression was increased with IBHB, along with a 3.1-fold increase in COX-2 luciferase activity (P<0.01), but these markers were reduced by ~2-fold with Avns (P<0.01). Postaglandin E2 (PGE2) level was increased 3.7-fold with IBHB treatment (P<0.01), but was decreased by 59, 54 and 62% (P<0.01), respectively, with AvnA,B and C.

CONCLUSIONS: Avns are potent inhibitors of NFkB-mediated inflammatory response due to the downregulation of IKKβ activity in C2C12 cells.

CAMK in Skeletal Muscle Stimulated by Caffeine to Promote Endurance Adaptation

CAMKI is a kinase protein that forms an oligomer of 6 proteins that is highly seen in the muscle when it is stimulated. It can be activated by increasing the levels of Ca2+ within the skeletal muscle to promote the synthesis of PGC1-alpha mRNA to induce mitochondrial biogenesis.

Purpose: To determine if caffeine can cause a shift in Ca2+ levels in skeletal muscle to stimulate CAMK1 to promote mitochondrial biogenesis. Methods: Mice were administered different amounts of caffeine, later tissue samples were collected to analyze and quantify levels of mitochondrial protein. Western Blots and qPCR analysis were used to determine changes in protein levels from control groups to the stimulated groups. Antibodies were used to determine the concentration of the proteins in question. These included p-CAMK because CAMK activity is determined by measuring autophosphorylation, COX5 and 5.4, HAD, LCAD, MCAD, VLCAD, Cytochrome-C, CD6, CPT-1, GLUT4, Citrate Synthase, and PGC1-alpha. Results: Our current findings suggest that as the caffeine dosage increases the levels of mitochondria biogenesis induces proteins increases and so do mitochondrial proteins, suggesting that there are more mitochondria being made. At the moment we are unable to compare the findings to our control groups because we have yet to receive the key with respect to our control group’s protein levels from our sample provider. But with the preliminary data we have we suspect that higher dosages of caffeine induce mitochondrial biogenesis. Conclusion: At the moment we do not have sufficient data to make a conclusion but if the trend we are observing continues this may prove revolutionary to the way that endurance athletes train and what we will consider fast times in the future.

Whey protein/peptide is often taken in after resistance exercise to enhance the muscle hypertrophy since it has benefits for the skeletal muscle protein synthesis. Recently, we found that whey peptide intake after resistance exercise activates intracellular signaling involved in protein synthesis in a dose-dependent manner in human skeletal muscle. However, the effects of whey peptide alone on the signaling in human skeletal muscle remains unclear. Purpose: To determine the effects of whey peptide intake on the phosphorylation status of mammalian target of rapamycin (mTOR) signaling in human skeletal muscle. Methods: Healthy young men (n=5, weight=64.5±4.1 kg) and women (n=5, weight=52.7±4.7 kg) participated in this study. At 12-hours fasting, subjects were in resting supine position for 30 minutes. After resting, muscle biopsies (~15 mg) were obtained from the vastus lateralis, and blood samples were collected. Then, subjects took an equal amount of whey peptide solution (20g/200 mL water). One hour after intake of whey peptide, muscle, peptide and blood samples were collected. Muscle samples were used to determine the phosphorylation status of mTOR (Ser2448) and S6K1 (Thr389) by using Western blot analysis. Blood insulin and essential amino acid concentration were measured at commercially available laboratories. Results: Whey peptide intake significantly increased the concentration of serum insulin in women (p<0.05), whereas it did not change in men. Plasma essential and branched-amino acids concentrations significantly increased after whey peptides intake in both men and women (p<0.05). At resting, there were no differences in MMP-2 gene expression alone did not affect MMP-2 or 9 gene expression. There was no difference in MMP-2 gene expression (P>0.05) 3 days post-injection. There was a main effect of injury to increase MMP-9 (P>0.05) gene expression 3 day post-injection regardless of diet. Conclusion: Collagen III ratio differed between lean and obese at the onset of regeneration. It does not appear that MMPs and 9 are responsible for this change. Future studies can include examining other MMPs and regulators of MMPs as well as later timepoints during the regenerative process.

This work was supported by a grant from the American Biosciences Institute.

CAMK in Skeletal Muscle Stimulated by Caffeine to Promote Endurance Adaptation

CamKII is a kinase protein that forms an oligomer of 6 proteins that is highly seen in the muscle when it is stimulated. It can be activated by increasing the levels of Ca2+ within the skeletal muscle to promote the synthesis of PGC1-alpha mRNA to induce mitochondrial biogenesis.

Method: Our results suggested that whey peptide intake activates mTOR signaling in human skeletal muscle. Wheeler young men (n=5, weight=64.5±4.1 kg) and women (n=5, weight=52.7±4.7 kg) participated in this study. At 12-hours fasting, subjects were in resting supine position for 30 minutes. After resting, muscle biopsies (~15 mg) were obtained from the vastus lateralis, and blood samples were collected. Then, subjects took an equal amount of whey peptide solution (20g/200 mL water). One hour after intake of whey peptide, muscle, peptide and blood samples were collected. Muscle samples were used to determine the phosphorylation status of mTOR (Ser2448) and S6K1 (Thr389) by using Western blot analysis. Blood insulin and essential amino acid concentration were measured at commercially available laboratories. Results: Whey peptide intake significantly increased the concentration of serum insulin in women (p<0.05), whereas it did not change in men. Plasma essential and branched-amino acids concentrations significantly increased after whey peptides intake in both men and women (p<0.05). At resting, there were no differences in MMP-2 gene expression alone did not affect MMP-2 or 9 gene expression. There was no difference in MMP-2 gene expression (P>0.05) 3 days post-injection. There was a main effect of injury to increase MMP-9 (P>0.05) gene expression 3 day post-injection regardless of diet. Conclusion: Collagen III ratio differed between lean and obese at the onset of regeneration. It does not appear that MMPs and 9 are responsible for this change. Future studies can include examining other MMPs and regulators of MMPs as well as later timepoints during the regenerative process.

This work was supported by a grant from the American Biosciences Institute.

Dose-Dependent Effects of Whey Peptide Intake on mTOR Signaling in Human Skeletal Muscle

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Conclusion: Collagen III ratio differed between lean and obese at the onset of regeneration. It does not appear that MMPs and 9 are responsible for this change. Future studies can include examining other MMPs and regulators of MMPs as well as later timepoints during the regenerative process.
demonstrating nursing work. However, the effects of long, successive work shifts have not been evaluated on lower body fatigue responses in nurses using functionally sensitive markers of fatigue, such as maximal and explosive muscular force production capacities.

**PURPOSE:** To determine the effects of long, cumulative nursing work shifts on fatigue-related lower body strength responses in nurses. **METHODS:** Thirty-nine (age=32.25±10 yr) female nurses working as fulltime RNs, LVNs, and CNAs were recruited from hospitals. Nurses were familiarized on all strength assessments (on a separate day) and then performed the strength tests on the day before, and the day following (>24 hours) a demanding multi-shift work period. Specifically, nurses worked three 12 hour shifts over a four-day period. Participants performed three maximal voluntary contractions (MVCs) on a dynamometer for both the leg extensors and flexors, in randomized order. MVCs were used to calculate peak torque (PT; Nm), and rate of torque development (RTD; Nm·s⁻¹) at early (50ms; RTD50) and late (200ms; RTD200) phases of the torque-time curve. **RESULTS:** For the leg extensors, significant declines (P<0.01–0.025) were found for PT (165.0 and 154.2 Nm for pre and posttest, respectively), RTD50 (1011.2 and 841.9 Nm·s⁻¹), and RTD200 (643.2 and 559.2 Nm·s⁻¹). For the leg flexors, significant declines (P<0.026) were found for PT (91.4 and 77.5 Nm) but no changes were found for RTD50 or RTD200 (P=0.062 and >18). **CONCLUSION:** These findings demonstrated that a demanding nursing work period induced strength-fatigue related of the lower body. Declines were more prominent for explosive strength (ΔRTD50=−16.8%) versus maximal strength (ΔPT=−6.5%) characteristics of the leg extensors, and were generally less prominent for the leg flexors. Marked reductions in explosive strength capacities may contribute to increased injury risks resulting from a slower capacity to respond rapidly to sudden work-related perturbations (slips, patient handling events etc.), especially under fatigued conditions.

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**2081** Board #233 June 2, 2:00 PM - 3:30 PM

**Development of an Aerobic Fitness Standard for Telecommunication Mast Climbers**

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**PURPOSE:** To quantify the aerobic energy demand during safe and effective mast climbing performance to develop a job-related aerobic fitness standard.

**METHODS:** Following institutional ethics approval, 19 male and 2 female certified climbers volunteered (age 44 ± 11 years, stature 1.75 ± 0.08 m, body mass 84.7 ± 16.9 kg). The study was conducted in two phases. In both phases, the time taken to complete a 100 m ladder climb was recorded while heart rate and the rate of oxygen uptake (VO2) were measured. In Phase 1, 11 climbers heart rate was measured throughout a climbing assessment day, in which they completed a self-paced 100 m ladder climb. Subsequently, a panel of subject matter experts were consulted to set an appropriate standard for safe and effective 100 m ladder climbing performance (deemed to be 30 min). In Phase 2, 10 climbers completed a 100 m ladder climb only, under the instruction to complete the task at a steady pace in 25-35 min (i.e. approximately the proposed standard).

**RESULTS:** During the training day in Phase 1, all participants’ peak heart rates occurred during the 100 m climb. Participants completed the 100 m ladder climb faster in Phase 1 than Phase 2 (14:10 ± 0:18:28.56 ± 0:10 min·sec, P=0.001) with no difference in a peak heart rate 2 (174 ± 14 vs. 162 ± 16 b·min⁻¹, P=0.055). The relationship between average VO2 during climbing and 100 m climb time was established using Ordinary Least Product regression (Average 100 m climb VO2 (mL·kg⁻¹·min⁻¹) = −0.0144 *100 m climb time (s) + 38.0, r=-0.80, p<0.001; SEE = 3.3 mL·kg⁻¹·min⁻¹). The mean VO2 required to complete the 100 m ladder climb in 30 min was 20 mL·kg⁻¹·min⁻¹. Walking time was inversely correlated with both systolic and diastolic BP (r = -0.46 and r = -0.39, respectively). Bouts of 10-60 min sitting was also inversely correlated with BMI (r = -0.34). Conclusions: Future interventions should be designed that are based on occupation-specific behavioral patterns to reduce shorter bouts of sitting (<30 min) than solely emphasizing on reducing the total amount of sitting in a workplace. Varying sample characteristics (greater sample engaging in >90min of sitting) along with monitoring of leisure/time physical activity are also warranted to further understand the impact of occupational sitting patterns on metabolic risk factors.

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**2082** Board #234 June 2, 2:00 PM - 3:30 PM

**Varying Bouts Of Occupational Sitting On Metabolic Risk Factors In Office Workers**

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**PURPOSE:** To determine the impact of varying bouts of sitting on metabolic risk factors in office workers. **METHODS:** A total of 35 office workers (age = 45.17 ± 12.47 years) who were required to sit for at least 50% of their work hours were recruited from the university and the local county offices. Metabolic risk factors [resting blood pressure (BP), body mass index (BMI), waist circumference, triglycerides, high-density lipoprotein, and fasting glucose] were obtained from each participant. A 5-workday behavioral monitoring occurred using activPAL devices during work hours. **RESULTS:** Average daily work hours (hrs) was 8.09 ± 0.48 hours. Mean sitting, standing, and walking times were 5.89 ± 1.52 hrs, 2.01 ± 1.57 hrs, and 1.09 ± 2.59 hrs, respectively. Daily step counts were 3710 ± 2259 steps. Average bouts of <10min, 10-60min, 60-90 min, and <90min of consecutive sitting were 25.58 ± 16.66 bouts, 9.72 ± 2.75 bouts, 0.59 ± 0.61 bouts, and 0.27 ± 0.34 bouts, respectively. Pearson’s correlation analysis indicated inverse correlation between bouts of 10-60min sitting and triglycerides (r = −0.43). Walking time was inversely correlated with both systolic and diastolic BP (r = −0.46 and r = −0.39, respectively). Bouts of 10-60min sitting was also inversely correlated with BMI (r = −0.34). **CONCLUSIONS:** Future interventions should be designed that are based on occupation-specific behavioral patterns to promote relatively shorter bouts of sitting (<30min) rather than solely emphasizing on reducing the total amount of sitting in a workplace. Varying sample characteristics (greater sample engaging in >90min of sitting) along with monitoring of leisure/time physical activity are also warranted to further understand the impact of occupational sitting patterns on metabolic risk factors.

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**Risk Factors In Office Workers**

One of the leading causes for firefighter injuries reported in the United States is slips, trips and falls suggesting that maintaining postural balance is an important issue in firefighter safety and health. Little information is available about how ankle mobility and strength are affected by strenuous firefighter activity and its consequent influence on postural balance.

**PURPOSE:** To assess changes in functional ankle mobility and strength and a consequent effect on postural balance following firefighter activities.

**METHODS:** Eight healthy men completed a battery of firefighter activity simulations, consisting of uphill walking, weight carrying, crawling, stepping, and dummy dragging, lasting approximately 40 minutes to completion while wearing a full standard firefighter ensemble. Immediately before and after the simulation, subjects were assessed for ankle range of motion (ROM) and isometric peak power (IPP) of plantarflexion, dorsiflexion, inversion, and evasion using an isokinetic dynamometer, and for postural balance to determine overall stability index (OSI) under a dynamic perturbation condition using a Biodesix balance system.

**RESULTS:** Ankle ROM did not change significantly, but ankle IPP except dorsiflexion was significantly reduced in POST measurements. There was a significant difference between PRE and POST OSI (0.96±0.52, 1.22±0.80, respectively) (p<0.001).

**CONCLUSIONS:** Ankle ROM was minimal; however, ankle IPP was significantly reduced to which postural stability in a dynamic perturbation condition was impaired. This implicates that ankle fatigue developed due to strenuous firefighter activity is likely an important determinant for impaired postural balance in firefighters.

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**Measurement**  | Plantarflexion | Dorsiflexion | Inversion | Eversion
---|---|---|---|---
PRE | 23.46±1.7 | 16.45±5.0 | 23.71±9.1 | 30.6±9.1
IPP | 141.5±43.0* | 54.1±20.5 | 25.7±11.3* | 30.6±6.1*
POST | 22.3±5.3* | 15.9±4.6 | 23.2±10.4 | 32.3±13.6
IPP | 109.2±36.5* | 43.7±11.6 | 19.5±7.1* | 26.7±6.4*
Numerous indices relate heat stress to changes in physical performance, but many are too complex to be practical for field use, or in cases where clothing creates a microclimate distinct from ambient conditions. The Physiological Strain Index (PSI), however, requires only rectal temperature (Tc) and heart rate (HR) data and has been shown to be accurate in predicting composite heat stress in a variety of conditions. This case study - in which a 37-year old male professional firefighter in the UK ran the 2015 Humber Bridge Half Marathon while wearing his full firefighting kit - allowed us to collect data needed to examine whether PSI (as a measure of overall physiological stress) is a determinant of changes in half-marathon running characteristics.

**PURPOSE:** To ascertain whether PSI is a determinant of changes in half-marathon running characteristics in full firefighting kit.

**METHODS:** A GPS-enabled heart rate monitor (HRM) and a rectal temperature probe were fitted to the subject, who wore his full kit of non-breatheable turnout coat and pants, leather boots, helmet, and breathing apparatus (full-face mask, hoes, air tank). The subject planned to walk (not run) up hills and change air cylinders at 2.4 km intervals, or as needed. Heart rate (HR), speed (Sp), and distance (D) were recorded every two seconds. Tc was recorded when air cylinders were changed. Post hoc calculation of Tc progression and PSI were then descriptively compared to changes in running characteristics: Mean Speed (MSp), Run Time/Walk Time Ratio (RWR), and Run/Walk Oscillation Rate (OR).

**RESULTS:** Despite the generally cool ambient conditions (17.1°C, 80% humidity), PSI mean climbed steadily from 3.6 to 9.5 on a scale of 0-10 over the course of the event. Peak MSp of 7.4 kph was reached at 9 km, with PSI = 8.7, RWR = 5.9 and OR = 2. From this point on, MSp and RWR declined steadily, while waves of rising speed and PSI - followed by dropping speed and PSI - became more prominent, especially as PSI neared 10.0, indicating that a physiological limit had been reached.

**CONCLUSION:** PSI was shown to be a strong determinant of changes in running characteristics. Given its ease of use (requiring only two direct physiological measures) and its applicability to varied environments, further investigation into the ability of PSI to predict physical performance decrement is warranted.
Background: Surface electromyography (sEMG) can be used to provide real-time muscle performance data and desirable feedback to patients and clinicians in rehabilitation or sports injury settings. However, a comparison of electrical activity patterns of muscles with different fiber type compositions has not been conducted, and the relationship between electrical outputs with muscles of different sizes is relatively unexplored.

Purpose: This study was designed to evaluate and compare the recruitment and activation patterns of large and small muscles with different fiber type combinations (proportion of type I and II fibers) during isometric contractions using sEMG.

Methods: Participants (n=10, mean age: 24.4 ± 2.5 years) with no history of musculoskeletal injuries or cardiovascular problems were asked to perform progressive isometric contractions at 25%, 50%, 75%, and 100% of their maximal voluntary contraction (MVC) level. sEMG data was collected from the abductor pollicis brevis (APB) of the thumb and vastus lateralis (VL) of the upper leg. Raw force output, mean integrated EMG (iEMG), normalized electrical activity output, and median frequency were compared between these two muscles and four contraction levels.

Results: APB, which consists of a higher percentage of Type I fibers, generated more electrical activity (mean iEMG: APB = 1187.57 ± 171.41 uV·s, VL = 175.93 ± 18.00 uV·s, p<0.001), but less force output at maximal contraction (p<0.001). Normalized electrical activity showed significantly different recruitment patterns between the two muscles (p<0.001), and no frequency spectra indicated a higher median frequency for APB (mean MDF: APB = 100.45 ± 3.30 Hz, VL = 77.24 ± 1.22 Hz, p<0.001).

Conclusion: sEMG has been used as a biofeedback tool to help both patients and clinicians in documenting muscle recovery following sports injuries. However, it is important to realize there are muscle differences based on size and type of fiber. Changes in electrical activity used as an indication for strength improvement cannot be generalized across muscles. Smaller, predominately Type I muscles may require a higher muscle performance target during rehabilitation. Supported by NSF EFRI 1332329.

Whole body vibration (WBV) and local muscle vibration (LMV) improve quadriceps function and may improve RTD, but their efficacy for doing so has not been compared. It is important to realize there are muscle differences based on size and type of fiber. Changes in electrical activity used as an indication for strength improvement cannot be generalized across muscles. Smaller, predominately Type I muscles may require a higher muscle performance target during rehabilitation.

Supported by NSF EFRI 1332329.

**Summary:**

**Quadriceps Rate of Torque Development (RTD):**

1. **Introduction:**
   - Define RTD as the slope of the torque signal during the first 100ms following contraction.
   - RTD is important to force attenuation during gait and may improve RTD, but their efficacy for doing so has not been compared.
   - Differences in RTD are related to muscle mass and type.

2. **Methods:**
   - Participants: 10 healthy volunteers (mean age: 24.4 ± 2.5 years).
   - Protocols: Isometric contractions at 25%, 50%, 75%, and 100% of their MVC.
   - Measurements: sEMG (APB and VL) and force output.
   - Statistical Analysis: ANOVA and Bonferroni post-hoc tests.

3. **Results:**
   - APB generated more electrical activity than VL (p<0.001).
   - APB showed a higher median frequency compared to VL (p<0.001).

4. **Conclusion:**
   - Quadriceps RTD is influenced by muscle mass and type.
   - WBV may be appropriate to aid in the restoration of RTD following ACLR. Future studies are needed to determine the effects of repeated WBV exposure on quadriceps function.

**Supported by NSF EFRI 1332329.**
To be able to propel the body forwards during the gait, the foot unavoidably exerts a series of forces on the ground. At the same time, the ground returns these forces with the same magnitude, but in the opposite direction and course. These reaction forces produced during the gait are accountable for the body advancing, and their study is important to analyses human gait.

**PURPOSE:**

The purpose of this work is to compare the reaction forces produced during the gait in patients with a torn anterior crossed ligament at various times during the rehabilitation process.

**METHODS:**

The reaction forces of both legs were assessed (injured and healthy) in 11 subjects with a torn anterior crossed ligament using a dynamometric platform (NedSVE/IBV, Institute of Biomechanics, Valencia, Spain) before undergoing surgery, and at 2 and 6 months after surgery. The following reaction forces were analyzed: initiation force (I), brake force (B) and propulsion force (P). An ANOVA of repeated measurements and a multiple pair comparison of the least significant difference were done to statistically analyses the data obtained.

**RESULTS:**

No significant differences were found in the reaction forces between both legs (p>0.05), although differences were noted at various times during rehabilitation when both legs together were compared (p<0.05). Significant differences were found 6 months after surgery (P: 109.17±17.17 N, B: 94.51±19.95 N, I: 779.22±92.23 N) compared to before surgery (P: 100.51±13.79 N, B: 81.56±16.2 N, I: 772.84±99.9 N) and 2 months after surgery (P:100.93±15.95 N, B: 84.17±21.49 N, I: 767.11±97.34 N).

**CONCLUSIONS:**

As the results indicate, the three reaction forces analysed throughout the rehabilitation process improved. No differences were found between the values collected before surgery and those obtained 2 months after surgery, although those patients who underwent surgery improved after 6 months. Therefore, we can conclude that the gait alters owing to a torn anterior crossed ligament, and alterations in the gait are noted in both legs before surgery and 2 months after surgery, which noticeably recover 6 months after surgery.

**Osteoarthritis is a common cause of disability.** Aquatic exercise is thought to be beneficial and is often recommended for people with osteoarthritis; however, few studies have examined the effects on people with osteoarthritis, and these have yielded inconsistent results. **Purpose:** This paper reports a study of the effects of aquatic exercises on cardiopulmonary endurance and depression in adults with osteoarthritis of the knee. **Methods:** Participants were recruited from Başkent University Faculty of Health Science Department of Physical Therapy and Rehabilitation, Ankara, Turkey. **Bileşen Ecevit Universityesi Health of School Department of Physical Therapy and Rehabilitation, Zonguldak, Turkey.** Başkent University Faculty of Health Science Department of Physical Therapy and Rehabilitation, Ankara, Turkey. **Bayindı Hospitals Group International Patient Center, Ankara, Turkey.** Başkent University Faculty of Medicine Department of Physical Therapy and Rehabilitation, Ankara, Turkey.

Participants reported a range of indices of physical quality of life. Overall, severe indices were more common among females compared to males. The majority (75%) reported having pain getting out of bed. Having severe pain while getting out of bed was reported by 24% of participants, and it was more reported among females compared to males (22% vs. 12%, P-value 0.02). About 46% reported severe pain while bending, and it was more noted among males compared to females (55% vs. 44%, P-value 0.05). About 19% reported severe pain while kneeling, and it was significantly differential among females compared to males (22% vs. 5%, P-value 0.02). A similar pattern was also reported with severe pain while sitting cross leg.

**Conclusions:** The study provides a suggestive evidence for increased prevalence of severity of physical quality of life among patients suffering from OA in Oman. The severity of physical quality of life was more prominent among females compared to males.

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**Osteoarthritis is a common disease especially among elders, and it has major public health burden and consequences.**

**Objectives:** The aim of the present study is threefold. First, is to describe the socio-demographic and clinical profiles of patients suffering from OA in Oman. Second, is to evaluate the indicators of physical quality of life among patients of O.A. Third, is to compare between female and female patients in terms of selected clinical characteristics and indicators of physical quality of life.

**Methods:** A cross-sectional study was conducted in two polyclinics in Muscat, Capital of Oman, over the period from January to December 2013. Socio-demographics were collected through a structured entry form. A standardized and validated Arabic version of Knee Injury and Osteoarthritis Outcome Score- Physical Function Short Form (KOOS-PS) questionnaire has been used to assess the physical disability of patients with knee osteoarthritis.

**Results:** Overall, the study included 213 participants, of them 171 (%) were females and 42 (%) were males. Compared to males, female patients tended to be older in age, less educated, with lower income, and more over weight. The majority had OA for durations of less than a year. About 12% reported a history of trauma. About 22% reported using herbal medicine, and oil preparations constituted for 4.2%. Participants reported a range of indices of physical quality of life. Overall, severe indices were more common among females compared to males. The majority (75%) reported having pain getting out of bed. Having severe pain while getting out of bed was reported by 24% of participants, and it was more reported among females compared to males (22% vs. 12%, P-value 0.02). About 46% reported severe pain while bending, and it was more noted among males compared to females (55% vs. 44%, P-value 0.05). About 19% reported severe pain while kneeling, and it was significantly differential among females compared to males (22% vs. 5%, P-value 0.02). A similar pattern was also reported with severe pain while sitting cross leg.

**Conclusions:** The study provides a suggestive evidence for increased prevalence of severity of physical quality of life among patients suffering from OA in Oman. The severity of physical quality of life was more prominent among females compared to males.
exercise training only for lower extremity, consisting of two phases and containing warm-up, stretching and strengthening periods in each phase. The second study group (60:40 vs. 40:60) of exercises for upper extremities was done in unison with trunk exercise training, in addition to the lower extremity. Instruments were the 6-minute walk test and Hospital Anxiety and Depression scale Hospital Anxiety and Depression scale was used for evaluation of emotional status and cardiopulmonary endurance was evaluated 6-minute walking test. Results: When Hospital Anxiety and Depression scale HAD scale was tested, there was no significant difference compared to delayed condition). When EEC was examined before and after treatment there were statistically significantly improves in all the groups (p<0.001). Nevertheless, it was found that depression status and 6 walk distance of the cases in the first study group were better when compared to the other groups (p<0.05).

Conclusion: It was seen that the aquatic exercises therapy consisting of upper & lower extremity and trunk exercises were more effective in the improvement of the muscle capacity and depression severity levels of the individuals were lessened.

### EFFECTS OF TISSUE LOADING DUE TO MASSAGE ON MUSCLE MECHANICAL PROPERTIES RECOVERY FOLLOWING ECCENTRIC EXERCISE

**PURPOSE:** Although massage is an increasingly popular modality for a variety of muscle-skeletal disorders, including chronic back pain and exercise-induced muscle injury, the relationship between the applied mechanical loading parameters and clinical outcomes have not yet been well characterized. The effects of the kinetic parameters on daily (RI) and between-day (RI') recovery indices of muscle stiffness and isometric torque production recovery following four days of massage were determined.

**RESULTS:** Transverse loading had moderate correlations with RI (tissue stiffness reduction) with immediate massage (power: r = -0.45; dose: r = -0.42), but weak relationships with delayed massage (power: r = -0.15; dose: r = -0.29). The increases in tissue stiffness between-day (RI') also had moderate correlations with transverse loading with immediate massage (power: r = 0.48; dose: r = 0.49), but weak correlations with delayed massage (power: r = -0.31; dose: r = 0.22). Total mechanical dose (r = -0.46 and -0.40 for immediate and delayed conditions, respectively) and average mechanical power (r = -0.39 and -0.45 for immediate and delayed conditions, respectively) over the 4 day massage protocol predicted an inverse relationship with active property recovery.

**CONCLUSIONS:** These findings provide evidence of the importance of mechanical loading, its effects on tissue and joint function, and further insight in aiding clinical decision-making for proper dosing of massage therapies following EEC injury.

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ACLR. PURPOSE: To compare QMQ between limbs and evaluate relationships between QMQ, quadriceps function, and self-report function in individuals with ACLR.

METHODS: Twenty-six individuals with unilateral ACLR (73% females; age = 23 ± 3 yr; time since ACLR = 56 ± 45 months; International Knee Documentation Committee Index [IKDC] = 78 ± 9) volunteered for this study. QMQ was calculated as the echo intensity of cross-sectional ultrasound images of the rectus femoris (RF) and vastus lateralis (VL), and averaged as a composite quadriceps value. Isometric (peak torque and rate of torque development) and isokinetic (peak torque and power at 180°/s) quadriceps function was assessed in the ACLR limb and normalized to body mass. QMQ was compared between limbs via paired t-tests, and relationships between QMQ, quadriceps function, and self-report function (IKDC) were evaluated via Pearson correlations.

RESULTS: QMQ did not differ between limbs for the RF (arbitrary grayscale units: 110 ± 8 vs. 110 ± 7; p = 0.472), VL (112 ± 9 vs. 113 ± 9, p = 0.203), or quadriceps composite (111 ± 8 vs. 112 ± 7, p = 0.326), and was not correlated with any quadriceps function index (r = -0.283 - 0.122, p > 0.05). IKDC was not correlated with QMQ of the VL (r = -0.093, p = 0.332) or quadriceps composite (r = -0.242, p = 0.127), but poorer RF QMQ was associated with poorer self-report function (r = -0.376, p = 0.035).

CONCLUSIONS: Poor QMQ of the RF is indicative of poor self-report function, but QMQ does not differ between limbs and is not associated with quadriceps function in individuals with ACLR. These data suggest that QMQ has limited clinical application for identifying individuals at heightened risk of OA and disability following ACLR. Previous reports of associations between QMQ and muscle function in elderly subjects likely reflect age-related sarcopenia.

D-39 Free Communication/Poster - Physical Activity in Older Adults

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(Please note that a full manuscript is required in order to publish this abstract.)

Purposes: Health and social benefits of engaging in physical activity (PA) for older adults are well documented. Evidence from interventional studies supports the implementation of PA as a preventative and therapeutic intervention for care home residents but little is known about the level of PA residents typically engage in. This study described accelerometer determined levels of PA and sedentary behaviour and its associations with personal characteristics in care home residents.

Methods: Care home residents [n = 110, aged 59 - 100 yr] were invited to wear an Accelerometer on the hip for 7 days. The proportion of accelerometer wear time spent sedentary and engaging in PA was calculated. Residents completed the six item cognitive impairment test. Care home staff reported on residents’ independence [Barthel Index (BI)] and mobility [Physical Activity and Mobility in Residential Care Scale (PAM-RC)].

Results: 62 residents [aged 85 ± 8 yr] provided valid accelerometer data [≥ 8 hours 25 min ± 2 days]. Mean accelerometer wear time was 12 hours 23 min ± 1 hour 28 min. The largest proportion of wear time was spent sedentary [< 100 counts per min (cpm); median: 94% (IQR: 9%)], followed by low intensity PA [100 - 759 cpm; median: 6% (IQR: 9%)]. Engagement in light [760-2019 cpm] and moderate-vigorous [MV;≥ 2020 cpm] intensity PA was < 1%. Residents deemed independent [BI score ≥ 11] spent a higher portion of wear time engaging in low intensity PA [6%] and less time sedentary [93%] compared to those more dependent [4% and 96% respectively; P< 0.05]. Level of cognitive impairment was positively associated with engagement in MVPA [P< 0.05]. 34% of the sample engaged in ≥ 30 min of PA daily; however this was not MVPA or accumulated in bouts of ≥ 10 min as per the current PA guidelines. Residents who accumulated ≥ 30 min of PA were more independent and had walked outside [P< 0.05].

Conclusions: Care home residents spent the majority of their time sedentary and the little PA they did engage in was predominantly of low intensity. Higher levels of independence, mobility and interestingly cognitive impairment were associated with more engagement in PA. 34% of the sample did manage to accumulate ≥ 30 minutes of daily PA which suggests there is potential to either increase the volume or intensity of PA for residents to engage in.

Supported by NHHR Grant PPG-1210-12017

2100 Board #252 June 2, 2:00 PM - 3:30 PM

Accelerometer Determined Levels of Physical Activity and Sedentary Behaviour in Older Care Home Residents

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(Please note that a full manuscript is required in order to publish this abstract.)

PURPOSE: To estimate functional fitness deficiency profile of US older adults using a diagnostic testing model and examine its relationship with major chronic diseases.

METHODS: Nationally representative data (N = 7,495, 45.88% male, 60 years or older) from the 2003-2012 National Health and Nutrition Examination Survey (NHANES) were used for this analysis. A Q-matrix representing four latent functional fitness aspects (mobility, strength, flexibility, and motor function) was first developed by coding the 20 NHANES physical functioning questionnaire items. Using the Q-matrix and the corresponding data, participants’ functional fitness deficiency profiles were then determined by the DINA (Deterministic, Inputs, Noisy, “And” Gate; Macready & Dayton, 1977) Model. Finally, functional fitness deficiency characteristics by chronic diseases (asthma, cancer, heart disease, stroke, arthritis, and diabetes) were analyzed and compared.

RESULTS: The overall prevalence of US older adults’ functional fitness deficiency are 24.26% for mobility, 30.72% for strength, 29.81% for flexibility, and 22.13% for motor function. Persons with chronic disease often illustrated a unique pattern of functional fitness deficiency, e.g., compared with persons with asthma, cancer, heart disease, arthritis, and diabetes, persons with stroke had the highest prevalence of functional fitness deficiency cross all attributes (48.36% for mobility, 54.97% for strength, 53.49% for flexibility, and 46.51% for motor functioning), and persons with asthma and heart disease had higher prevalence of deficiency in the strength attribute (43.25% and 44.44%, respectively).

CONCLUSIONS: The diagnostic analysis provides rich information on functional fitness deficiency and its relationship with common chronic diseases of US older adults, which, in turn, should help health care systems and rehabilitation programs develop targeted and effective intervention and treatment programs for this population.

2102 Board #254 June 2, 2:00 PM - 3:30 PM

Awareness Of A Physical Activity Campaign, Physical Activity, And Sedentary Behavior In Japanese Elderly Adults

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(Please note that a full manuscript is required in order to publish this abstract.)

PURPOSE: It is well known that physical activity (PA) and exercise are important for maintenance and improvement of health as well as prevention of non-communicable diseases. In Japan, the “Physical Activity Guidelines 2013 for Health Promotion” includes as a key message “+10 (plus ten): Add 10 minutes PA for your health.” We conducted a 2-year (2013-2015) community-wide campaign to promote PA based on these guidelines (PA campaign) in four areas of Fujisawa city, Kanagawa, Japan. The campaign involved information, education, and community support. In this study, we compare elderly adults who are aware of this PA campaign with those who are not, in terms of physical activity levels, through a questionnaire.

METHODS: Individuals 65 years or over were selected via population-based random sampling of 3000 adults living in Fujisawa, aged 20 years or over, and were asked to complete self-administered questionnaires. The sample consisted of 264 men (median age [25%-75%ile]: 73 [68-78] yrs) and 284 women (73 [68-80] yrs). Total PA time was the sum of self-reported time spent in exercise or activities equivalent to walking per day. Total PA time and sedentary time were dichotomized by a median split; sex was also a dichotomous variable. Logistic regression analyses were used to calculate the adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) of total PA time and sedentary time according to awareness of the PA campaign, stratified by sex and adjusting for socio-demographic variables.

RESULTS: The median total PA time was 90 minutes/day and 105 minutes/day in men and women, respectively; whereas the median sedentary time was 300 minutes/day in both sexes. Total PA did not significantly differ by campaign awareness (men: OR=0.85 (95%CI: 0.47-1.53), women: 0.99 (0.56-1.77), respectively). Sedentary time significantly differed by campaign awareness (men: 1.87 (1.05-3.32), women: 1.96 (1.13-3.41)).

CONCLUSIONS: Elderly adults who were aware the PA campaign had lower sedentary time, although total PA time did not differ by campaign awareness. These findings could inform improvements of this PA intervention.
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).

2103 Board #255 June 2, 2:00 PM - 3:30 PM Comparing Physical Activity And Sedentary Time Between Elder Runners And Non-runners In Puerto Rico
Osvaldo J. Hernandez-Soto1, Farah A. Ramirez-Marrero, FACSM2, José J. Alequin-Cruz1, Yarelis Barreto-Cordero1. 1Inter American University, San Germán, Puerto Rico. 2University of Puerto Rico, Rio Piedras, Puerto Rico. 3University of Puerto Rico-Medical Sciences Campus, Rio Piedras, Puerto Rico. Email: ojhsui@gmail.com (No relationships reported)

Aging is associated with dramatic reductions in physical activity (PA) and increased sedentary time (ST), both associated with poor health outcomes. Yet, a limited number of elders maintain high level PA through participation in long distance running. The evaluation of PA and ST between elder runners and non-runners using accelerometers is very limited. Purpose: To compare PA, ST, and anthropometric characteristic of Hispanic elder long distance runners and non-runners in Puerto Rico. Methods: Elder runners (n=14) from the Master’s Activity Federation and non-runners (n=15) from one elder home centers (66.5±6.8 and 67.2±4.8 years of age, respectively, P=0.75) wore an ActiGraph GT3X+ accelerometer on the right hip attached to an elastic belt during seven consecutive days. Runners self-reported an average of 5.5 miles/day, 3-6 days per week. Non-runners did not participate in formal PA program. Anthropometric measurements (height, weight, waist and hip circumferences) were obtained to determine body mass index (BMI), waist to hip ratio (WHR), and waist to height ratio (WHR). Independent t-tests were used to determine differences between groups, and Spearman correlations to determine associations between variables. Results: Runners compared with non-runners had higher moderate to vigorous PA (101.5±13.3 vs. 125.4±2.1 min/week; P=0.01), less ST (6.9±2.0 vs. 8.4±1.3 hr/day, P=0.03), and lower BMI and WHR (23.3±2.8 vs. 32.3±6.5 kg/m², P=0.001; 0.49±0.05 vs. 0.65±0.09, P=0.001; respectively). WHR was not different between groups (0.89±0.07 vs. 0.94±0.07, P=0.14). BMI and WHR significantly correlated with PA (rs=-0.37, -0.44; respectively, P<0.05) and ST (rs=0.36, 0.34; respectively, P<0.05). Conclusion: Although differences in PA, ST, and anthropometric characteristics between elder runners and non-runners were in the expected direction, runners did not achieve the minimal PA recommendation. Further evaluations must clarify the gap for Dementia R&D from the Japan Agency for Medical Research and Development (AMED).

2104 Board #256 June 2, 2:00 PM - 3:30 PM Quantifying Longitudinal Patterns and Trends of Objectively Measured Physical Activity Across the Age Spectrum
Jennifer A. Schrack1, Luo Xiao2, Vadim Zipunnikov1, Eleanor M. Simonsick1, Stephanie Studenski1, Ciprian Crainiceanu1, Luigi Ferrucci2. 1Johns Hopkins University, Baltimore, MD. 2North Carolina State University, Raleigh, NC. ‘National Institute on Aging, Baltimore, MD. Email: jschrac1@jh.edu (No relationships reported)

PURPOSE: Physical activity is fundamental to maintaining health and functional status with aging. Accelerometers present new opportunities to define and quantify daily physical activity in older adults, and to better understand the associations among physical activity and health-related outcomes. The objective of this study was to examine the onset and magnitude of the age-related decline in physical activity, and corresponding changes in circadian patterns of activity, in a large cohort of well functioning adults. METHODS: Physical activity was assessed in 308 participants (mean age 70.0, range 38–95, 47% male) in the Baltimore Longitudinal Study of Aging (BLSA) over a 7-day period using the Actiheart, a unidirectional chest-worn accelerometer. Activity was recorded in one-minute activity count epochs, a composite measure of physical activity intensity and duration. The primary outcome was physical activity decline over a mean three-year period (range 1-6 yrs). The association between the log of physical activity counts and age was modeled using linear regression models with generalized estimating equations for repeated measures, adjusted for age, sex, BMI, race, education, employment, functional status, and history of chronic conditions. RESULTS: In fully adjusted population average models, physical activity declined 1.6% per year (p < 0.001). The decline was attenuated in those currently employed and those with better functional status (p < 0.001), but accelerated in participants with higher BMI and those with a history of stroke (p < 0.01). Those who declined were older, more likely to be male, and to have had a history of stroke and peripheral neuropathy at baseline (p < 0.05). In models stratified by age and time-of-day, the greatest decline occurred among those aged 75 and older (n = 90), specifically in the morning hours (8-12 am) (p = 0.02). CONCLUSIONS: Among well functioning, community-dwelling older adults, age-related decline in physical activity is exacerbated by the presence of chronic conditions. Such decline is most evident in the morning hours, when physical activity is typically highest. Use of accelerometers that can generate detailed data on activity patterns throughout the day may provide useful information for effective interventions for maintaining activity later into life.

2105 Board #257 June 2, 2:00 PM - 3:30 PM Associations Between Physical Activity, Sedentary Behaviour And The Environment: A Cross Sectional Study Of Uk Adults
Claire Griffiths1, Steven Zwolinsky1, Darren Greenwood2, Paul Norman2, Jim McKenna3. 1Leeds Beckett University, Leeds, United Kingdom. 2University of Leeds, Leeds, United Kingdom. Email: C.Griffiths@leedsbeckett.ac.uk (No relationships reported)

Purpose: To investigate the association between physical activity (PA) and sedentary behaviour (SB) and opportunities for PA in the environment. Methods: Cross sectional study, September 2013 to August 2014. Participants were adults (16 years +) of whom 9,429 were a sample of 34,895 and SB = 13,401. PA ad SB data was obtained using the short IPAQ. PA was classified as meeting the PA guidelines using a threshold of 7.5 MET-h/wk1. SB was classified as sitting for ≥ 5 hours/day. The PA environment was characterised using the Ordnance Survey Points of Interest (POI) data. PA opportunities within the study area were grouped into four categories, ‘green space’, ‘specialised facilities’, ‘general PA facilities’ and ‘all POI combined’. Neighbourhoods were characterised using Lower Super Output Area of residence. Index of multiple deprivation, age and gender and population density were included as covariates within a causal framework. Random intercept models estimated associations between PA opportunities and PA and SB in separate models. Results: 67% of participants achieved current PA recommendations, while 56% were classified as sedentary. Compared to those living in the least derived areas (IMD Q1), those living in the most deprived areas (IMD Q4) were less likely to meet the PA recommendations (OR=0.74 95%CI=0.67 to 0.83) but also less likely to be sedentary (OR=0.89 95%CI=0.80 to 1.00). One third (n=5633) of respondents and LSQAs (n=144) had no access to any PA opportunities. Only 30% (n=4799) of respondents and 11% of LSQAs (n=50) had access to green space. The most deprived quintile had the lowest count of PA facilities across all categories. Individuals with access to 2+ opportunities for PA were slightly more likely to achieve the PA recommendations (OR=1.11 95%CI=1.01 to 1.22). There was no evidence of an association between PA opportunities (all POI combined) and SB nor between PA and SB, with green space specifically as a green space variable. There is little evidence to suggest that access to opportunities for PA, including green space, substantially either increases PA or reduces SB, any associations observed were relatively small and unlikely to influence policy. The evidence is not well placed to support policy interventions.

2106 Board #258 June 2, 2:00 PM - 3:30 PM A Quantified Pre-frailty Prediction Score in Frailty Syndrome
Hung-Ju Chen, Wen-Hsu Sung, Shun-Hwa Wei. National Yang-Ming University, Taipei, Taiwan. (No relationships reported)

Frailty syndrome is currently a novel but emerging concept in geriatrics and leads to disability of older adults and escalation of healthcare costs. Early Pre-frail detection is essential for Frailty prevention. Fried Frailty Criteria contained five clinical physiological items helps to determine whether an elder is in Frailty or Pre-frail stage; however, no quantitative index of Frailty has been developed so far. PURPOSE: To organize common clinical physical performance tests and to form a quantitative score to indicate the degree of Pre-frail severity. METHODS: Thirty-five community-dwelled elders were recruited and screened into Frailty (n=4, 72.5±5.5 y/o), Pre-frail (n=19, 74.6±3.5 y/o) and Robust groups (n=12, 71.42±5.82 y/o). Only Pre-frail and Robust groups participated and performed six physical performance tests, including Single Leg Stand (SLS), Repeated Chair Rise (RCRT), Timed Up and Go (TUG), Self-selected Walking Speed (SSW), Functional Reach (FR), and Grip Power (GP). Differences between groups were compared using independent t-test and Mann-Whitney U test, and a binary logistic regression model was used to build a Pre-frail index, the “FAT score”. Statistically significant level was set at .05. (α = .05) RESULTS: Five tests were valid to detect Pre-frail from Robust, i.e. RCRT (20.26 vs 9.25 sec, p = .001), TUG (19.58 vs 10.33 sec, p = .006), SWS (75.19±12.76 vs 111.09±26.1 m/s, p = .000), FR (17.59±1.84 vs 19.53±1.84 m/s, p = .000).
Despite this evidence, CVD continues to rise, and public health PA initiatives often fail to demonstrate clinically relevant effects. In short, laboratory efficacy often fails to translate into real-world effectiveness.

**Purpose:** We investigated the effectiveness of three physical activity interventions. We did so using a Phase-IV clinical trial model, in which all treatments were administered in uncontrolled community settings, and in which all interventions and measures were delivered by and, conducted by, community health centre staff.

**Methods:** Participants were sedentary individuals receiving no medication to reduce CVD risk for ≥38 years (age 43±5 years). Participants selected a PA or exercise (EX) pathway. Those who selected PA were randomised to either fitness centre based PA counselling delivered by an exercise professional (PAC) or a wait-list control condition (CONT). Those who selected EX were randomised to either a structured exercise program (STRUC) or unstructured fitness centre use (FREE). Measures were mean arterial pressure (MAP: mmHg) estimated using the formula Diastolic Blood Pressure (DBP) + (0.33 x (Systolic BP – DBP)), and total cholesterol (TC: mmol/L). Measures were taken at baseline and 48 weeks. Data were analysed using paired-sample t-tests.

**Results:** Data analysis for cholesterol indicated a small but statistically significant increase in TC in CONT (M=0.8%, SD=0.5, p = .005). TC was however approximately equivalent to baseline in PAC and FREE and reduced, although not significantly, in STRUC. Data for blood pressure indicated a statistically significant decrease in MAP in STRUC (M=2.5%, SD=8.3, p = .004). MAP was reduced, although not significantly, in all other treatments and CONT.

**Conclusions:** Data suggest that over 48 weeks, all forms of exercise might be effective in offsetting increases in total cholesterol associated with inactivity. Furthermore, a structured exercise programme might be more effective than either unstructured exercise or physical activity counselling in reducing mean arterial blood pressure.

**D-40 Free Communication/Poster - Physical Activity Interventions in Adults - Part II**

**Thursday, June 2, 2016, 1:00 PM - 6:00 PM**

**Room: Exhibit Hall A/B**

**2107 Board #259**

**June 2, 3:30 PM - 5:00 PM**

**The 10-week Lifestyle Intervention Fit For School: Impact On Obesity Indices, Biomarkers, And Blood Pressure**

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(No relationships reported)

**Scientific Abstract**

Although body mass index is frequently used by researchers to evaluate the effectiveness of lifestyle interventions, the inclusion of additional measures may provide a more thorough and valid assessment of intervention effectiveness.

**Purpose:** To examine changes in cardiometabolic risk in youth following a 10-week school-based lifestyle intervention. **Methods:** Forty five participants (10.87 ± 0.54 yrs) including 27 boys and 18 girls took part in the study. All participants had obesity indices, biomarkers, and blood pressure assessed pre- and post-intervention. Intervention participants completed a weekly 10-week intervention consisting of healthy eating and physical activity education, physical activity, parental involvement, and behaviour change while control participants received no intervention. Changes in outcome measures between groups across time were assessed using general linear mixed models with repeated measures with adjustment for covariates and expectation maximization for missing data. **Results:** A significant group x time interaction was observed for glucose (p=0.05, ES = 0.38), TG (p=0.05, ES = 0.30), TC (p=0.05, ES = 0.36), HDL-C (p=0.05, ES = 0.26), and LDL-C (p=0.05, ES = 0.41). In the intervention group, TC decreased 1.31 mmol/L (CI = 0.77 to 1.86, p<0.001), HDL increased 0.15 mmol/L (-0.28 to -0.02, p<0.05), LDL decreased 1.5 mmol/L (0.93 to 2.07, p<0.001), and WC decreased 2.3 cm (1.07 to 3.53, p<0.05) post-intervention. Systolic BP increased in the control group 7.82 mmHg (-14.25 to -1.38, p<0.05), but not in the intervention group. **Conclusion:** In conclusion, the 10-week lifestyle intervention, Fit for School, may be an effective way to prevent and reduce cardiometabolic risk factors in primary school children. Although the initial findings appear promising, further work over a longer period of time is required to determine the sustained impact of health enhancement interventions in children on cardiometabolic risk factors. These findings highlight the importance of using additional markers rather than BMI alone to measure intervention effectiveness.

**2108 Board #260**

**June 2, 3:30 PM - 5:00 PM**

**Effects On Cardiovascular Risk Factors Of Three 48-week Community-based Exercise Interventions**

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(No relationships reported)

A sedentary lifestyle is associated with cardiovascular disease (CVD). Blood pressure (BP) and blood lipids (cholesterols) are key mediators of CVD. A substantial body of evidence demonstrates reduced CVD risk following systematic physical activity (PA).
HITT. PURPOSE: The purpose of this study was to examine alterations in resting vagal tone through the measurement of heart rate variability (HRV) over a 16-week CF training program.

METHODS: Nine apparently healthy females (35.8 ± 9.25 years) participated in this study. On two separate occasions, Pre and Post 16-week, participants attended the Exercise Science lab in order to obtain a 10-minute resting HRV recording using Polar Team2 monitors (Lake Success, NY). In order to quantify HRV, the last five-minute segments of each 10-minute recording were analyzed using methods outlined in (Version 2.2). The markers used to quantify HRV were the time domain of the Root Mean Square of Successive Differences (RMSSD) and the High-frequency (HF) of the power spectrum density.

RESULTS: Data was log transformed due to a violation of normality and expressed as lnRMSSD and lnHF. Paired sample t-tests showed no significant differences between pre and post lnRMSSD (Pre: 1.60 ± 0.24 ms2, Post: 1.64 ± 0.20 ms2, p = 0.510) and lnHF (Pre: 1.68 ± 0.18 ms2, Post: 1.70 ± 0.19 ms2; p = 0.765).

CONCLUSIONS: 16-weeks of HITT was not sufficient enough to significantly influence markers of resting vagal tone.

In the United States, 1 out of every 3 adults will develop type 2 diabetes (T2DM) in their lifetime. Physical activity is an important part of managing T2DM among adults with the prevalence of sedentary lifestyle increasing. Self-regulation has been an important tool of T2DM management, as adults with T2DM are often required to monitor their diet and physical activity. Therefore, it is important for health professionals to focus on advancing any pre-existing use of self-regulatory strategies to also include exercise behavior. PURPOSE: To evaluate the effect of a brief, behavioral intervention on dimensions of self-regulation for physical activity in a sample of overweight and obese adults with T2DM. METHODS: A total of 23 participants were randomly assigned to intervention (n = 12) and control (n = 11). Individuals in both groups met with researchers individually during fifteen-minute sessions once a week for four weeks. The intervention group engaged in a behavioral intervention that targeted self-regulation variables by incorporating exercise diaries to plan and log weekly physical activity that used goal setting and self-monitoring. The control group only received information regarding their own weekly physical activity habits and was excluded from self-regulation strategies provided in the intervention group. Measures of physical activity, in minutes, using a BodyMedia Armband and dimensions of perceived self-regulation were taken at pre and posttest. RESULTS: The effect of the intervention on self-regulation scores was significant, F(1, 21) = 7.011, p = .015. This implies that there were significant differences in self-regulation between the intervention and control groups. Inspection of Cohen’s d effect sizes reveals a large effect (d = .581) of the intervention on all dimensions of self-regulation.

CONCLUSIONS: This study demonstrated the ability of a behavioral intervention to improve self-regulation for physical activity among adults with T2DM. This is critical as health promotion programs can adopt similar strategies to improve self-regulation for physical activity in this population and for future research.

Physical activity and exercise reduce the risk of chronic disease. Sedentary behavior has emerged as an independent risk factor for chronic disease and premature death. PURPOSE: To determine whether an intervention to disrupt sedentary time at work would reduce sedentary time during working hours, non-working hours, number of sit-stand transitions during working hours, and change in perceived wellness.

METHODS: Office staff and administrators who worked in office buildings at a University with a sedentary job description, consisting of sitting at a desk for the majority of the workday were recruited. Participants (n = 44) were randomly assigned to the control-group control (CC) (n = 22), or intervention group (CI) (n = 22). Both groups wore an activPAL3 activity monitor, functioning as both an accelerometer and inclinometer continuously for 2 weeks. The CC group maintained normal behaviors. The CI group maintained normal behaviors during week 1, but responded to the hourly alerts on their computer throughout the workday during week 2. The hourly audible alert was a reminder to get up and move for a short duration. Both groups completed a perceived wellness survey at the beginning of the study and after weeks 1 and 2. RESULTS: Participants were women aged 48 ± 10 with a BMI of 30.5 ± 8.2. A repeated measures ANOVA (group x time) found no differences during week 2 in sit time during non-work hours (CC 13.82 ± 1; CI 13.54 ± 4.44) or sit-to-stand transitions at work (CC 39 ± 12; CI 41 ± 13; p = .673). There was a between group difference in sedentary time at work during week 2 (CC 6.05 ± 7.4; CI 5.42 ± 1.19; p = .012). However, neither group changed from week 1 to week 2 (p = 0.509). Perceived wellness was not different between groups (p > .05). A significant difference was found in perceived wellness from day 0 to day 16 (p < 0.001) in both groups. CONCLUSIONS: The intervention had no effect on sitting time or sit-to-stand transitions during the workday. There was no change in any variable during non-work hours. Perceived wellness scores improved over time for both groups in the absence of behavior change.

An Intervention To Reduce Sedentary Time And Change Perceived Wellness In Women Office Workers

Physical Activity (PA) Body Mass Index (BMI)

PURPOSE: To evaluate the impact of an intervention to promote healthy lifestyles among medical students at Universidad de los Andes in Bogota, Colombia.

METHODS: A longitudinal, exploratory study was conducted between May 2014 and June 2015. The sample contained 156 medical students enrolled in the Medical Physiology course. The curriculum intervention comprised a healthy lifestyle promotion strategy. One class was dedicated to Exercise Physiology. Students were asked to conform groups to research topics related to PA, nutrition and tobacco. The professor gave a formative sport incentive (10% of the final grade) to the student who regularly practiced PA and adopted healthy behaviors during the semester. A quantitative approach was used to measure health and fitness-related variables (i.e. BMI, Body fat, VO2max, Handgrip strength, Sit-up strength) at the beginning and at the end of the course. A qualitative approach was used to assess perceptions about the curriculum intervention and PA practices. Data was collected through self-reported evaluations (n=130) and semi-structured interviews (n=36). RESULTS: Of students, 57% were females, with age average of 20±1.5 years. Body fat decreased in 1.24%; Handgrip strength increased in 2.8 kg [CI: 1.83 to 3.83; p-value<0.01]; Sit-up strength in 30 seconds increased in 3 Sits-ups [CI: 2.43 to 3.72; p-value<0.01]. No differences were observed in BMI. All students reported to have practiced PA during the semester –on average three times a week– influenced by the curriculum intervention; particularly the academic incentive and physical fitness tests. Students reported to practice a vast variety of PA activities –sports, workouts, aerobic– mainly accompanied by friends, classmates and family members. Lack of time was the main barrier to practice PA. The intervention increased student’s recommended levels of PA (83% students post class compared to 36% students pre class). CONCLUSION: A minimal curricular intervention was effective in improving medical students’ personal PA habits and fitness. It remains to examine whether achievements of healthy lifestyles among students are maintained over time.

An Intervention To Reduce Sedentary Time And Change Perceived Wellness In Women Office Workers

Long-term Effectiveness Of A Primary-care Health Intervention In New Zealand

Physical activity and health information

PURPOSE: To determine the long-term effectiveness of a primary-care health intervention and change perceived wellness in women office workers.

METHODS: Office staff and administrators who worked in office buildings at a University with a sedentary job description, consisting of sitting at a desk for the majority of the workday were recruited. Participants (n = 44) were randomly assigned to the control-group control (CC) (n = 22), or intervention group (CI) (n = 22). Both groups wore an activPAL3 activity monitor, functioning as both an accelerometer and inclinometer continuously for 2 weeks. The CC group maintained normal behaviors. The CI group maintained normal behaviors during week 1, but responded to the hourly alerts on their computer throughout the workday during week 2. The hourly audible alert was a reminder to get up and move for a short duration. Both groups completed a perceived wellness survey at the beginning of the study and after weeks 1 and 2. RESULTS: Participants were women aged 48 ± 10 with a BMI of 30.5 ± 8.2. A repeated measures ANOVA (group x time) found no differences during week 2 in sit time during non-work hours (CC 13.82 ± 1; CI 13.54 ± 4.44) or sit-to-stand transitions at work (CC 39 ± 12; CI 41 ± 13; p = .673). There was a between group difference in sedentary time at work during week 2 (CC 6.05 ± 7.4; CI 5.42 ± 1.19; p = .012). However, neither group changed from week 1 to week 2 (p = 0.509). Perceived wellness was not different between groups (p > .05). A significant difference was found in perceived wellness from day 0 to day 16 (p < 0.001) in both groups. CONCLUSIONS: The intervention had no effect on sitting time or sit-to-stand transitions during the workday. There was no change in any variable during non-work hours. Perceived wellness scores improved over time for both groups in the absence of behavior change.
was gathered via telephone interviews from patients that were offered a Green Prescription program up to 3 years ago. Respondents were classified as either having completed the program (intervention group, n = 93), or not completed the program (control group, n = 56, either declined enrolment, or dropped out after a few sessions).

**RESULTS:** Participants who had completed the Green Prescription program 2-3 years ago reported 64 ± 48 additional minutes per week (mean ± 95% CI) of physical activity compared to those that dropped out. Forty-two percent of participants in the intervention group reported increased physical activity levels since being prescribed the Green Prescription compared to 29% in the control group. The control group were more likely to be sedentary than the intervention group (Odds Ratio 1.8, 95% CI 1.2-2.9) and less likely to meet the current physical activity guidelines of at least 150 minutes of physical activity per week (comprising of at least 30 min per day on 5 or more days) (OR = 0.7, 95% CI 0.3-1.4). **CONCLUSION:** After being offered a Green Prescription 2-3 years ago, participants who completed the program had significantly increased their daily physical activity (P = .009). Differences between groups were consistent across both age and sex categories. **Purpose:** To examine the impact of a women’s physical activity intervention on increased physical activity levels since being prescribed the Green Prescription compared to 29% in the control group. The control group were more likely to be sedentary than the intervention group (Odds Ratio 1.8, 95% CI 1.2-2.9) and less likely to meet the current physical activity guidelines of at least 150 minutes of physical activity per week (comprising of at least 30 min per day on 5 or more days) (OR = 0.7, 95% CI 0.3-1.4). **Conclusions:** After being offered a Green Prescription 2-3 years ago, participants who completed the program had significantly increased their daily physical activity (P = .009). Differences between groups were consistent across both age and sex categories.

A sedentary lifestyle is associated with cardiovascular disease (CVD). A substantial and compelling body of evidence demonstrates reduced CVD risk following systematic physical activity (PA). Despite this evidence, CVD continues to rise, and public health PA initiatives appear to be failing to demonstrate clinically relevant effects. **Purpose:** A core component of cardiovascular health is the ability to utilise oxygen, termed ‘oxygen uptake’ or VO₂. We investigated the effectiveness of three physical activity interventions on oxygen uptake. We did so using a Phase-IV clinical trial model, in which all treatments were administered in uncontrolled community settings, and in which all interventions and measures were delivered by, and conducted by, community health centre staff. **Methods:** Participants were sedentary individuals receiving no medication to reduce CVD risk (n=238, age=43.15 years). Participants selected a PA or exercise (EX) pathway. Those who selected PA were randomised to either fitness centre based physical activity counselling delivered by an exercise professional (PAC) or a wait-list control condition (CON). Those who selected EX were randomised to either a structured exercise program (STRUC) or unstructured fitness centre use (FREE). The dependent measure was predicted maximum oxygen uptake (VO₂ max), measured using the Cosmed Fidmate. Measures were taken at baseline and 48 weeks.

**Results:** Repeated measures ANOVA indicated no statistically significant difference between treatments (F[3,215] = 1.73, p = .321), and paired-sample t-tests indicated no significant pre-post effects for any treatment. When data were grouped using a quartile split by baseline VO₂ max however, repeated measures ANOVA indicated significant differences between treatments (F[3,215] = 16.1, p < .001), specifically that whilst in the highest two quartiles VO₂ max was reduced (M = -2.7, SD = 7.0, p=.05 and M = -2.6, SD = 6.0, p=.008 respectively), and no significant change was observed in the third quartile (M = -0.1, SD = 5.0, p = .89), in the lowest quartile, VO₂ max was significantly increased (M = 4.1, SD = 6.6, p < .001). **Conclusions:** Data suggest that in terms of VO₂ max, treatments in the current study were more effective with the least fit participants at baseline, and actually counter-productive for the most fit.

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Increased levels of strength have demonstrated positive effects on body fat, resting metabolic rate, blood pressure, glucose metabolism, and insulin resistance. Many people, however, do not participate in strength training due to fear of re-injury, disabilities, and lack of time and/or motivation. A novel exercise technique known as blood flow restriction (BFR) that consists of restricting the circulatory pathways by way of pneumatic cuffs or elastic wraps has gained popularity. It has been found that BFR increases skeletal muscle activation and strength while using shorter training times, a relatively low intensity (20% 1RM), as well as low intensity walking and baking it into a viable intervention for sedentary individuals. However, a proper protocol has not been developed. The protocol currently in use did not evaluate initial restrictive pressure (IRP), an important variable, in its design. Additionally, individuals that have used BFR report high levels of pain or discomfort. **Purpose:** To examine the current protocol with the inclusion of various IRP, while observing changes in electromyography (EMG), maximal voluntary contraction (MVC), rate of perceived exertion (RPE), and discomfort/pain (DP).

**Methods:** Sixteen healthy male (age= 26.63 (5.88) years) participants were grouped based on four sets of bilateral knee extensions on three separate occasions separated by at least 48 hours. Each session was randomized into the following conditions: IRP0@FRP+20, IRP65@FRP-20, and IRP50 (Control). During each condition RPE and DP were recorded. MVC was recorded pre and post exercise. EMG was recorded at the vastus lateralis with a focus on motor unit activation (RMS) and muscle firing rate (MDF).

**Results:** No significance was found between conditions for RPE, DP, or MDF. The strength of knee extensions was significantly decreased by IRP65@FRP-20. **Conclusion:** The results suggest that IRP may be used to elicit a greater effect during BFR exercise without changing the level of exertion or discomfort felt by the subject. Further research is needed for the development of a proper protocol, which includes IRP in its design, so that BFR may be utilized as an intervention technique in a sedentary population.

Young adults face an abundance of behavior choices when entering college. One important decision is to regularly participate in physical activity. Common barriers to physical activity may hinder an individual’s decision to make healthy behavior choices, such as physical activity. **Purpose:** To examine the impact of a women’s physical activity intervention on perceived benefits and barriers, body composition, and energy expenditure.

**Methods:** Non-randomized experimental design was used between two groups (n=50) of college-aged women. The first group was enrolled in one of two one-credit physical activity courses (intervention; n=15, age=21.93 years). The second group was enrolled in a freshman general requirement course (control; n=35, age=19.8 years). The intervention included a 7-week physical activity program (150 minutes/week) developed based on the Health Belief Model, which targeted perceived barriers and benefits to exercise. Each session highlighted behavior change strategies targeting barriers and benefits, followed by a physical activity session. Pretest and posttest measurements included: Exercise Benefits/Barriers Scale to assess barriers and benefits to physical activity, BODPOD to measure body composition, and accelerometry to estimate daily energy expenditure (SenseWear armband). ANCOVA was used to evaluate differences between groups following intervention. **Results:** Intervention women increased fat-free mass (0.49kg) compared to a loss of fat-free mass in control (-2.5kg; p=0.03). Physical performance, a benefit subscale to exercise, also showed a trend (control=0.07; intervention= 0.13, p= 0.07). There was no significant difference in energy expenditure between groups. **Conclusions:** The increase in fat-free mass is a significant finding when looking at energy balance and weight management over time. Resting metabolic rate is strongly associated with fat-free mass; accounting for 70% of resting metabolic rate. A trending increase in physical performance suggests a physical activity intervention may be effective for preventing sedentary behavior and promoting physical activity in college-age populations. Policies that mandate a physical activity course for freshman students may be one way to protect against chronic disease and overweight/obesity.

For many years, Public Health in the UK has used weight management interventions and therefore weight loss as the key mechanism for reducing cardiovascular disease (CVD) risk. While traditional interventions have focussed on nutritional support and feminised commercial weight loss groups, many commissioners now look to more innovative sport-based alternatives to engage harder to reach groups in improving CVD risk. Despite this, little direct comparison has been made between the two types of programme as to their effectiveness. **Purpose:** To compare the effectiveness of Motivate, a 12-week weight management programme, delivered by a professional soccer club (MOT), with a commercial weight loss group (COM) in reducing the body weight of community dwelling men and women 35 years and older.

**Abstracts were prepared by the authors and printed as submitted.**
METHODS: One hundred and seventy three men and 98 age-matched women (mean age 52.28 ± 9.74 and 51.19 ± 9.04) attending the MOT and COM programmes during March 2012 - February 2013 were included. Height (m) and weight (kg) were measured at weeks 1 and 12 as part of both interventions. Changes in body weight were compared over the 12 weeks and between the two interventions using a 2-way RM ANOVA, with significance set to p = 0.05.

RESULTS: Body weight significantly improved over time in both MOT (4.76kg, p = 0.05) and COM programmes (4.55 kg, p = 0.05). Men were significantly heavier than women (p = 0.00) in both programmes, but there was no significantly different change in weight loss between genders. There was a significant difference in weight loss between programmes (p = 0.05), but not when controlling for starting weight (p = 0.903). Attendance was similar for both programmes and there was a significant relationship between the number of sessions attended and weight loss in men (r = 0.513, p = 0.00) and women (r = 0.559, p = 0.00).

CONCLUSIONS: Despite larger numbers of men and women achieving 5% weight loss in the commercial weight loss group, innovative community weight management interventions aimed at reducing CVD risk via weight loss programmes using high intensity exercise as well as nutrition education are equally as successful at reducing body weight in men and women, when controlling for starting body weight. When comparing solely weight loss, the wider cardiovascular health benefits of such interventions may be masked.

2119 Board #271 June 2, 3:30 PM - 5:00 PM
A 5-week Zumba Fitness® Intervention Improves Quality Of Life In Inactive Ecuadorian Workers
Emilio Villav-González, Susana Paz-Viteri, Vinicio Sandoval, Marcela Guerendiain, Yaira Barranco-Ruiz. National University of Chimborazo, Riobamba, Ecuador. Email: emiliovillagon@gmail.com (No relationships reported.)

Zumba Fitness® is a highly popular aerobic dance fitness program that combines different Latin Rhythm. Despite the attractiveness of Zumba, there is little evidence supporting the potential health benefits of this relatively new exercise approach. Purpose: To investigate the effects of a Zumba Fitness® intervention on quality of life in inactive Ecuadorian workers. Methods: A total of 69 inactive (<150 min of physical activity/week) participants (age 38.8±0.93 yrs; women, 81.2%; men, 18.8%) completed a 5-week intervention attending Zumba Fitness classes 3 days/week, 60 minutes/class out from working hours. Quality of life using the SF-36 Health Survey was measured at pre-intervention, post-intervention and 2-months follow-up. The rating of perceived exertion by Borg Scale (0-10) was recorded after each Zumba class (mean RPE=6.35±0.10). Repeated measures ANOVA test was used to compare variables before, after and follow-up of the intervention. Results: Significant differences (p<0.05) were observed immediately after intervention (mean differences post-intervention—pre-intervention) in physical role (17.89±7.03), vitality (12.89±3.81), mental health (6.37±2.27) and social function (16.96±4.50) subscales from SF-36. In addition, social function (10.37±3.13) and mental health (9.76±3.42) subscales showed a significant increase at 2-months follow-up (mean differences 2-months follow-up—pre-intervention). No interaction on the effects of the intervention was observed by sex. Conclusions: A 5-week Zumba Fitness® intervention improves quality of life in Ecuadorian inactive workers at short and long-term. Funding was provided by the National University of Chimborazo, Ecuador (29-CI-2014-10-17-22).

2120 Board #272 June 2, 3:30 PM - 5:00 PM
Reductions In Diabetes And Cardiovascular Risk Following An Exercise And Diet Intervention For Diabetes Prevention
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PURPOSE: To determine the impact of the type 2 diabetes (T2D) Prevention Using Lifestyle Education (PULSE) program for men on T2D and cardiorespiratory health (CVD) risk.

METHODS: A 6-month parallel-group RCT was conducted. Eligible men were aged 18-65 years, BMI 25-40 kg/m² and at high-risk for T2D. The PULSE Program consisted of print and video resources on weight loss, diet and exercise for T2D prevention. Men were provided with a home-based unsupervised aerobic and resistance training program. Participants provided written informed consent. Assessments were conducted at baseline, 3 and 6 months (primary time point). Linear mixed models (intention-to-treat) were used to determine significant (P<0.05) group-by-time interactions. Effect sizes were calculated using Cohen’s d. Chi-square (X²) tests were used to detect significant differences (P<0.05) between groups for classification of prediabetes, MetS and CVD risk (Framingham 10-year risk [next highest, >10%], and Australian 5-year risk [moderate, >10%]).

RESULTS: Baseline characteristics (mean/SD) were: age (52±10.9 y), weight (103.0±13.1 kg) and HbA1c (5.8±0.5%). At baseline there were no between group differences for prediabetes, MetS, Framingham or Australian CVD risk score (all p>0.05). Group-by-time differences at 6 months (mean [95% CI]) favored the intervention for weight (-5.52 [-7.40, -3.64], p<0.01; Cohen’s d=0.42, primary outcome), HbA1c (-0.2% [-0.3, -0.1], p<0.01, d=0.41), waist (-6.2 cm [-8.7, -3.7], p<0.01, d=0.98), VO2max (3.34 ml·kg⁻¹·min⁻¹ [0.73, 6.13], p<0.01, d=0.51) and lower body muscular fitness (17 repetitions [9, 25], p<0.01, d=0.74). At 6 months there was a significant between group difference favoring the intervention for the Australian CVD risk score (X²=5.76, p=0.02) and Framingham CVD risk score trended towards significance (X²=3.34, p=0.07), but no differences in prediabetes (X²=0.08, p>0.78) or MetS (X²=0.01, p=0.94) classification.

CONCLUSION: A self-administered lifestyle intervention led to improvements in T2D and CVD risk. This has important implications, as self-administered programs have great potential for dissemination. Supported by HMRI.

2121 Board #273 June 2, 3:30 PM - 5:00 PM
Qualitative Analysis of Health Coaches’ Experiences during a Workplace Wellness Intervention
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Health coaching is an emerging field not yet examined as intensively as specific theoretical approaches (e.g., motivational interviewing) known to facilitate health behavior change, though evidence supporting coaching’s effectiveness is positive. There is little study of the health coach’s perspective on the coaching experience and such knowledge would be valuable to advancing this young profession. PURPOSE: To examine health coaches perceptions and experiences with clients during a workplace wellness program (WWP). METHODS: Professional health coaches (N=13; trained by Wellcoaches methods and with at least one-year in practice) were interviewed individually after being employed to provide up to 6 mo coaching to over 300 participants in a workplace wellness program. The interview inquired about their experiences and approaches in 30-35 min weekly coaching sessions with their clients from diverse socio-economic backgrounds. The semi-structured interviews lasted between 40-60 min. Consensual Qualitative Research (CQR) procedures were used to analyze interview data in developing higher order themes and subthemes. RESULTS: Four domains were revealed: 1) treatment approaches, tools and skillsets used during coaching; 2) challenges and experiences with WWP intervention; 3) Coach experiences towards own journey to wellbeing; 4) client-coach connections and positive/negative experiences with clients. Subthemes identified factors coaches described as important components of the coaching process (e.g., client driven approach), the navigation of challenging interactions or experiences during the coaching process (e.g., clients not wanting coaching), and the experiences associated with implementing a treatment approach/philosophy with clients from WWP that differed compared to typical clients. CONCLUSION: Providing coaching in the workplace presents various challenges related to flexibility of coaching within the program structure. However, coaches interviewed were generally positive about working with their clients. Relationship building was identified as critical to success in the coaching process. Future work should compare coach and client experiences in the coaching process. Funding provided by: Institute of Coaching at McLean Hospital, a Harvard Medical School affiliate.

2122 Board #274 June 2, 3:30 PM - 5:00 PM
A Randomized Controlled Trial to Test the Feasibility of the Trans-Contextual Model in Physical Activity
Sami Yli-Pipari1, Todd Layne2, Carol Irwin2. 1University of Georgia, Athens, GA. 2University of Memphis, Memphis, TN. (No relationships reported)

One of the key questions in human behavior is how social environment facilitates individuals’ behavior change. Trans-contextual model (TCM) is an integration of social psychological theories; self-determination theory (SDTD), hierarchical model of intrinsic and extrinsic motivation (HMIEM), and theory of planned behavior (TPB), and it is designed to determine the role of social agents on motivation and intended behavior. Specifically, TCM is a multitheory approach to understanding the processes by which forms of motivation toward educational activities in a classroom context lead to motivation toward similar activities and behaviors in out-of-school contexts.
PURPOSE: The present study was a randomized controlled trial to examine the feasibility of the TCM on predicting physical education (PE) students' autonomous motivation and its transfer to intended physical activity (PA) participation.

METHODS: A three-wave data comprising six schools (3 experiment and 3 delayed treatment schools) and 408 (naproxenarm = 198; noncox 210) school students (Mage = 12.29). Participants were recruited on their affiliation in a local school district, and the data were collected in a middle school setting in the mid-south United States during a seven week period. Primary outcomes of this parallel group study were student autonomous motivation in PE and exercise, PA intention, and PA.

RESULTS: Firstly, the results showed that the intervention had a positive effect on students' autonomous PE motivation via their perception of autonomy (β = .29, p < .01) explaining 51% in the changes in the students' autonomous PE motivation (SDT premise). Secondly, autonomous motivation in PE was shown to predict autonomous motivation in exercise (β = .63, p < .01; R2 = .44). (HMIEM premise). Finally, autonomous motivation in exercise predicted PA through PA intention (TPB premise) explaining 35% of the changes in the variance of PA. In addition, a moderate indirect effect from autonomous exercise motivation via PA intention to PA emerged (β = .17, p < .01, CI 95% [.11, .22]).

CONCLUSIONS: This study corroborated the central tenets of the TCM, and supported its feasibility on real life PE context. Future studies are needed to examine the long lasting effects of autonomy support on PA.

Clinical and general health guidelines recommend physical activity (PA) and exercise for osteoarthritis (OA). Among people with OA, PA levels are low, there is a global underutilisation of exercise, and benefits are generally not sustained due to suboptimal adherence that declines over time. Telephone delivered health coaching can be used in chronic disease management to improve adherence to treatment recommendations and to facilitate health behaviour change.

PURPOSE: To investigate whether telephone coaching improves effectiveness of a physiotherapy-prescribed home-based PA and exercise program for people with knee OA.

METHODS: A 2-arm pragmatic randomised controlled trial was carried out with 168 inactive adults aged 50 years and older with knee pain and clinically-diagnosed knee OA. After randomisation to a Coaching (N=84) or Control (N=84) group, all participants received 5 x 30-minute individual consultations with a physiotherapist over 6 months for education, home-based exercise prescription, and advice to increase PA. Those in the Coaching group also received 6-12 telephone coaching sessions by trained health coaches for behaviour change support around PA. Primary outcomes were self-reported knee pain (numeric rating scale) and physical function (WOMAC) at 6 months. Secondary outcomes included these same measures at 12 and 18 months, other pain measures, PA, and quality of life.

RESULTS: 142 (85%), 136 (81%), and 128 (76%) participants completed 6-, 12- and 18-month measurements, respectively. Change in pain (mean difference 0.4 units; CI 95% [.11, .22]) were self-reported knee pain (numeric rating scale) and physical function (WOMAC) at 18-month measurements, respectively. Change in pain (mean difference 0.4 units; CI 95% [.11, .22]).

CONCLUSIONS: This study corroborated the central tenets of the TCM, and supported its feasibility on real life PE context. Future studies are needed to examine the long lasting effects of autonomy support on PA.

Purpose: The present study examined the reported changes in moderate to vigorous physical activity (MVPA) and smoking behaviors at the end of an 8-week treatment as part of an ongoing study. Methods: Healthy sedentary smokers (N= 57) were randomly assigned to an 8-week cognitive behavioral smoking cessation program (CBT) plus either an Iyengar yoga program (Yoga) or a health & wellness control (CTL). Results: Participants averaged 46.9 years of age (SD=11.5), were predominantly women (54.4%), mean BMI was 27.8 (SD=4.6). Participants reported smoking an average of 17.8 (SD=10.1) cigarettes per day at baseline. Self-reported minutes/week of MVPA was collected via the 7 day Physical activity recall (PAR) at baseline and weeks 8, along with cigarettes/smoked per day and confidence to quit. The yoga program was designed for sedentary novices and was considered as light activity on the PAR. Using a generalized linear model, we tested the association between treatment group and changes in MVPA over the 8 week treatment phase. At baseline there were no significant differences in MVPA between groups (Yoga = 122 min/week; CTL = 154 min/week). Results did not show significant-between-group differences in MVPA (p>0.05), we tested the association between changes in MVPA and changes in cigarettes smoked/day after the 8 week treatment, amongst the aggregate sample. A similar modeling approach was used in which mean cigarettes/day at week 8 was regressed on changes in min/week of MVPA from baseline to 8 weeks, controlling for baseline smoking levels. Results revealed a significant negative association such that those with greater increases in MVPA over 8 weeks reported lower mean cigarettes smoked/day at end of treatment (b=−0.02, SE=0.01, p=0.02). Furthermore, there was a trend for a positive association between changes in MVPA and changes in mean confidence to quit smoking, b=.01, SE=.004, p=.09. Conclusion: These results provide an indication that self-initiated changes in moderate-to-vigorous physical activity among a sample of adult smokers may be associated with reductions in smoking behavior and increased confidence to quit.

Supported by NIH R01 AT06948

Purpose: To compare the effect of BodyPump and traditional resistance training with and without a personal trainer to a non-exercising control group, on muscle strength and body composition in overweight previously inactive females. METHODS: Healthy, non-exercising women with a BMI ≤ 25 (n=143) were randomized in one of four groups: Bodypump (BP) (n=37), resistance training with a personal trainer (PT) (n=35), non-supervised resistance training (NS) (n=35) or control group (C) (n=36). Participants in the BP group followed a high repetition (20-100 in each muscle group), low- to moderate group resistance program. Participants in the PT and NS group followed a non-linear resistance program (repetitions 3-15, series 2-4). The interventions included three sessions (45-60 minutes) weekly for a period of 12 weeks. The maximum weekly muscle strength measured at one repetition maximum (1RM), and 70 % submaximal muscle strength in squat and bench press. Secondary outcome was body composition measured with Inbody 720. RESULTS: Loss to follow-up were 32 %, 17 %, 40 % and 36 % in BP, PT, NS- and C groups respectively. Of totally 36 exercise sessions, the mean adherence were 21.1 (SD 7.8) in BP, 32.2 (SD 5.6) in PT and 26.9 (SD 7.6) in NS. The BP group did not show any effect in muscle strength compared to controls, but significant improvements were seen in the PT and NS group. The PT group increased 35 % in 1RM squat (kg) (95 % CI 15.8 - 33.0, p<0.001), 21 % in 1RM bench press (95 % CI 3.5 - 9.3, p<0.001), 60 % in submaximal strength squat (kg reps) (95 % CI 47.2 - 77.7, p<0.018) and 27 % in submaximal bench press (95 % CI 25.1 - 216.3, p=0.029). The NS group increased 18 % in 1RM squat (95 % CI 1.1 - 19.6, p=0.020), 21 % in bench press (95 % CI 2.9 - 9.4, p<0.001), 51 % in submaximal strength squat (95 % CI 28.9 - 807.7, p=0.028) and 38 % in submaximal strength (95 % CI 32.5 - 248.0, p=0.004) bench press. None of the groups showed improvements in body composition. CONCLUSION: Resistance training with and without a personal trainer showed the best results in muscle strength. None of the groups differed from control group in body composition. Adherence to resistance training was highest in the personal trainer group.

Abstracts were prepared by the authors and printed as submitted.
The decline in estrogen levels that follows menopause leads to a deleterious increase in total and central fat, and a concomitant decrease in muscle and bone mass. These changes in body composition are compounded by reducing basal metabolic rates and decreasing levels of habitual physical activity. PURPOSE: The study aimed to determine the effects of a six-week resistance training program on body composition in postmenopausal women. METHODS: Thirty-seven postmenopausal women were randomly assigned to a six-week moderate-intensity resistance training group (RT) (n = 22) and a no-exercise control group (CON) (n = 15). The RT group participants participated in two, non-consecutive, 40-minute moderate-intensity (67-85% 1-RM) resistance training sessions each week for six weeks using three sets of 12 repetitions for 8 exercises. Results indicated that six-weeks of resistance training resulted in significant (p ≤ 0.05) improvements in fat mass (from 21.51 ± 8.73 to 19.750 ± 6.398 kg, p < 0.001), percentage body fat (from 30.658 ± 5.076% to 25.494 ± 9.886%, p = 0.026), body mass index (from 24.497 ± 3.850 kg/m² to 24.274 ± 4.041 kg/m², p = 0.059) and sum of skinfolds (from 22.908 ± 6.054 mm to 20.723 ± 5.264 mm, p = 0.000) for the RT group following the concomitant decreases in muscle and bone mass. These changes in the measured variables. CONCLUSIONS: Six weeks of moderate-intensity resistance training can effectively be used to improve several kinanthrometric variables simultaneously in apparently healthy postmenopausal women and may be an effective tool at reducing the prevalence of overweight and obesity in this at-risk population.
Football Fans in Training (FIT) is an effective, gender-sensitized, weight loss and healthy living program for overweight/obese men, delivered via professional football clubs. Hockey Fans in Training (Hockey FIT) is a new program adapted from FIT for Canadian hockey. PURPOSE: To examine the impact of Hockey FIT on steps, self-esteem, mood, and self-rated health, 12 weeks after baseline (post program).

METHODS: 80 male fans [35-65 years; body mass index (BMI) ≥ 28 kg/m²] of 2 Ontario Junior A hockey clubs were randomized to either intervention (Hockey FIT) or comparator (wait-list control), within a pilot, pragmatic randomized controlled trial (RCT). Hockey FIT involved 24 weekly, 90-minute group sessions delivered by trained coaches using club facilities. Each session combined classroom material, including evidence-based behaviour change techniques (e.g., self-monitoring, goal setting) and healthy eating advice (e.g., reducing portion size), with physical activity sessions. Prescriptive exercise (e.g., individualized target heart rates and pedometre-based incremental step targets) was incorporated throughout. We examined between-group differences in mean steps/day (7-day pedometre monitoring), self-esteem (Rosenberg scale), positive and negative affect (I-PANAS-SF scale), and self-rated health (EQ-5D-3L VAS score) using linear mixed effects regression models that accounted for club and age.

RESULTS: Groups were similar at baseline [median (interquartile range): age: 48.0 (17.0) years; BMI: 35.1 (6.3) kg/m²]. 75% of men in the intervention group attended ≥ 6 sessions. At 12 weeks, the intervention group increased their daily steps to a greater extent than the comparator [difference between groups in mean change: 3127 (95% confidence interval: 1882 to 4372) steps/day, p < 0.001]. The intervention group also improved their self-rated health (scale 0 to 100; 100 = best) to a greater extent than the comparator [difference between groups in mean change: 7.0 (2.1 to 11.9) points, p = 0.005]. There were no differences between groups in self-esteem or positive/negative affect post program. CONCLUSION: Hockey FIT has the potential to help overweight/obese men increase their physical activity levels and improve their self-rated health. Long-term follow-up and a full-scale pragmatic RCT is warranted.

In SCT, no changes in total energy (1,762±494 vs. 1,740±527 kcal), or % energy from carbohydrate (44.2±7.4 vs. 43.3±7.9%), fat (36.0±7.0 vs. 36.4±7.5%) or protein (18.2±4.5 vs. 18.0±4.0) (all p>0.05) occurred.

CONCLUSIONS: RT initiation and maintenance are associated with changes to total energy intake and macronutrient composition in adults with prediabetes assigned to a lower-contact intervention. Intervention characteristics and participant burden may influence whether or not dietary modifications occur with maintenance of RT.

Combined aerobic and resistance training (ATRT) programs are recommended to improve fitness; however, a novel training program focused on individual body type (BT) may provide additional benefits to body satisfaction. Purpose: To examine body image dissatisfaction (BID) responses after 7 weeks of BT training or ATRT. Methods: Participants (age 19.1±1.5y; BMI 23.2±3.5) provided self-report measures of BID (Body Area Satisfaction Scale (BASS), Body Shape Questionnaire (BSQ), and Body Morph Assessment program version 2.0 (BMA 2.0)) at baseline and after 15 exercise sessions, 2 d/week. Participants were randomized to BT or ATRT intervention after classification to a Body Type (Cone, Spoon, Hourglass, or Ruler) according to circumference measures. BMA 2.0 assessed perceived current body size (CBS), selected ideal body size (IBS), selected acceptable body size (ABS), and BMA-BID (CBS-IBS). Given this was an efficacy trial, intent-to-treat (ITT; n=132) and per protocol (PP; BASS, BSQ n=77; BMA n=93; completed ≥ 10 of 15 supervised sessions) data analyses were utilized. Results: Overall, body image scores decreased with a trend observed for the BMA-BID (baseline: 5.95% (4.5-6.5); follow-up: 4.3 (3.9-5.8); p=0.07) after exercise training indicating improvements in BID. Results were similar among ITT and PP analyses. Increases in BID were seen in the ATRT group with significantly lower BASS scores compared to BT group at follow up (ATRT = 2.61 vs. 2.45; P < 0.05). Participants in the ATRT group saw themselves as smaller and as a smaller acceptable goal based on significant reductions in CBS and ABS relative to BT. Sum circumferences were different between both programs (BT =6.3cm; 95% CI -1.9, -10.7cm; ATRT = -7.5cm; -3.3, -11.7cm); however, changes in body satisfaction were not related to changes in total body circumferences (P=0.05 for all). Conclusion: Baseline scores for BID suggest women in this study were generally unsatisfied with their overall body image (BASS < 3.0, BSQ > 80). In general, BT and ATRT produced similar responses; exercise reduced CBS—thereby reducing the discrepancy between CBS and IBS—improving overall body satisfaction regardless of changes in body composition. Supported by the Robert and Patricia Hines Endowment in Kinesiology.

High-intensity interval training (HIIT) has been shown to improve cardiometabolic health during supervised lab-based studies but adherence, enjoyment and health benefits of HIIT performed independently are yet to be understood, specifically in an overweight and obese sample. PURPOSE: We compared adherence, enjoyment and cardiometabolic outcomes after 8-weeks of HIIT or traditional moderate-intensity continuous training (MICT), matched for energy expenditure, in overweight and obese young adults. METHODS: 17 overweight and obese adults (mean±SD: age 26.2±2.0 y; BMI 35.6±1.3 kg/m²; body fat 35.2±1.7%; VO2peak 34.6±1.8 mL/kg/ min) were randomized to HIIT (n=8) or MICT (n=9). After completing 12 sessions of supervised training over 3 weeks, participants were asked to independently perform HIIT or MICT for 30 minutes, 3 times per week for 5 weeks. Cardiometabolic outcomes, measured at baseline and post intervention, included measured cardiorespiratory fitness (VO2peak), fasting lipids, and inflammatory markers. Enjoyment of exercise was measured by the validated Physical Activity Enjoyment Scale. Data were analyzed using multivariate ANOVA and ANCOVA. RESULTS: Exercise adherence (93.4±3.1% vs 93.1±3.7%, respectively) and exercise intensity (185.4±17.1 vs. 1720±471 kcal, p<0.001) were high and similar between HIIT and MICT (p=0.05). After controlling for baseline values, both HIIT and MICT decreased total cholesterol (-19.9±6.6 vs -8.8±6.1 mg/dL, respectively) and LDL cholesterol (-21.5±4.5 vs -7.4±2.4 mg/dL, respectively),
with HIIT showing a greater decrease in both lipids (p<0.05). HIIT significantly increased VO\textsubscript{max} by 10% with no change in MICT (p<0.05, 0.30 cmL/s vs. 0.03 ± 0.1 L/min, respectively). Intermittent-6 and c-reactive protein showed a trend to increase in HIIT and decrease in MICT (p<0.05 for group). Our novel findings suggest that HIIT is enjoyable, has high unsupervised adherence rates, and may be effective for reducing cardiometabolic risk factors in overweight and obese adults. However, HIIT may be associated with an increase in inflammation with short-term exercise in this population. Funded by CTR-IN NIH NIGMS #1U54GM104944-01A1

2134 Board #286
June 2, 3:30 PM - 5:00 PM
Effects of High-Intensity Physical Training on Inflammatory Markers of Men with Metabolic Syndrome
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The risk factors for metabolic syndrome (MS) induce to a chronic inflammatory state, because of the increase in pro-inflammatory markers. One of the causes is the hyperactivity of visceral adipose tissue that releases interleukins. Regular physical exercise is considered a non-pharmacological treatment, since it increases energy expenditure, decreasing visceral adipose tissue and consequently, the inflammatory markers secretion. But the aerobic exercises are most studied when it comes to inflammatory profile.

PURPOSE: The aim of this study was to analyze the effects of 15 weeks of anaerobic high-intensity physical exercise on inflammatory markers of men with MS. METHODS: The sample included 21 men aged between 40 and 66 years, diagnosed with MS according to NCEP/ATP-III (2001) parameters. They had anthropometric measures and blood sample collected before and after 15 weeks of physical training, that consisted in a high intensity physical exercise protocol, 3 times a week, lasting approximately 1 hour, where muscle resistance exercises were performed (60 to 80% of maximal load). For the statistical analyses, Student t test and Wilcoxon Rank Test were used. RESULTS: A decrease in body fat percentage (32.5 ± 15.02 vs. 31.90 ± 9.15, p<0.05) and an increase in lean body mass percentage (64.12 ± 4.73 vs. 64.68 ± 4.87, p<0.05) were observed, although no significant changes were observed in body weight or BMI. The physical training diminished the pro-inflammatory markers IL-1β (182.67 ± 27.26 vs. 141.71 ± 8.39 pg/mL, p<0.001), IL-6 (182.36 ± 19.6 vs. 149.11 ± 12.28 pg/mL, p<0.001), IL-8 (79.23 ± 65 vs. 56.17 ± 9 pg/mL, p<0.001), TNF-α (208.71 ± 7.69 vs. 9.01 ± 176.28 pg/mL, p<0.001) and IFN-γ (281.95 ± 10.79 vs. 216.71 ± 22.45 mg/mL, p<0.001). On the other hand, a significant increase in the anti-inflammatory interleukin IL-10 (78.52 ± 9.49 vs. 95.23 ± 9.99 pg/mL, p<0.001) was observed. CONCLUSIONS: It was concluded that, regardless of the fact that there were no significant changes in body weight and body mass index (BMI), 15 weeks of anaerobic high-intensity physical exercises had a positive effect on the inflammatory state of men with metabolic syndrome. These results suggest great importance of the muscle mass in inflammation regulation.

2135 Board #287
June 2, 3:30 PM - 5:00 PM
Effects of Exercise Training on Insulin Sensitivity and Lipid Adaptations With and Without Weight Loss
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Purpose: Achieving at least modest weight loss (MWL) (≥ 3.0% from baseline) with exercise training is associated with improvements in cardiometabolic risk factors, however the independent contributions of exercise versus weight loss is unclear. The present study evaluated whether the achievement of at least MWL with aerobic training results in greater improvements in insulin sensitivity and lipid metabolism compared to those who do not achieve MWL.

Methods: In the Studies of Targeted Risk Reduction Interventions Through Defined Exercise (STRRIDE) overweight and obese adults with dyslipidemia completed 8 months of aerobic training at a low amount, moderate amount, high amount, high intensity (LAMI), low amount, moderate high intensity (LAHI), and high amount, high intensity (HAHI). We analyzed data presented from participants (N=163) who were adherent to training (>70%). Participant data were categorized based on whether or not MWL was achieved. Insulin sensitivity (intravenous glucose tolerance test), lipid concentrations and lipoprotein particle size were assessed at baseline and follow-up.

Results: Response rates for MWL were 18.9%, 16.7% and 32.1% in the LAMI, LAHI and HAHI groups, respectively (22.7% overall). A greater increase in insulin sensitivity was observed in participants that achieved MWL compared to those that did not in the LAMI (MWL: 1.3, no MWL: 3.4, p<0.002) and the HAHI (MWL: 0.7, No MWL: 1.8, p<0.04), but not the LAHI group (MWL: 0.6, No MWL: 1.4, p=0.37). When exercise groups were collapsed together, similar effects were observed for changes in insulin sensitivity (MWL: 2.3, No MWL: 3.4, p<0.001). Additional, responses in the LDL: VLDL -44.2 mg/dL, No MWL: -20.1 mg/dL), low density lipoprotein (LDL) particle size (MWL: 0.30 nm, No MWL: 0.07 nm), and high density lipoprotein (HDL) particle size (MWL: 0.12 nm, No MWL: 0.02 nm) (p<0.05). No significant effects were observed for changes in LDL, HDL, or total cholesterol concentrations (p>0.05).

Conclusion: The results of this present study suggest that modest weight loss with aerobic exercise training enhances the changes in insulin sensitivity and elements of lipid metabolism compared to no weight loss. Although exercise has independent effects in improving health, clinicians should encourage weight loss with exercise training to maximize cardiometabolic health benefits in overweight and obese adults.

2136 Board #288
June 2, 3:30 PM - 5:00 PM
Effects Of Drinking Seawater During A Resistance Training Program On Kidney, Performance And Cardiovascular Health
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The oceans contain a vast amount of potential resources for pharmaceuticals and nutritional supplements. Recently, the most widely available component of the oceans, seawater, has been incorporated into supplements designed to improve physical performance and overall health but the efficacy of this is currently unknown.

PURPOSE: To analyze the effects of consuming a SW-based electrolyte drink during a resistance-training (RT) program on kidney health, physical performance, and cardiovascular risk in older adults.

METHODS: 56 sedentary older adults (71.3±16.2 yr) were divided into three groups: control group (CG) (n=18) that continued normal lifestyle interventions aimed at healthy eating, healthy weight and physical activity. Increasing rates of chronic disease (CD) have led to an increased effort to implement lifestyle interventions aimed at healthy eating, healthy weight and physical activity. For the other 3 groups, participants were trained for 12 weeks in a high intensity physical exercise protocol, 3 times a week, lasting approximately 1 hour, where muscle resistance exercises were performed (60 to 80% of maximal load).

RESULTS: SWG significantly (p<0.05) improved VR (+44.6%) and HLP (+52.8%), significantly reduced urea levels (-6.6%) and AI (-4.9%), and showed a trend towards reducing creatinine levels (-5.4%). PG significantly improved VR (+29.3%) and HLP (+52.5%), and significantly reduced AI (-50%) with no changes in urea and creatinine values. There were no significant differences between the exercise groups, VR (+9.5%) and HLP (+5.4%), and creatinine (+1.3%) did not change in CG but there were significant changes in AI (+14.1%) and HLP (-24.7%). There was not an interaction between groups for VR, HLP, and AI, but there was for urea and creatinine levels with CG showing significant differences compared to the exercise groups.

CONCLUSIONS: Drinking SW while involved with a RT program may improve kidney health, cardiovascular health, and BS in older adults.

2137 Board #289
June 2, 3:30 PM - 5:00 PM
Men’s Experiences With The Hockey Fans In Training Physical Activity And Healthy Living Program
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(no relationships reported)

Increasing rates of chronic disease (CD) have led to an increased effort to implement lifestyle interventions aimed at healthy eating, healthy weight and physical activity. While male CD risk exceeds that of women, men are often highly underrepresented in lifestyle programs. This may in part be due to the fact that men consider programs inherently feminine, serving as a barrier for participation. Some studies have observed that men prefer lifestyle programs that incorporate an element of competition and output in the company of others. Additionally, programs situated in the context of sports may have lower drop-out rates and higher levels of satisfaction due to feelings of affiliation. PURPOSE: To review men’s feedback regarding their motivation for joining and their experience in a 12-week lifestyle intervention in the context of professional hockey clubs, in London and Sarnia, Ontario, Canada. METHODS: Participants who completed at least 6 of the 12 weekly sessions (n=30) were asked to fill out an online questionnaire after their completion of the intervention. The questionnaire was designed to elicit why they joined the program, what changes they saw following their participation, as well as what program components they found enjoyable, how relationships were formed, and whether they would recommend the program to others.

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useful and not useful in helping them make those changes. RESULTS: A total of 27 men completed the questionnaire. Weight loss and a desire to increase physical activity were the two main reasons cited for joining the program. After the 12-week intervention, 100% of the men reported eating a healthier diet and 78% reported having increased their activity level. Satisfaction with the program elements was high with 96% of men believing both the classroom and exercise components were useful. Most suggestions for improvement involved decreasing the repetition of classroom material and increasing the proportion of physical activity each session. CONCLUSION: Our results support previous research showing increased levels of satisfaction in men when lifestyle interventions are run in a sporting context and incorporate both an educational component (with a large focus on healthy eating and physical activity) and an exercise component. This information will be used to support the refinement of the Hockey FIT program prior to conducting future studies.

2139 Board #291
June 2, 3:30 PM - 5:00 PM
Factors Associated With Inter-Individual Variability In The Fat-Free Mass Response To Resistance Training
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PURPOSE: To assess baseline factors associated with the response of fat-free mass (FFM) to a 9 mo. resistance training (RT) protocol.

METHODS: Normal/overweight sedentary, physically untrained young adults (n = 78, age ~22 yrs. BMI ~ 25 kg/m2) completed a 9-mo., supervised efficacy trial (1 or 3-sets RT, 9 exercises, 3 d/wk.) Participants were asked to maintain ad-libitum diets. Body weight and composition (DXA), height, energy intake ([EI]/macronutrient; digital photography), bench and leg press strength (1-RM), total daily energy expenditure (TDEE) and non-exercise energy expenditure (NEEx; TDEE minus the energy expenditure of RT; doubly labelled water) were assessed at baseline and 9 mos. Participants who did, or did not increase FFM in response to RT were classified as responders (R) and non-responders (NR), respectively.

RESULTS: Participants completed 92 ± 6% of scheduled RT sessions. FFM increased significantly from baseline to 9 mos. (1.2 ± 1.7 kg, p < 0.001) with inter-individual variability (range = -2.0 to 6.2 kg). Fifty-five (70%) and 23 (30%) participants were classified as R (FFM change = +2.1 ± 1.4 kg) and NR (FFM change = -0.7 ± 0.6 kg), respectively. There were no significant baseline differences (all p > 0.05) between R and NR in the proportion of females (R = 51%, NR = 52%), body weight (R = 75.5, NR = 72.9 kg), BMI (R = 25, NR = 25 kg/m2), fat mass (R = 72.1, NR = 69.6 kg), FFM (R = 48.1, NR = 48.6 kg), EI (R = 2407, R = 2484 kcal/d), protein intake (R = 88.4, NR = 90.4 g/d), bench press strength (R = 45, NR = 45 kg), leg press strength (R = 153, NR = 152 kg), TDEE (R = 2543, NR = 2595 kcal/d) or NEEx (R = 719, NR = 771 kcal/d). The proportion of R and NR differed significantly by intervention group (1 set, R = 43.6%, 3 sets, R = 56.4%; 1-set, NR = 69.6%, 3-sets, NR = 30.4%, p < 0.037).

CONCLUSION: None of the baseline characteristics evaluated were associated with the FFM response to a 9 supervised RT protocol. The observation that the proportion of R was higher in the 3-set compared with the 1-set group suggests RT volume is an important factor in the FFM response to RT. Thus, 3-set RT protocols are recommended for use by untrained young adults if the goal of RT is an increase in FFM.

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2140 Board #292
June 2, 3:30 PM - 5:00 PM
Can a Sports Team-based Lifestyle Program (Hockey Fans In Training) Improve Weight In Overweight Men?
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(NO relationships reported)

The issue of gender is often neglected when planning and implementing chronic disease prevention and management strategies. Football Fans in Training (FIT) — a gender-sensitised, weight loss and healthy living program for men delivered via professional football clubs — has been shown to be highly effective in helping overweight/obese men lose weight and improve their health risk. PURPOSE: To examine the potential for new male-friendly, physical activity and healthy living program — Hockey Fans in Training (Hockey FIT) — to help overweight/obese men decrease their weight, waist circumference (WC), and body mass index (BMI), after 12 weeks. METHODS: A pilot, pragmatic randomized controlled trial (RCT) whereby male fans (35-65 years; BMI ≥ 28 kg/m2) of 2 Junior A hockey clubs (Ontario, Canada) were randomized to either the intervention (Hockey FIT) or comparator (wait-list control). Hockey FIT involved 12 weeks, 90-minute group sessions delivered by trained coaches using club facilities, including evidence-based behaviour change techniques (e.g., self-monitoring, goal setting) and healthy eating advice (e.g., reducing portions), with physical activity training. Lifestyle prescriptions, including incremental step count targets, were also prescribed each week. We examined between-group differences in mean weight loss, WC, and BMI using linear mixed effects regression models that accounted for club and age. RESULTS: Baseline characteristics were similar between groups (total N = 80, median (interquartile range) — age: 48.0 (17.0) years; ii) weight: 112.2 (23.2) kg; iii) WC: 119.3 (13.5) cm; iv) BMI: 35.1 (6.3) kg/m2). Of the 40 men in the Hockey FIT group, 30 (75%) attended at least 6 sessions. At 12 weeks, the Hockey FIT group lost more weight than the control group [difference between groups in mean weight change (control is reference): -3.6 (95% confidence interval: -5.2 to -1.9) kg, p = 0.001]. The Hockey FIT group also saw greater reductions in WC and BMI, when compared to the control group [difference between groups in mean i) WC: -2.8 (-5.0 to 0.6) cm, p = 0.08; ii) BMI: -0.9 (-1.4 to 0.4) kg/m2, p = 0.01]. CONCLUSION: Hockey FIT has the potential to help overweight/obese men lose weight and improve health risk. A definite RCT is warranted with long-term follow-up.
To study the reproducibility between HR measures we used the intraclass correlation coefficient (ICC). RESULTS: The reproducibility of HR was excellent (r=0.767) and significant (p<0.001) between AT and HRRes60% test, and excellent (r=0.773) and significant (p<0.001) of all the analyzed formulas had any degree of correlation to estimate the AT HR and HR in RCP for the age group between 40-50 years; b) the reproducibility of HR was moderate (r=0.574) and significant (p=0.043) between AT and HRRes40% test and HRRes80% predicted and it was excellent (r=0.880) and significant (p<0.001) between CPT and HRRes80% test for the age group of 51- 60anos; c) was excellent (r=0.827) and significant (p<0.001) for the age group of 61-70anos and excellent (0.772) and significant (p=0.001) for BMI< 30, between AT and HRRes60% test and was moderate (r=0.744) and significant (p=0.002) for the age group of 61-70anos and moderate (r=0.733) and significant (p<0.002) for BMI< 30, both between CPT and HRRes80% test. CONCLUSION: In patients with MP (overall study population), prescribing training is possible using the formulas of HRRes 60% and 80% obtained in the conventional stress test when the CPT is not available; for the age group of 61-70anos and BMI< 30, the percentage correlation of HRRes are the same as those observed for the overall study population; and in the lower age groups (40-50years and 51-60years) were not observed the same results, possibly due to the small sample size in each subgroup.
PURPOSE: The aim of this study was to characterize in a mouse model of SCD i) the potential abnormalities in muscle energetics and function, and ii) the potential beneficial effects of endurance training.

METHODS: Sedentary control (HBAA-SED, n=10), heterozygous (HBAS-SED, n=10) and sickle cell (HBS-SED, n=10) mice and endurance-trained (8-weeks treadmill running) healthy (HBAA-END, n=10), heterozygous (HBAS-END, n=11) and sickle cell (HBS-END, n=8) mice were placed in a home-built device designed for a strictly non-invasive study of posterior hindlimb muscles function and metabolism by NMR during a standardized rest - stimulation - recovery protocol.

RESULTS: During the stimulation period, HBS mice developed less force as compared to HBAS mice (p<0.01) and HBAS mice displayed a reduced total force production as compared to HBAA mice (p<0.05). Whatever the genotype, training resulted in a significantly increased force production (p<0.001). Regarding muscle energetics, the exercise-induced phosphocreatine (PCr) depletion and pH decrease were significantly (p < 0.05) larger in HBS SS mice as compared to HBAA and HBAS mice. Interestingly, training resulted in a significant (p<0.05) reduction in PCR depletion and intracellular acidosis.

CONCLUSIONS: We demonstrated in the present study that SCD was associated with an impaired muscle force production and a larger exercise-induced metabolic consumption. The larger acidosis, which could trigger VOC, might be explained by both an increased non-oxidative glycolytic energy production and an altered protons handling. Interestingly, endurance training improved muscle function and reduced metabolic abnormalities, including acidosis.

Purpose: The purpose of this study was to investigate the effects of yoga exercise invention on quality of sleep and quality of life in stroke patients.

Method: Thirty-five stroke patients were randomly assigned to the following two groups. six patients were in the experimental group (age: 58±2±10±11 yr), another nineteen patients were in the control group (age: 60±8±10±7 yr). The experimental group had performed yoga exercise twice a week for eight weeks with each session lasting 60 minutes per day, including warm-up (15 minutes), main exercise (35 minutes) and moderate stretching (10 minutes), additionally except rehabilitation courses held by the hospital. The control group had not carried out any exercise intervention except rehabilitation courses. The quality of sleep, and quality of life were tested before and after yoga exercise intervention. Analysis of covariance (ANCOVA) was applied to examine the difference between experimental and control groups on quality of sleep and quality of life.

Results: The score of quality of sleep for stroke patients in the experimental group (0.33%) decreased significantly compared to that in the control group (17.3%) (p<.05). In addition, the score of quality of life in the experimental group (17.5%) increased significantly compared to that in the control group (2.9%) (p<.05).

Conclusion: The result indicated that the yoga exercise intervention could improve the quality of sleep, sleep efficiency, quality of life and physical health domain in stroke patients.
There is a lack of evidential value regarding the effects of exercise on depressive symptoms in adults with arthritis and other rheumatic diseases.

**PURPOSE:** Determine whether evidential value exists that exercise reduces depressive symptoms in adults with arthritis and other rheumatic diseases.

**METHODS:** Using data from a previous meta-analysis of 29 published studies that included 2449 participants (1470 exercise, 979 control) with fibromyalgia, osteoarthritis, rheumatoid arthritis or systemic lupus erythematosus, a novel, recently developed method, p-curve, was used to assess for evidential value and rule out selective reporting of statistically significant findings regarding exercise and depressive symptoms in adults with arthritis and other rheumatic diseases. Using the method of Stouffer, scores were calculated for selective-reporting bias with alpha (p) values <= 0.05 considered statistically significant. In addition, average power of the tests included in p-curve, adjusted for publication bias, was calculated. **RESULTS:** Fifteen of 29 studies (51.7%) with exercise and depression results were statistically significant (p < 0.05) while 73.3% had p-values < 0.025. None of the results were statistically significant with respect to exercise increasing depressive symptoms in adults with arthritis and other rheumatic diseases. Statistically significant right-skel to rule out selective reporting was found (z = -5.28, p = 0.99). The relative frequencies of p-values were 66.7% at 0.01, 6.7% each at 0.02 and 0.03, 13.3% at 0.04 and 6.7% at 0.05. The average power of the tests included in p-curve, corrected for publication bias, was 69%. Diagnostic tests revealed that the observed power estimate was a better fit than the alternatives. **CONCLUSION:** Evidential value results provide additional support that exercise improves depressive symptoms in adults with arthritis and other rheumatic diseases.

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**Exercise Reduces Depressive Symptoms in Adults with Arthritis: Evidential Value**

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(No relationships reported)

The ability to perform physical activity of prolonged duration and adequate intensity (i.e. exercise tolerance) is instrumental to obtain the well-known health benefits that are associated with physical training in Type 2 diabetes (T2D). During whole-body physical activity exercise tolerance is compromised as the oxygen cost (VO2) of energy production becomes progressively higher (i.e. ‘exercise tolerance’) at power outputs (PO) above the lactate threshold (LT). This loss of muscle efficiency, of which type I fibers fatigue and/or increased type II fibers recruitment are putative causes, impairs exercise tolerance. **PURPOSE:** To test the hypothesis that a strength training intervention (ST), by inducing muscle hypertrophy, could improve exercise tolerance.**RESULTS:** A significant difference was established between aerobic (1.36±0.79) and baseline (1.14±0.53) conditions (p=0.21) or anaerobic (1.04±0.70) and baseline (0.99±0.72) conditions (p=0.66). In hockey players, no significant differences between PRE and POST brain cortical activity were found. The hockey players, no significant differences between PRE and POST brain cortical activity were found. **CONCLUSIONS:** In triathletes, brain cortical activity decreased following running exercise within the frontal lobe (p<0.001). No differences were found for cycling exercise. Comparing the trials of the preferred with non-preferred mode revealed no difference for regions of interest (frontal p=0.943, occipital p=0.438, parietal p=0.987, temporal p=0.664). In hockey players, no significant differences between PRE and POST brain cortical activity and between active and passive players were found.

**Thematicsa:** The triathlete study supports that the effect of exercise on brain cortical activity is not dependent on adaptation, whereas the hypothesized effect of exercise preference was disproven. The hockey data suggests that steady rather than interval running is making the difference. Steady running should be recommended to support mental health. Further studies are required for verification.

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**Influence of Aerobic versus Anaerobic Exercise on Insulin Function in Recreationally Active Non-Diabetic Females**

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Insulin sensitivity and related metabolic complications can be attributed to a lack of physical activity and poor eating habits resulting in improper endocrine function which can lead to type II diabetes (T2D). T2D is classified by the body’s inability to adequately respond to insulin, and in turn results in dangerously high levels of glucose in the blood. **PURPOSE:** To determine the effect of a single bout of aerobic exercise versus a single bout of anaerobic exercise on insulin sensitivity.

**METHODS:** Non-diabetic collegiate females (N=14; ht=169.31±5.73 cm; wt=61.36±10.79 kg; age=21.35±0.81 yrs) classified as recreationally active (2-5 days/week of planned physical activity lasting no more than 45 minutes) participated in this study. Baseline venous blood was drawn following an 8-hour fast and 24-hour exercise restriction. Each subject participated in a single bout of aerobic and anaerobic exercise. The aerobic exercise session consisted of 30 minutes of cycling at 60% of the subject’s HR max. The anaerobic exercise session consisted of 6×100-meter sprints with a 90 second rest following each sprint. Venous blood was drawn again 24-48 hours after each exercise condition. Blood glucose and insulin concentrations were determined using an ELISA Merodia insulin test. Insulin sensitivity was calculated using the HOMA-IR index. Paired t-tests were run at the p<0.05 level using Minitab 16 to determine which exercise condition had a greater effect on increasing insulin sensitivity. **RESULTS:** A significant difference was established between aerobic (1.36±0.79) and anaerobic (1.04±0.70) conditions (p=0.03), but no significance was found between aerobic (1.36±0.79) and baseline (1.14±0.53) conditions (p=0.21) or anaerobic (1.04±0.70) and baseline (1.14±0.53) conditions (p=0.66).

**CONCLUSIONS:** Results indicated aerobic exercise is more effective than anaerobic exercise in improving insulin function.
Exercise Effect Upon Plasma Irisin And Its Association With Some Metabolic And Anthropometric Variables.

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Background: Irisin, a recently identified myokine, is induced by muscular contraction and activates profound changes in the subcutaneous adipose tissue, promoting thermogenesis and energy expenditure. Plasma irisin level and its change after recreational physical activity (RPA) have not been clearly elucidated.

Purpose: To assess the change in plasma irisin after eight weeks of RPA and its association with metabolic and anthropometric variables.

Methods: Thirty-six sedentary obese children were included in this study. RPA training program consisted in 4 weekly sessions during 8 weeks. Each 60 minutes session was divided in 10 minutes warm-up, 40 minutes exercise, and 10 minutes cool-down. Anthropometric (height, weight, waist circumference, triceps and subscapularis skinfolds), blood pressure and metabolic (glucose, cholesterol, triglycerides, HDL, and irisin) measures were obtained in each participant before and after the intervention. Data are presented as medians with ranks. Analysis included paired student’s t-test, and Spearman’s correlation.

Results: From a total of 36 children included (age, 9.5 ± 1.5 years; body mass index, 23.8 (19.1-36.2 Kg/m2); 19 boys (52.8%) and 17 girls (47.2%) were studied. An increment in muscle area of the arm was observed 2583(1677 – 4563 mm2) to 2742 (2086-4817 mm2; p=0.05). The RPA resulted in a significant decrease in systolic blood pressure (r=0.47, p<0.05) and diastolic blood pressure (r=0.36, p<0.05). No significant correlations between irisin and anthropometrics measurements before the RPA, while plasma irisin was positively correlated with the arm muscular area (r=0.45, p<0.05) after the RPA.

Conclusion: Similar to other studies, no changes were observed in plasma irisin levels after an RPA program. Nevertheless, the increased arm muscle area after 8 weeks of RPA was related to plasma irisin levels. Further studies are needed to clarify the mechanisms of this correlation in obese children.

Exercise Prescriptions Of Walking And Running For Improvement Of Blood Lipid Profile And Blood Glucose

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Purpose: Some research has suggested that walking for distance as opposed to walking for time may be a stronger predictor of overall amount of accumulated exercise or physical activity and thereby overall energy expenditure (Williams, 2012). The primary purpose of this study was to compare walking/runnig for distance to walking/runnig for time as part of a 10-week exercise intervention.

Methods: Participants included 15 overweight but otherwise healthy adults. Fasting blood lipid profile [high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), triglycerides (TG), total cholesterol (TC)] and fasting blood glucose (BG) were measured using a Cholestech LDX system (Alere, Waltham, MA). Spearman’s correlation.

Results: Comparing Distance-based Vs. Time-based Exercise Prescriptions Of Walking And Running

The Impact Of Three Progressively Higher Step Recommendations On Weight And Body Composition Over The Freshmen Year

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In today’s society cell phones have become a near-ubiquitous tool and is used in many common activities such as when standing in a line, walking from one location to another, in the classroom while learning, while watching sporting events, etc. Purpose: To assess the effects of various cell phone functions (talking, texting, and listening to music) on anterior and posterior postural stability compared to a control condition.

Methods: Forty-five college students (n = 16 males) participated in four conditions in a randomized order. During the control condition no cell phone functions were utilized. For the texting and talking conditions participants followed a predetermined script. Finally, during the music condition participants selected the music of their choosing.

Results: The anterior and posterior stability index scores during the control (0.85) condition was significantly lower (p < 0.05) compared to the talking (1.58) condition. The control (0.85) condition was not significantly different than the music (0.81) condition. The difference between the two conditions was significant (p < 0.05) lower than the talking (1.58) condition. The music (0.81) condition was significantly lower (p < 0.01) than both the talking (1.04) and the music (1.58) conditions.

Conclusion: Based on the current results, it is recommended that cell phone texting and talking be refrained from while either maintaining balance in a static position or while moving within the anterior and posterior plane.
Momordica grosvenorii effective components intervened for 20 days. Blood samples were collected before and after the experiment. Blood lactate acid (LD), blood urea nitrogen (BUN), aspartate transaminase (AST), alanine transaminase (ALT), blood rheological index (high shear viscosity and reduction viscosity of whole blood) were measured. Exercise fatigue was induced by exhaustive exercise (riding, 230 W, 60-70rpm). Results: The intervention of Momordica grosvenorii effective components has a positive effects on exercise fatigue indexes. Compared with the control group, TAC, SOD, ABN, ALT, AST and GPT in high dose group were significantly lower (**P < 0.05), ALD, GPT, GTP in medium dose group were significant lower (P < 0.05), low dose group only GPT was significant lower (P < 0.05). MDA and GPT were significantly correlated with blood rheology index (P < 0.05). MDA was very significantly correlated with high shear viscosity and reduction viscosity of whole blood (P < 0.01). Conclusion: Intervention of high dose effective components of the grosecnor moronica can improve anti-fatigue, improve the index of blood rheology, the ability of anti fatigue, so as to eliminate and delay exercise fatigue.

2157 Board #309 June 2, 3:30 PM - 5:00 PM
Brief, Intense Intermittent Stair Climbing Is A Practical, Time-Effective Method To Improve Cardiorespiratory Fitness
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Sprint Interval Training (SIT), involving brief intermittent bursts of very intense exercise, has been touted as a time-efficient alternative to traditional endurance training for improving cardiorespiratory fitness (CRF) and clinical markers of health. Most SIT protocols, such as Wingate-based cycling, have been studied in a laboratory setting and require specialized equipment, which is impractical for many individuals. Stair climbing may be a more suitable and accessible alternative to laboratory-based SIT. While established as an effective form of exercise to enhance CRF, the minimal effective "dose" of stair climbing remains unknown.

PURPOSE: To determine whether brief, intense intermittent stair climbing improves CRF. METHODS: Twelve sedentary but otherwise healthy women (age = 26±11 y; BMI = 23.6±3.0 kg/m²) trained 3 d/wk for 6 wk. Each 10-min training session involved a 2-min warm up, 3x20-bouts of intense stair climbing interspersed with 2 min of recovery, and a 3-min cool-down. Training was performed using the stairwell of a 6-story campus building. Subjects were instructed to climb stairs as fast as possible. Recovery periods involved descending the stairs slowly and walking on flat ground. RESULTS: Participants climbed 59±4 stairs (height climbed = 11.4±0.8 m) during each bout. Mean power output was 365±40, 354±38 and 337±35 W for the 16:00 h, 03:00 h and 22:00 h collections, respectively. Total energy cost (E) = 11.5±2.2 kcal/bout. VO2peak increased from 1.8±0.2 to 2.1±0.5* kcal·min⁻¹·BW⁻¹ (P<0.05) and from 35.3±4.6 to 40.4±5.1 mL·O2·min⁻¹·kg⁻¹ (P<0.05) after training (p<0.01). Absolute VO2peak similarly increased from 1.8±0.2 to 2.0±0.3 mL·O2·min⁻¹·kg⁻¹ (P<0.001) as body mass was unchanged after training (61.5±3.1 vs. 62.1±2.7 kg, p>0.05).

CONCLUSION: Brief, intense intermittent stair climbing for 6 wk improved CRF. This change is similar to that previously reported after laboratory-based SIT protocols of similar duration, and traditional endurance training involving a much higher exercise volume and time commitment.

2158 Board #310 June 2, 3:30 PM - 5:00 PM
Influence of Exercise Time of Day on Salivary Melatonin Responses
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Sleep deprivation may have changes in cognition, pain, mood, metabolism, and immunity, which can ultimately create negative consequences on athletic performance. Melatonin is thought to induce sleepiness due to its synchronization with the circadian rhythm. PURPOSE: The purpose of this study was to evaluate the influence of exercise time of day on salivary melatonin (s-Mel) responses. METHODS: Ten regularly exercising, males (age 20.7 ± 0.7 yr; height 1.74 ± 0.04 m, mass 73.6 ± 11.4 kg, maximal oxygen consumption [VO2max] 56.4 ± 4.8 ml/kg/min) completed a VO2max using an incremental protocol on a treadmill. In a randomized, crossover design, subjects completed three protocols: morning exercise (09:00 h), afternoon exercise (16:00 h), and no exercise (control) at least 5 days apart. For each exercise session, subjects performed 30 min of steady-state running at 75% of VO2max following a 5 min warm-up. Saliva was collected via a passive drool into 2 ml polypropylene conical tubes at 20:00 h, 22:00 h, and 03:00 h following all sessions. RESULTS: No significant differences existed in the s-Mel levels for exercise time of day. A trend found morning exercise produced a higher concentration of s-Mel than afternoon exercise (p = 0.074). The 20:00 h collection time was significantly higher than the 03:00 h collection (p = 0.001). Additionally, s-Mel levels were significantly (p = 0.018) greater for the 20:00 h collection time compared to the 22:00 h collection, and 22:00 h was greater than 03:00 h (p = 0.038). CONCLUSION: It appears that exercise time of day did not affect s-Mel levels.

2159 Board #311 June 2, 3:30 PM - 5:00 PM
The Effects Of A 10-week Whole-body Vibration Program On Balance And Lower Body Muscular Strength In Adult Women.
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The effects of a 10-week whole-body vibration program on balance and lower body muscular strength in adult women.

Abstract: The purpose of this study was to examine the effects of 10 weeks of whole-body vibration on balance, lower body muscular strength, and bone mineral density in women. The study was comprised of two groups: whole body vibration (WBV, n = 19) and control (CON, n = 16). Both groups completed a 10-week WBV program. The WBV group received a vibratory stimulus while performing lower extremity exercises. The CON group performed the same protocol without vibration. Data were collected on balance, muscular strength and bone mineral density. Two, factorial MANOVA's were used to analyze the data with a significance level of .05. Isometric strength of the quadriceps increased significantly for both groups. The improvement in strength was significantly greater in the WBV group (pre: 138.7 ± 50.8 ft•lb, post: 157.5 ± 51.9 ft•lb) compared to the control group (pre: 129.3 ± 33.9 ft•lb, post: 136.5 ± 33.8 ft•lb). No significant differences were observed between the groups for any other variables.

In conclusion, adding WBV to a lower extremity exercise program appears to improve lower body muscular strength.

2160 Board #312 June 2, 3:30 PM - 5:00 PM
Association between Physical Activity and Depression: The Exercise for Persons Who Are Immunocompromised (EPIC) Study
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Background: The prevalence of major depressive disorder and depressive symptoms is higher in people living with HIV (PLWH) than in their seronegative counterparts. Evidence suggests that depression may negatively affect the progression of HIV, and that it is associated with reduced medication adherence. Physical inactivity is hypothesized to be associated with poorer mental health in general population; however, this relationship is less examined among PLWH. PURPOSE: This study explored the cross-sectional relationship between self-reported physical activity levels and depressive symptoms in a community sample of PLWH. METHODS: Baseline data collected from a trial testing the acute effects of exercise resistance in PLWH were used. Participants were 15 males and 6 females ages 32-61 (M=49.4, SD=9.2) who completed questionnaires relating to their physical activity and mental health. Physical activity was assessed with the interview version of the past-month Moderate Activity Questionnaire (MAQ); depressive symptoms were measured with the Center for Epidemiologic Depression Scale (CES-D) and the Patient Health Questionnaire (PHQ-9). Height and weight were measured using standard procedures, and body mass index (BMI) was calculated. Participants were classified as completely sedentary: no physical activity reported in the past 7 days (n=9); or leisurely active: any leisure activity reported in the past 7 days (n=10).

PHQ-9 scores were 8.4±3.6 in the completely sedentary group, and 6.3±3.3 in the leisurely active group. Using ANOVA, no significant main effect or interaction were found. PHQ-9 scores were positively correlated with BMI (r = 0.33, p = 0.03) and depressive symptoms were significantly higher in completely sedentary (n=9): 17.6±5.7, compared to leisurely active: 12.8±5.5 (p<0.05). CONCLUSION: The findings of this study support previous research that links sedentary behaviors and increased depressive symptoms in children and adults. Future research is needed to explain the relationship between physical activity and depressive symptoms over time.
activity reported in the past 7 days (n=12). Group differences were analyzed using t-tests with significance level set at p<.05. RESULTS: The leisurely active group had significantly lower CES-D (r=−2.65, p=.02) and PHQ-9 (r=−2.46, p=.02) scores than the sedentary group. There were no significant differences for BMI between the two groups. CONCLUSION: The results of this study suggest a significant inverse association between physical activity and depressive symptoms among PLWH. Future studies will be required to examine the direction of the effects, and the mechanisms that may be involved in the relationship between physical activity and depressive symptoms in PLWH.

2161 Board #313
June 2, 3:30 PM - 5:00 PM
Commuting with Electric Assist Bicycles as a Means to Improve Cardiometabolic Risk Factors
James E. Peterman, Kaleb L. Morris, Rodger Kram, William C. Byrnes, FACSM. University of Colorado Boulder, Boulder, CO. (Sponsor: William C Byrnes, FACSM)

This study used a type of electric assist bicycle known as a pedelec. A pedelec is a bicycle equipped with a modest electric motor that provides assistance only when the rider is actively pedaling thus helping to overcome the common hurdles associated with active transportation (e.g. difficult hills and longer distances). PURPOSE: Our primary purpose was to quantify improvements in cardiometabolic risk factors associated with pedelec commuting for 4 weeks. Our secondary purpose was to quantify pedelec use (distance and intensity). METHODS: Twenty physically inactive participants (6 males, 14 females) visited the lab three times for baseline physiological measurements (body composition, VO2max test, mean arterial pressure (MAP) blood pressure, lipid profile, and 2-hour oral glucose tolerance test (OGTT)). During the following 4 weeks, participants commuted using a pedelec a minimum of 3 days/week. While riding the pedelec, participants wore a heart rate monitor and used a GPS device. Heart rate data was used in conjunction with a regression equation developed from the VO2max test to estimate METS. After 4 weeks, participants repeated the physiological measurements. RESULTS: Commuting with a pedelec significantly improved 2-hr post OGTT glucose (5.45±1.18 to 5.02±0.91 mmol/L, p=0.05), VO2max (2.19±0.48 to 2.37±0.52 L/min, p=0.05), and power output at the end of the VO2max test (165.65±39.4 to 185.6±33.8 Watts, p=0.005). There was a trend for improvements in MAP (84.1±10.5 to 82.7±9.4 mmHg, p=0.15) and fat mass (28.3±11.3 to 27.8±11.4 kg, p=0.07). The average ride distance was 11.2±6.8 km with ride time averaging 32:56±14:41 (hr:min:sec). Average week total distance and time were 317.9±113.7 km and 16:16:41:3±19:05, respectively. Estimated METS while riding were in the moderate intensity range (4.6±1.2 METS).

CONCLUSIONS: Commuting with a pedelec for 4 weeks resulted in significant improvements in 2-hr post OGTT glucose, VO2max, and peak power output. Despite the electric assistance, riders self-selected an intensity that helped them meet the ACSM guidelines for physical activity. Pedelecs are an effective form of active transportation that can improve some cardiometabolic risk factors.

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2162 Board #314
June 2, 3:30 PM - 5:00 PM
Kinesio Taping does not Alter Muscular Performance of Lower Extremity in Obese Adults
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Obese adults often experience a weight burden imposed on the joints during physical activities. Taping is known as an effective therapy that can lessen the stress on joints during physical activity. Specially, Kinesio taping has gained recognition to improve exercise performance. However, the acute effects of Kinesio taping using obese population have not been established. PURPOSE: The purpose of this study was to examine the acute effects of Kinesio taping on the muscular strength, power, and endurance of lower extremity in obese adults. METHODS: This study was conducted in randomized crossover design with 7 days washout periods. Fourteen obese adults (male: 5, female: 9), mean age of 24.0±6.91) took part in the study. All subjects underwent three different trials which were no taping, placebo taping (3M tape), and Kinesio taping. The tape was applied to the rectus femoris, biceps femoris, and patella ligament based on the Kinesio taping techniques. Subjects wore an eye mask and the taped leg was covered by clothes for preventing subjects and researchers from identifying different tappings (double-blind). Muscular power, isometric muscle strength, and muscle endurance of lower extremity were assessed. The percentage change from base-line values were used for dependent variable. Repeated measures ANOVA was used to determine differences among three trials. RESULTS: There were no statistical differences in peak power (F=0.978, p=.402), mean power (F=1.386, p=.283), muscular strength (extension: F=1.138, p=.350; flexion: F=3.326, p=.068, and endurance (F=3.675, p=.060) among three trials. Although, this study did not show any significant differences, Kinesio taping showed a slight improvement in peak power and mean power 0.22 % and 0.89 % respectively to compared with the placebo taping. Also, leg strength showed relatively higher augmentation in Kinesio taping 4.28% in flexion and 1.37% in extension than the placebo taping respectively. CONCLUSIONS: The Kinesio tape did not improve lower limb performance in obese adults. Short application period may affect to the non-significance result. Further studies are needed to investigate the effective period of taping on lower limb exercise performance in obese adults.

Introduction: Healthy lifestyle behaviors (such as routine physical activity, proper nutrition, avoidance of smoking, and reduced alcohol consumption) play a critical role in workplace wellness and overall wellbeing. However, it is unclear what effects a healthy lifestyle intervention will have on absenteeism and presenteeism.

Purpose: To examine the effectiveness of a healthy lifestyle workplace intervention on absenteeism and presenteeism.

Methods: A total of 50 participants (35 Females (43 ± 11.5 yr) and 15 males (44.9 ± 10.5 yr) completed a 12 wk comprehensive health lifestyle intervention (ACCELERATION) in the workplace. Workers received weekly 1 hr education and exercise sessions related to evidence-based best practice in proper nutrition, physical activity, smoking cessation, alcohol reduction, mental health, and stress management. Participants completed questionnaires related to employee absenteeism and presenteeism at baseline and after a 3-month follow up.

Results: Due to the non-normal distribution, a Wilcoxon matched pairs signed rank test was conducted to determine differences in baseline and follow up absenteeism costs. Results of the analysis indicated that there was no significant difference in baseline absenteeism costs (m = 272.6±399.4) and follow up costs (m = 289.3±374.3). The results of the analysis indicated that there was no significant difference in baseline absenteeism costs (m = 272.6±399.4) and follow up costs (m = 289.3±374.3). The analysis also showed that during the 3-month follow up there were no significant differences in the scores for presenteeism costs at baseline (m = 3798.3±3441.9) and follow up (m = 3496.6±3627.3) time points (p=0.49;5.37, p=0.594). Presenteeism was reduced by 17% from 29.0% to 12.0% equating to an average cost savings of $420.12/290.30 per employee.

Conclusion: These results indicate that the comprehensive healthy lifestyle behaviour intervention (ACCELERATION) had a positive effect on employee health costs. Future larger scale studies are warranted.

2164 Board #316
June 2, 3:30 PM - 5:00 PM
Objectively Measured Aerobic and Resistance Exercise and Cardiovascular Disease Risk Factor Response
Elizabeth C. Schroeder, Duck-chul Lee. Iowa State University; Ames, IA.

(No relationships reported)

PURPOSE: To examine the effects of objectively measured weekly exercise weight (EW) lifted and exercise heart beats (EHB) during exercise training on changes in cardiovascular disease (CVD) risk factors.

METHODS: We randomized 31 pre-to-stage 1 hypertensive (not on medication), overweight/obese, and sedentary non-smokers (58.8± years) into an aerobic training (AT) only (n=16) or a resistance training (RT) only (n=15) 8 week exercise intervention. Participants exercised 3 days/week for 60 min/session. An innovative exercise training system and software (TechnoGym) captured EW lifted and EHB automatically each session. Total weekly EW lifted was calculated as the sum of weekly repetitions x sets x exercise area x exercise area. Average change over 8 weeks, then divided by body weight (lbs). Total weekly EHB were calculated by the sum of exercise heart rate x session/week, with resting heart rate x minutes of exercise subtracted. We measured peripheral and central blood pressure (BP), % body fat, cardiorespiratory fitness, bench and leg press 1 repetition maximum (1RM), and blood lipids at baseline and 8-weeks. Individual CVD risk factors were standardized as sex specific z-scores for each participant and the mean was used to establish an overall clustered CVD risk score. Data was analyzed using Pearson correlation and linear mixed models adjusting for age, sex, and average daily steps.

RESULTS: The average weekly EW and EHB were 220.68 lbs and 7004±1419 beats, respectively. Regression analysis revealed a reduction in overall CVD risk by -0.25 (p = 0.06) per 100 lbs lifted relative to body weight with RT and -0.1 (p=0.16) per 1000 beats with AT. With RT, we found strong correlations between total EW and changes in peripheral systolic (r=−0.45, p=0.09) and diastolic BP (r=−0.59, p=0.02), central systolic (r=−0.47, p=0.08) and diastolic BP (r=−0.53, p=0.04), and leg press 1RM (r=−0.62, p=0.01). With AT, strong correlations with total EHB were noted with change in triglyceride levels (r=−0.50, p=0.049).

Abstracts were prepared by the authors and printed as submitted.
CONCLUSIONS: In individuals at high risk of developing CVD, increased total EW lifted and EHB are associated with improved overall CVD risk, especially peripheral and central BP with greater EW lifted, and triglyceride levels for additional EHB. Supported by Iowa State University College of Human Sciences seed grant.

Squat as a lower body training is known its positive impact in both fitness training and strength training for athletic performance, as well as a mean for rehabilitation. However, the physiological impact and application to health intervention have not been systematically reviewed.

PURPOSE: To provide a systematic review on squat as an exercise intervention and examine its physiological impact in fitness training, health promotion and rehabilitation.

METHOD: Key words, such as “Squat”, “Physiology” combined with “Rehabilitation”, “Training”, “Fitness” and etc., were researched in the databases of “Web of Science”, “Google”, and “PubMed”. Criterion search was defined in “written in English” paper only, back to year of 2005. RESULT: 321 papers were found, but only 150 were qualified. Four categories were summarized including fitness performance, body physiology impact, chronic disease and anatomy morphology. Clinical trial (50%) design was mostly conducted. Most of the qualified studies (50%) adapted squats to improve fitness performance, in particular counter movement jump, acceleration, and running speed, showing a moderate intensity of squat intervention could greatly improve the athletic performance. Physiological impacts (30%) such as muscle activation were also examined in some of the studies, reporting that muscle activation of the lower limb resulting from several of squat depth; several studies noted that common various such as stance width, hip rotation, and front squat had no impact to muscle activation. About 10% of the qualified studies discussed the important role of squats in chronic disease intervention, showing a positive impact. For example, a 3-time weekly, moderate intensity squat intervention could help reduce disease symptoms, especially in older adults (aged 60-85 yr). CONCLUSION: While squat has been widely used in fitness and athletic training, its application to health and chronic diseases are still limited. Combined with other physical activity intervention, such as aerobics and resistant training, squat could bring some positive impact on lower extremity, balance, and even mobility. Meanwhile, there is still a gap in the information on detailed dose-response of squat in exercise and its interaction with age, gender, etc.

PURPOSE: To assess the effects of various cell phone functions (talking, texting, and listening to music) on medial and lateral postural stability compared to a control condition.

Methods: Forty-five college students (n = 29 females) participated in four conditions in a randomized order. During the control condition no cell phone functions were utilized. For the texting and talking conditions participants followed a predetermined script. Finally, during the music condition participants selected the music of their choice. Results: The medial and lateral postural stability index scores during the control (0.66) and music (0.66) conditions were significantly (p < 0.001) lower than the talking (1.21) and talking (0.86) conditions. The control (0.66) condition was not significantly (p = 0.83) different than the music (0.66) condition. The talking (0.86) condition was significantly (p < 0.001) lower than talking (1.21) condition. Conclusion: Based off of the current results, it is recommended that cell phone texting and talking be refrained from while either maintaining balance in a static position or while moving within the medial and lateral plane, such as side to side movement or sliding. Failure to do so can possibly lead to orthopedic injuries.

The ability to pay adequate attention to two tasks at the same time has become more important with the advancement of today’s technology. While dual-tasking neither source receives the proper attention needed to be properly performed. The effects of cell phone use during common activities is just beginning to be understood. Purpose: To assess the effects of various cell phone functions (talking, texting, and listening to music) on medial and lateral postural stability compared to a control condition.

Methods: Forty-five college students (n = 29 females) participated in four conditions in a randomized order. During the control condition no cell phone functions were utilized. For the texting and talking conditions participants followed a predetermined script. Finally, during the music condition participants selected the music of their choice. Results: The medial and lateral postural stability index scores during the control (0.66) and music (0.66) conditions were significantly (p < 0.001) lower than the talking (1.21) and talking (0.86) conditions. The control (0.66) condition was not significantly (p = 0.83) different than the music (0.66) condition. The talking (0.86) condition was significantly (p < 0.001) lower than talking (1.21) condition. Conclusion: Based off of the current results, it is recommended that cell phone texting and talking be refrained from while either maintaining balance in a static position or while moving within the medial and lateral plane, such as side to side movement or sliding. Failure to do so can possibly lead to orthopedic injuries.

The theore in developing obesity and metabolic syndrome becomes another burden in patients with schizophrenia who took antipsychotics. Exercise and lifestyle modification are suggested as effective and primary management for the chronic diseases. Walking is a feasible lifestyle activity but ceiling effect due to a relative low intensity is challenged. Purpose: To compare the effect of different walking exercises on fitness and metabolic abnormal factors in patients with schizophrenia.

METHODS: Fifty-six admitted patients, meeting DSM-IV criteria for schizophrenia and having antipsychotic-treated under stable medical condition, were recruited and divided into three groups: walking prescription group (WP, set target speed and distance based on individual fitness level, n=22), free walking group (Wf, encouraged to walk 30 minutes per day, n=20) and control group (C, n=14). Physical fitness (e.g. step physical fitness index and leg strength) and metabolic factors (e.g. waist girth, blood pressure, fasting plasma glucose and lipids) were assessed before and after 6-month intervention. Basic data and clinical features were also investigated. RESULTS: After adjusting for age, sex and baseline values, WP got significantly improvement on muscular fitness of abdominal muscle endurance and leg strength after 6-month intervention. While subjects in both Wf and C got little improvement or regressions on muscular fitness. Metabolic factors were not significantly different among three groups on pre- and post 6-month intervention. The change of step physical fitness index, hostess, significantly correlated to the change of triglycerides after 6-month intervention (Pearson’s r = -0.57, p<0.001). A negative correlation was also found between the change of abdominal muscle endurance and the change of systolic blood pressure (Pearson’s r = -0.32, p=0.039). CONCLUSIONS: Walking exercise by setting a route with prescribed distance and slope individually for 5 days a week is feasible and more effective for patients with schizophrenia.
Despite the known health benefits of a healthy diet and physical activity (PA), many older adults do not meet guidelines. Evidence suggests that health behaviors cluster. **PURPOSE:** To examine the associations between various dietary and PA behaviors. Participants completed a baseline questionnaire assessing demographic variables, self-reported fruit and vegetable (FV) consumption, and fat- and fiber-related behaviors (lower scores indicate more favorable fat- and fiber-behaviors). Objectively measured height and weight were also obtained. Participants wore an accelerometer for seven days, during all waking hours. Time spent sedentary, and in light and moderate to vigorous PA was calculated. Pearson correlation coefficients examined relationships between dietary and PA behaviors. **RESULTS:** Participants (n=71) averaged 64.0±8.5 years of age and had a BMI of 33.3±7.1. Most were women (75%), married (61%), white (80%), and had at least some college education (82%). On average, participants spent 62% of the day sedentary, 37% in light PA, and 1% in moderate to vigorous PA. Percent time sedentary was not related to FV consumption \((r=-.04, p=.52)\), fat-(\(r=-.12, p=.31)\) or fiber-related behaviors. Percent in light PA was not related to FV consumption \((r=.04, p=.75)\), fat-(\(r=-.12, p=.31)\) and fiber-related behaviors \((r=-.09, p=.44)\). Percent time in moderate to vigorous PA was not related to FV consumption \((r=-.03, p=.78)\), fat-(\(r=-.08, p=.52)\) or fiber-related behavior \((r=-.11, p=.36)\). There was a significant relationship between FV consumption and \(r=-.33, p=.004\) and fiber-related behaviors \((r=-.74, p<.001)\). **CONCLUSIONS:** Our findings suggest that dietary behaviors among older adults may cluster; however there is no evidence that dietary and PA behaviors cluster. Interventions aiming to improve the health of older adults via PA and healthy diets may not lead to changes in the other. A better understanding of the extent to which health behaviors, beyond PA and diet, cluster among older adults may help to inform interventions aimed at improving health.

**Interaction between meals and exercise is of interest because it may affect insulin resistance through both an insulin-dependent and non-insulin mediated muscle glucose uptake. We hypothesized an equal involvement of both mechanisms regardless of whether exercise precedes or follows the meal.**

**PURPOSE:** To examine postprandial (PP) insulin resistance to moderate-intensity exercise completed 1 h before, or initiated 1 h after, the meal. **METHODS:** Twenty-four healthy postmenopausal women, aged 50±6 years, were assigned, eight each, to either sedentary (SED), exercise before meals (EBM), or exercise after meals (EAM). Two 800-Kcal meals containing 60% carbohydrate, 25% fat, and 15% protein were provided at 10 and 17 h. EBM group completed 2-h treadmill exercise at 45%VO2max 1 h before each meal, while exercise in EAM group started 1 h after the onset of the meals. Homeostasis-model assessment of insulin resistance (HOMA-IR) was calculated from glucose and insulin areas under the curves (AUCs) and were compared between SED and EBM or EAM and between EBM and EAM groups. AUCs also were calculated for insulin and glucose during early (10-14 h and 17-21 h) and late PPs (14-17 h). **RESULTS:** HOMA-IR insulin resistance scores were 50% lower \((t=3.22, p=0.0061)\) when exercise was performed during early PP after the first meal than before the first meal. The corresponding 60% reduction of HOMA-IR occurred with exercise, compared to exercise prior, to the second meal \((t=3.95, p=0.0015)\). While PP HOMA-IR did not differ between SED and EBM trials after each meal, it was 43% \((t=2.11, p=0.054)\) and 52% lower \((t=3.74, p=0.0022)\) after EBM compared to SED groups after the two respective meals. In contrast to the changes in PP HOMA-IR related to the timing of exercise and meals, a significant reduction in plasma glucose during exercise in late PP in the EBM compared to EAM group \((t=2.09, p=0.054)\) was not associated with changes in late PP HOMA-IR. **CONCLUSION:** Insulin resistance is acutely reduced during the early postprandial period by concurrent exercise but not by exercise completed 1 h before the meal. Timing of exercise during late postprandial period lowers plasma glucose concentration without affecting insulin resistance.

Supported by NIDDK, grant R15 DK082800 and Blue Cross Blue Shield student award.

**PURPOSE:** Few studies have examined the benefits of exercise immediately after heart or liver transplantation. This prospective, randomized, and assessor-blinded study compared the effect of high (HF) versus low (LF) about performance on an instrumented bedside exercise ergometer in organ transplantation recipients.

**METHODS:** Adult patients who received a heart or liver transplantation were randomized to either HF or LF about daily leg cycling. Data were transmitted via a wireless internet connection to the investigators from the intensive care unit or ward. HF subjects were encouraged to look at the summary of daily data about pedaling and to progress more activities for the legs. LF subjects were only encouraged to increase their total cycling time. The outcome measure was level of independence for walking, walking speed, 6-minute walking distance, Short-Form 36 health-related quality of life, and cardiorespiratory fitness.

**RESULTS:** Eighty-five patients who received a heart \((n=29)\) or liver \((n=56)\) transplantation participated at a median of 8 days after surgery. No adverse events were reported during the median study period of 17 days. The HF group \((n=44)\) achieved greater energy expenditure \((p<0.05)\), with a trend toward greater 6-minute walking distance at discharge compared to the LF group \((n=41)\). No significant between-group differences were detected in outcomes of interest. Of note, participants who performed cycling exercise for 24 minutes or more per day \((n=41)\) had significantly greater independence for walking, walking speed, 6-min walking distance, health-related quality of life scores in physical functioning and vitality, and cardiorespiratory fitness compared with patients using the bedside device for less than 24 minutes per day \((n=44)\).

**CONCLUSIONS:** In this first trial of bedside exercise with remote monitoring for inpatient organ transplantation rehabilitation, augmented feedback alone did not improve outcomes of interest. Exercise for 24 minutes or more per day, however, appeared to be efficacious and warrants further investigation, since the procedures were safe in the early postoperative period. Supported by Grant NSC 101-2314-B-002-006-MY3 from Ministry of Science and Technology, Taiwan (ClinicalTrials.gov Identifier: NCT01705015)

**PURPOSE:** The aim of this study was to assess the feasibility and the efficacy of a preoperative exercise program that was conducted to improve postoperative recovery.

**METHODS:** Thirteen patients \((63.21±12.6 y)\) with LSS awaiting surgery were recruited and participated to a 6-week \((3 \times 30 \text{ min/session})\) supervised exercise program prior to surgery. Physical and functional evaluations were conducted prior and at the end of the 6-week exercise program. The intervention program aimed at improving muscular strength and endurance, spinal stabilization, and cardiovascular capacities. Primary physical outcomes were trunk flexion and extensor maximal strength, trunk extensor endurance and lower limb maximal strength. The main feasibility variables were dropout rate, compliance to program and program satisfaction. Comparisons for physical outcomes were made using one-way ANOVA with repeated measures.

**RESULTS:** Dropout rate was 7.7% and the compliance to program was 85.9%. Nine of 10 participants showed a program satisfaction over 85%. Lower limb maximal strength was improved, but not significantly \((p=0.72, 95\% \text{ CI}=0.03 \text{ to } 37.2 \text{ N})$. 

Abstracts were prepared by the authors and printed as submitted.
p = 0.555). Trunk extensor endurance was not significantly improved (pre = 41.5 ± 57.2 s, post = 53.4 ± 69.2 s, p = 0.318). Extensor maximal strength was also not significantly improved (pre = 6.48 ± 0.28 V, post = 6.84 ± 0.98 V, p = 0.298), but flexor maximal strength was significantly improved (pre = 0.42 ± 0.20 V, post = 0.52 ± 0.23 V, p < 0.05).

CONCLUSION: A preoperative exercise program conducted to improve postoperative recovery is feasible. There seems to be a trend of improvement, however due to the poor physical condition of patients with LSS, participants are difficult to train and to evaluate within a specific time frame.

2173 Board #325 June 2, 3:30 PM - 5:00 PM
Educational Program Promoting Regular Physical Exercise Does Not Improve Muscular Capacity In Osteoarthritis Knee Patients
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Abstract

PURPOSE: To analyze the effects of an educational program promoting regular physical exercise on knee extension–flexion isokinetic performance in osteoarthritis knee patients.

METHODS: One hundred and thirty six sedentary patients (111 women; age = 67.6 ± 9.6, BMI = 30.6 ± 4.4 kg/m²), diagnosed with primary osteoarthritis (OA) of the knee and under conventional therapy, had their knee extension–flexion (5 reps at 60°/sec and 15 reps at 180°/sec at a Biodex™ Multi-Joint System 3 dynamometer) assessed before and after 12 month of an educational program of 8-hour intervention with a multidisciplinary team. To reinforce the educational program learning, each patient received a teaching support material (1 booklet and 1 DVD) to proceed with the recommendations at home. Statistical analysis was performed with ANOVA with repeated measurements and the Bonferroni’s test.

RESULTS: No significant differences between legs were observed in any variable analyzed, and only the data of right leg are displayed. No significant differences between pre and post-intervention with the educational was found in any variable assessed (Table 1).

CONCLUSIONS: An educational program with emphasis in promoting the regular practice of physical activity did not change the muscular capacity of knee OA patients, and the present results suggest that other interventions are necessary to improve this variable in the present population.

Table 1. Knee extension-flexion isokinetic performance before and after 12 month of an educational program.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Right Leg</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee Extension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak torque 60°/sec (Nm)</td>
<td>80.62 ± 38.92</td>
<td>83.76 ± 32.68</td>
<td></td>
</tr>
<tr>
<td>Total work 180°/sec (J)</td>
<td>528.28 ± 291.69</td>
<td>562.11 ± 249.03</td>
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</tr>
<tr>
<td>Work fatigue 180°/sec (%)</td>
<td>17.02 ± 23.35</td>
<td>16.92 ± 21.17</td>
<td></td>
</tr>
<tr>
<td>Agon / Ant ratio 60°/sec (%)</td>
<td>56.82 ± 26.61</td>
<td>56.95 ± 16.86</td>
<td></td>
</tr>
<tr>
<td>Knee Flexion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak torque 60°/sec (Nm)</td>
<td>44.96 ± 28.66</td>
<td>43.53 ± 19.92</td>
<td></td>
</tr>
<tr>
<td>Total work 180°/sec (J)</td>
<td>321.79 ± 216.71</td>
<td>319.98 ± 177.94</td>
<td></td>
</tr>
<tr>
<td>Work fatigue 180°/sec (%)</td>
<td>-19.88 ± 386.75</td>
<td>20.93 ± 25.12</td>
<td></td>
</tr>
</tbody>
</table>

2174 Board #326 June 2, 3:30 PM - 5:00 PM
Lumbar Strength, Back Pain And Work Ability After Low-dose, Non-supervised Exercise In Employees.
Sven Haufler1, Klaus Wiechmann1, Lothar Stein2, Klaus Wiechmann1, Lothar Stein1, Momme Kück1, Andrea Smith1, Stefan Meineke2, Yvonne Zirkelbach1, Samuel Rodriguez-Duarte1, Michael Drupp2, Uwe Tegtbur1. 1Hannover Medical School, Hannover, Germany; 2AOK lower saxony, Hannover, Germany.

PURPOSE:

Back pain is a major medical and social problem that causes physical and psychological distress and great expense to society in most industrialized countries. Feasible interventions, low in costs and personnel requirements are needed to implement action to a large number of persons concerned.
Strenuous running and cycling have been reported to alter normal kidney function. Although running protocols have been performed in both hot and cold settings, cycling protocols have been performed primarily in cool environments, thus leaving a need for a cycling protocol in the heat. PURPOSE: Observe the effect of a long-distance cycling event in a hot environment on renal function and identify potential factors related to renal stress. METHODS: 45 cyclists (38 male, 7 female, 51 ± 10 yrs, 84.7 ± 15.6 kg) completed either a 164 km or 100 km outdoor ride in the heat (max 36.6°C, 51% RH). Pre- and post-ride: body mass was measured to determine net fluid loss, a urine sample was collected to analyze urine specific gravity (USG) and urine color (UCol), and a blood sample (50 mL) was drawn. A muscle soreness questionnaire was also completed as a surrogate for muscle damage in the legs. Serum and urine Na+, K+, and Cl- concentrations were analyzed by ion-sensitive electrodes. Serum creatinine (Scr) was measured via colorimetric assay. Paired-samples T-tests were run to analyze differences in pre- and post-ride measures. RESULTS: A net fluid loss of 1.4 ± 1.1 kg (1.6 ± 1.4% body mass loss) was observed. USG was greater post- (1.021 ± 0.007) vs pre-ride (1.015 ± 0.007; P < 0.001). Urine Na+ was greater post- (3.5 ± 1.5) vs pre-ride (2.1 ± 0.9; P < 0.001). Leg muscle soreness increased post- (1.47 ± 1.67) vs pre-ride (1.08 ± 0.58; P < 0.001). Serum Na+ (pre-141.1 ± 23, post-142.8 ± 2.9 mmol/L; P < 0.001), serum K+ (pre-4.4 ± 0.5, post-4.7 ± 0.6 mmol/L; P < 0.002), and urine K+ (pre-36.6 ± 22.7, post-95.8 ± 42.7 mmol/L; P < 0.001) increased, whereas urine Na+ (pre-96.0 ± 49.9, post-52.1 ± 33.3 mmol/L; P < 0.001) decreased post-ride. Scr was greater post- (0.88 ± 0.21 mg/dL) vs pre-ride (0.52 ± 0.14 mg/dL; P < 0.001). CONCLUSION: Changes in electrolyte concentrations and Scr suggest kidney stress after endurance cycling in a hot environment. This impairment may be a result of dehydration and/or increased muscle damage (as indicated by increased soreness). Dehydration reduces blood volume and subsequent renal blood flow required for sufficient renal filtration. Muscle damage increases creatinine production, overloading the kidneys with waste to filter.

Urine osmolality (UOsm) represents the net sum of water gains, losses, and neuroendocrine responses that act to maintain body water homeostasis. Recently, we proposed a 24 h UOsm of ≤ 500 mOsm kg⁻¹ as a desirable target for urine concentration, reflecting sufficient total water intake to compensate daily losses, reduce circulating vasopressin, and ensure sufficient urinary output to reduce the risk of some renal and metabolic health consequences. However, measuring UOsm is more time-consuming and less convenient than specific gravity (USG) and color (UCol), both of which are more practical to measure during daily activities. PURPOSE: To establish the criterion values for USG and subject-assessed UCol, which would have the best diagnostic accuracy for identifying UOsm > 500 mOsm kg⁻¹. METHODS: A total of 817 individual urine samples were obtained from 82 healthy French adults (23.6 ± 2.9 years; 22.2 ± 1.5 kg²/m²; 41 women). Each urine sample represented a complete void. UOsm and USG were measured in the laboratory, and UCol was assessed by each participant under consistent lighting conditions against an 8-point color scale. USG were measured in the laboratory, and UCol was assessed by each participant under consistent lighting conditions against an 8-point color scale. The optimal cut-offs for USG and subject-assessed UCol for identifying UOsm > 500 mOsm kg⁻¹ were determined by logistic regression with receiver operating characteristic (ROC) analysis, favoring neither sensitivity nor specificity. RESULTS: The mean (5th; 95th percentile) for UOsm, USG, and UCol, respectively, were 436 (192; 938) mOsm kg⁻¹, 1.012 (1.003; 1.025), and 4 (1;7). ROC analysis revealed the optimal UOsm cut-off for identifying UOsm > 500 mOsm kg⁻¹ was 1.013 (AUC 0.984), while the cut-off for USG was 4 (AUC 0.831). A UCol of 1.013 or higher offered excellent sensitivity and specificity. A UOsm of 4 or higher was highly sensitive but less specific. CONCLUSION: In this analysis, we demonstrate that both UOsm and USG can be used with good-to-excellent accuracy to identify individuals above or below the 500 mOsm kg⁻¹ target. UOsm is both highly sensitive and highly specific, suggesting its utility for health care professionals and clinicians, with faster results and lower cost than USG. Subject-assessed UCol demonstrated excellent sensitivity and good specificity, confirming UCol as a practical field measure. A self-assessed UOsm of 3 or lower suggests a very high probability of UOsm being less than 500 mOsm kg⁻¹.
were exported to excel via a combination of proprietary software (Garmin Connect) a total of 14 runs (7 treadmill, 7 overground) with each run at a different velocity. Subjects (n=10; 22.3±2.6yrs; 1.71±.08m; 71.4±15.5kg) completed Global Positioning System (GPS) technology while running at different velocities on a treadmill. However, there are no data directly comparing the relationship between SL, SF, and velocity using wearable technology while running at different velocities on a treadmill. To compare the relationship between SL, SF, and velocity using wearable technology while running at different velocities on a treadmill. PURPOSE: To compare the relationship between SL, SF, and velocity using wearable technology while running at different velocities on a treadmill. METHODS: Fourteen male recreational runners (26.2 ± 4.2 yr; 178.4 ± 5.4 cm; 75.6 ± 5.7 kg) ran 10 trials overground at preferred running speed during four conditions: control shoe at PSL and 90% PSL; minimalist shoe at PSL and 90% PSL. Markers were placed on the pelvis and right lower extremity, and motion capture and force platform data were recorded at 240 and 240 Hz, respectively. A 2 x 2 factor repeated measures ANOVA was used to compare trial-averaged peak moments, angular impulse, and eccentric and concentric work during the four conditions (α = 0.05). A cumulative impulse was also calculated by multiplying impulse with the number of steps associated with a 5 km run. RESULTS: Increased eccentric work at the MTP (12.8 ± 4.9 vs. 8.9 ± 3.2 J/kg) and ankle joint (30.0 ± 6.7 vs. 26.4 ± 7.7 J/kg) was observed when running in minimalist shoes. Minimalist shoe running was also associated with reduced knee impulse (17.1 ± 3.7 vs. 18.7 ± 4.8 Nm/kg), while 90% PSL was associated with reduced knee impulse (15.0 ± 5.2 vs. 18.7 ± 4.8 Nm/kg), eccentric work (30.8 ± 10.8 vs. 39.8 ± 13.6 J/kg), and cumulative impulse (33.5 ± 5.6 vs. 29.3 ± 7.9 103 Ns/kg). 90% PSL also illustrated a lower ankle impulse (37.1 ± 4.9 vs. 38.6 ± 4.8 Nm/kg). CONCLUSIONS: Running in minimalist footwear was beneficial for knee joint loading, however increased loads were observed at the MTP and ankle joints, which may help to explain the running injuries seen in minimalist shoe users. Running at 90% PSL lowered ankle and knee joint impulse and eccentric work, suggesting that a combination of the control shoe and 90% PSL may provide a good compromise for minimizing injury.

Mathematically, running velocity is the product of stride length (SL) and stride frequency (SF), with the relationship between these parameters well documented. With the increase in availability and accuracy of wearable technology, parameters such as SL, SF, and velocity can be easily measured while running outdoors as well as on a treadmill. However, there are no data directly comparing the relationship between these parameters during treadmill running and overground running. PURPOSE: To compare the relationship between SL, SF, and velocity using wearable Global Positioning System (GPS) technology while running at different velocities on the treadmill and overground. METHODS: Subjects (n=10; 22.3±2.6yrs; 1.71±.08m; 71.4±15.5kg) completed a total of 14 runs (7 treadmill, 7 overground) with each run at a different velocity. SL, SF, and velocity data were recorded using a GPS watch with footpod (Garmin, Fenix2). Overground runs (approximately 1 min per velocity) were completed first, with treadmill run velocities matching the range of overground velocities. Raw data were exported to excel via a combination of proprietary software (Garmin Connect) and custom software to convert data to excel format. A global 2nd order polynomial lines were fit to the SL vs. velocity as well as to the SF vs. velocity plots for treadmill and overground. Additionally, for each individual subject, SL vs. velocity data sets were fit with a 2nd order polynomial with coefficients averaged across subjects and compared overground vs. treadmill (paired t-tests). RESULTS: The global SL vs. velocity relationship during treadmill running was described as SL=−0.046v+0.86v+0.01 (where v represents velocity) (R2=0.94) and during overground running as (R2=0.95). The global SF vs. velocity relationship during treadmill running was SF≈0.38v−3.18v+69.8 (R2=0.38) and during overground SF=3.03v−5.7v+81.4 (R2=0.68). For the SL vs. velocity relationship, the squared coefficient was greater during overground vs. treadmill (p=0.031) while the linear coefficient (p=0.136) and constant (p=0.260) were not. CONCLUSIONS: The larger SL vs. velocity v coefficient for overground running is an indication that subjects used different strategies to achieve faster velocities running overground and on a treadmill.

Running is a popular activity with over 2 million half-marathon finishers in the US each year. Unfortunately, running is associated with a high incidence of injury ranging from 24% to 77% per annum. Minimalist shoes have been developed to mimic barefoot running while protecting the foot. Common injuries in minimalist runners include plantar fasciitis, Achilles tendinopathy, and metatarsal stress fractures. It is known that changing a runner’s preferred stride length (PSL) can alter joint kinetics, however these effects have not been studied in minimalist runners. PURPOSE: To examine changes in metatarsophalangeal (MTP), ankle, and knee joint kinetics when running in minimalist shoes and at reduced stride length. METHODS: Fourteen recreationally active runners (26.2 ± 4.2 yr; 178.4 ± 5.4 cm; 75.6 ± 5.6 kg) ran 10 trials overground at preferred running speed during four conditions: control shoe at PSL and 90% PSL; minimalist shoe at PSL and 90% PSL. Markers were placed on the pelvis and right lower extremity, and motion capture and force platform data were recorded at 240 and 240 Hz, respectively. A 2 x 2 factor repeated measures ANOVA was used to compare trial-averaged peak moments, angular impulse, and eccentric and concentric work during the four conditions (α = 0.05). A cumulative impulse was also calculated by multiplying impulse with the number of steps associated with a 5 km run. RESULTS: Increased eccentric work at the MTP (12.8 ± 4.9 vs. 8.9 ± 3.2 J/kg) and ankle joint (30.0 ± 6.7 vs. 26.4 ± 7.7 J/kg) was observed when running in minimalist shoes. Minimalist shoe running was also associated with reduced knee impulse (17.1 ± 3.7 vs. 18.7 ± 4.8 Nm/kg), while 90% PSL was associated with reduced knee impulse (15.0 ± 5.2 vs. 18.7 ± 4.8 Nm/kg), eccentric work (30.8 ± 10.8 vs. 39.8 ± 13.6 J/kg), and cumulative impulse (33.5 ± 5.6 vs. 29.3 ± 7.9 103 Ns/kg). 90% PSL also illustrated a lower ankle impulse (37.1 ± 4.9 vs. 38.6 ± 4.8 Nm/kg). CONCLUSIONS: Running in minimalist footwear was beneficial for knee joint loading, however increased loads were observed at the MTP and ankle joints, which may help to explain the running injuries seen in minimalist shoe users. Running at 90% PSL lowered ankle and knee joint impulse and eccentric work, suggesting that a combination of the control shoe and 90% PSL may provide a good compromise for minimizing injury.

Injuries are common among runners training for distance events with annual incidence rates ranging from 19.4 to 79.3%. Recently, lower stride frequencies (SF) have been hypothesized as a potential factor contributing to these high injury rates. It has been suggested that SF ≤162 steps per minute (spm) may increase the likelihood of injury, whereas, SF ≥169 spm may be protective. PURPOSE: To compare SF in injured and non-injured runners before and after training for a half-marathon. METHODS: Twenty-eight recreational runners (males: n=9, 47.8±7.8yrs; females: n=19, 46.6±7.7yrs) training for a half-marathon volunteered to participate. Prior to beginning training (PRE), a 30-second 3-dimensional gait analysis was performed at a self-selected pace. The pace was used again for analysis at the conclusion of training (POST). Throughout training, participants submitted an online daily questionnaire regarding training and injury. Paired t-tests compared participants PRE to POST and a chi-square analysis examined the difference in injury rates between groups.

Due to the high prevalence of running-related injury running related injuries, step rate modulation and foot strike modifications are often utilized to lower external loading. Likewise, intrinsic foot stiffness (IFS) may also influence loading by modulating the arch’s ability to absorb impacts. Runners with greater IFS may adapt differently to step rate modifications compared to runners with lower IFS. PURPOSE: To determine the effects of IFS and changes in step rate on in-shoe maximum force in recreational runners. METHODS: Fifteen recreational runners (≥10 miles/week, age 20±7.0yrs, mass 68.2±11.8 kg, height 168.3±9.3 cm) volunteered to participate in this study. IFS was calculated from maximum isometric toe flexor strength trials performed while seated adjacent to a pressure platform. The subjects were divided into high and low IFS groups based on the median distribution. The subjects were then fitted with pressure distribution measurement insoles and ran on a treadmill at a self-selected speed (3.2±0.4m/s) matching an audible metronome, a preferred step rate (164±12steps/min), and a ten percent increased step rate (180±13 steps/min) in randomized order. Maximum in-shoe force was calculated from nine separate regions of the foot while running over ten consecutive steps during each condition. A 2x2 repeated measures ANOVA determined the difference between cadence and IFS group (p<0.05).

RESULTS: Total in-shoe maximum force was greater in the low IFS group (2.5±0.2BW) compared to high IFS (2.2±0.2BW; p<0.01). The infrasagittal (p=0.03) and lateral (p=0.04) heel regions exhibited a main effect for cadence condition, with lower in-shoe forces at increased cadence. There was not an interaction between IFS group and cadence condition. CONCLUSIONS: Recreational runners with greater IFS had lower overall maximum in-shoe force while running at a self-selected speed. Increasing IFS through targeted training interventions should be explored further. Increased cadence resulted in lower maximum forces at the heel. However, in our small sample, cadence-induced changes in maximum in-shoe regional forces were not influenced by IFS.
RESULTS: Overall, SF significantly increased, 165.3 ± 8.3 spm PRE to 173.2 ± 11.6 spm POST (p<0.01). Of the 28 runners sustained an injury and their SF significantly increased, 162.1 ± 6.6 spm PRE to 171.6 ± 10.5 spm POST, p=0.01. During PRE analysis, 12 runners had SF ≤162 spm (Low SF) and 9 had SF ≥169 spm (High SF). Difference in injury rates between SF groups was found to be significantly different (8/12, Low SF vs. 2/9, High SF; p<0.04). Of the Low SF group, 8 reported an injury and of the High SF group, only 2 reported an injury. Compared to PRE, the Low SF group significantly increased their cadence (Ve), rate of oxygen use (V2O2), heart rate (HR). 3D motion analysis and an instrumented treadmill were used to determine temporal/spatial parameters, peak ground reaction forces (GRF) and lower extremity joint powers.

CONCLUSIONS: Prior to beginning training, 42.9% of participants had SF below 163 spm, and this group had injury rates of 66.7%. Comparatively, 32.1% of participants had SF above 168 spm, and their injury rates were 22.2%. This suggests SF ≥169 spm may have been protective. Future research is needed to examine if altering SF for those with cadences ≤162 spm prior to training would decrease injury rates for runners training for half-marathons.

2184 Board #336 June 2, 2:00 PM - 3:30 PM
Effects of Increasing or Decreasing Cadence on Metabolic, Cardiopulmonary and Biomechanical Responses During Downhill Running
Trevor Leavitt, Laura Ann Zdziarski, Cong Chen, Daniel C. Herman, JoAnna L McClelland, Joseph G. Wasser, Kevin R. Vincent, FACSM, Marybeth Horodysky, Jason L. Zareskis, Heather K. Vincent, FACSM. University of Florida, Gainesville, FL. (Sponsor: Kevin R Vincent, FACSM)

(Purpose relationships reported)

PURPOSE: Running races are becoming popular in geographic areas with hilly terrain. This study compared the collective metabolic, cardiopulmonary and biomechanical responses during acute downhill and level running.

METHODS: This study used a repeated-measures, crossover design in healthy runners (N=30; 28.6±8.6yrs, 21.6±1.9kg/m2). Each runner completed six conditions including level running at self-selected cadence, and downhill running (+6% grade) at five cadences (self-selected, ±5% and ±10%). A portable gas analyzer and heart rate monitor collected energy cost, minute ventilation (Ve), rate of oxygen use (V2O2), heart rate (HR). 3D motion analysis and an instrumented treadmill were used to determine temporal/spatial parameters, peak ground reaction forces (GRF) and lower extremity joint powers.

RESULTS: During the downhill conditions, Ve increased (61.1 to 65.6 L/min; p<0.07) and HR increased (141 to 151 bpm; p<0.01) from fastest cadence to slowest cadence, with no difference in energy cost or VO2 among the conditions (both p>0.5). As cadence increased among the downhill conditions, step length decreased and step width increased (both p<0.05). GRF values progressively increased in the downhill conditions from fastest to slowest cadence (16.7 to 17.5 Nm; p<0.02). Among ankle, knee, and hip powers, knee power values increased from fastest to slowest cadence (9.5 to 12.2 Watts; p<0.03).

CONCLUSIONS: When compared to the control condition, running downhill with a progressively faster cadence increases cardiopulmonary and biomechanical responses, but not metabolic responses. The findings suggest that runners maintain energetic cost among different cadence conditions by making adjustments to muscle activation patterns when running downhill. This muscle recruitment concept could be tested using similar cadence conditions described here during flat, uphill and downhill running.

2185 Board #337 June 2, 2:00 PM - 3:30 PM
Kinetic Response to Stride Frequency Perturbations During Treadmill Running
Joshua P. Bailey, Leland Barker, Kendall Galor, Michael Soucy, John A. Mercer, FACSM. University of Nevada, Las Vegas, Las Vegas, NV. Email: bailey69@unlv.nevada.edu

(No relationships reported)

As a runner changes stride frequency, ground reaction forces likely change. There is a large body of research on ground reaction forces during running overground; however, there is very little research of ground reaction forces while running on a treadmill. PURPOSE: To investigate the effect of stride frequency perturbations on kinetic events during treadmill running.

METHODS: Participants (n=8; 24.9 ± 4.2 yrs; 1.73 ± 0.09 m; 73.3 ± 13.4 kg) determined preferred treadmill running speed while running on an instrumented force treadmill (Bertec, OH). Preferred stride frequency (PSF) was measured and participants ran a total of 7 conditions, each representing a different stride frequency perturbation (PSF, PSF ± 5%, ± 10%, ± 15%, ± 20%, ± 25%, ± 30% PSF). Conditions were run to 4 - 30 s data collection occurring every other 30 seconds after 1 minute. Data were processed via custom Matlab code identifying 15 right foot stance periods for analysis. Kinetic variables (active peak (FZ2), percent of stance phase of FZ2 (FZ2%)

and peak loading rate), braking impulse (BIM), propulsive impulse (PIMP) and stance period were analyzed using repeated measure ANOVAs across perturbation conditions (ε<0.05). Due to the reduced frequency of occurrence of impact peak (FZI) during the higher stride frequency perturbations (+5%, +10% & +15%), FZI's were analyzed comparing PSF to reduced SF perturbations (-10% & -15%) with multiple paired sample t - tests.

RESULTS: Peak loading rate, FZ2 and BIM were not significantly different across SF perturbations (p>0.05). Stance time was significantly different across perturbations (p<0.001). Stance time during PSF was longer (0.260s) than both PSF+10% (0.235s) and PSF+15% (0.228s) (p<0.05). PIMP was significantly different (p<0.001). Increased SF perturbations were significantly lower than decreased SF perturbations (p<0.05).

CONCLUSIONS: During treadmill running, SF perturbations affected running kinetics by reducing the occurrence of FZI during increased SF perturbations and increases in FZI magnitude at reduced SF.
with CAD. This was done for the healthy and injured groups separately and then combined. Additionally, CAD, VALR and VILR were compared between the healthy and injured groups. Significant difference at p ≤ 0.05.

**RESULTS:** CAD was not significantly correlated with either VALR or VILR for either group (Table). Furthermore, there were no differences in CAD between the healthy and injured groups. VALR and VILR were significantly higher in the injured group by 28% and 16% respectively.

**CONCLUSIONS:** While others have found that increasing cadence can reduce load rates, our results suggest that there is no relationship between these variables under habitual conditions. Future studies of gait retraining to increase cadence and reduce load rates should examine this relationship once the cadence has become habituated.

| Pearson correlations of CAD and load rates; Mean values for CAD, VALR, and VILR |
|---------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| CAD/ALR (r)                        | CAD/VLR (r)     | CAD (spm)       | VALR (BW/s)     | VILR (BW/s)     |
| Injured n=93                        | 0.02            | -0.001          | 164±9.62        | 51.19 ± 20.93*  | 61.82 ± 21.48*  |
| Healthy n=32                       | -0.13           | -0.29           | 161 ± 11.63     | 38.69 ± 15.51  | 52.78 ± 16.35  |

Impact loading (in particular, average vertical loading rate (AVLR)) has been implicated in the development of several running-related injuries (RRIs). Some researchers have also suggested that overstriding (landing with the foot too far in front of the centre of mass (COM)) may be linked to increased loading rates and RRI. There is no clear method for measuring overstriding. **PURPOSE:** To establish the relationship between kinetic outcomes (vertical impact peak (VIP), instantaneous vertical loading rate (IVLR), and AVLR) and five kinematic measures of overstriding (angle of Shank at initial contact (IC); horizontal distance from heel to COM at IC; horizontal distance from centre of pressure (COP) to COM at IC; angle between COP, COM, and vertical projection of the COM; percent of step length anterior to COM). **METHODS:** 2188 board #340 differences in kinematic correlates of impact loading between rearfoot and non-rearfoot strikers in running Christopher Napiér1, Christopher L. MacLean2, Jack E. Taunton, FACSM1, Jessica Maurer2, Michael A. Hunt1. 1University of British Columbia, Vancouver, BC, Canada. 2Fortius Sport & Health, Burnaby, BC, Canada. Email: c.nAPIer@alumni.UBC.ca (No relationships reported)

**Results:** While others have found that increasing cadence can reduce load rates, our results suggest that there is no relationship between these variables under habitual conditions. Future studies of gait retraining to increase cadence and reduce load rates should examine this relationship once the cadence has become habituated.

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**RESULTS:** CAD was not significantly correlated with either VALR or VILR for either group (Table). Furthermore, there were no differences in CAD between the healthy and injured groups. VALR and VILR were significantly higher in the injured group by 28% and 16% respectively.

**CONCLUSIONS:** While others have found that increasing cadence can reduce load rates, our results suggest that there is no relationship between these variables under habitual conditions. Future studies of gait retraining to increase cadence and reduce load rates should examine this relationship once the cadence has become habituated.

**Bilateral compartment syndrome is often observed in athletes, particularly female runners. The running mechanics of these runners are understudied, especially biomechanical patterns that may lead to symptoms of compartment syndrome.**

**Purpose:** To identify running mechanical differences between healthy runners and runners with bilateral compartment syndrome. **Methods:** Running videos of runners who were diagnosed with bilateral compartment syndrome were compared with videos of sex, age, and BMI matched healthy control runners. The main outcome variables were foot strike angle, overlap angle, knee joint angle, trunk angle and hip angle, at initial contact, midstance, take off and swing phases. The video image sequences were randomized and reviewed by a single examiner using ImageJ software. The examiner was blinded from the randomization process and statistical analysis. An independent t-test with an alpha level of 0.05 was performed. **Results:** A total of 31 healthy females runners (Age: 20.4±5.4 years old; BMI: 20.6±1.9) were compared to 7 female runners with bilateral compartment syndrome (Age: 17.9±2.1 years old; BMI: 21.9±2.3). The runners with bilateral compartment syndrome demonstrated significantly greater bilateral overlap angles on initial contact (Right leg: 11.2±3.7°; Left leg: 10.6±3.7°) compared to healthy controls (Right leg: 8.4±2.9°; p=0.016; Left leg: 7.4±2.5°; p=0.008). Injured runners demonstrated significantly greater right foot strike angles (17.7±3.9°) on initial contact compared to healthy runners (12.9±4.7°; p=0.022). However, the left foot strike angle did not reach statistical significance. No other variables reached significance between the two groups. **Conclusions:** Female runners with bilateral compartment syndrome showed a propensity of landing with their foot further in front of their knee and with their foot more dorsiflexed at initial contact phase of running compared with healthy female runners.

**D-43 Free Communication/Poster - Sports II: Upper Extremity**

**June 2, 2016, 1:00 PM - 6:00 PM**

**Room: Exhibit Hall A/B**

**Board #343 June 2, 2016, 2:00 PM - 3:30 PM**

**Changing Where Force is Applied Influences Force Parameters During Ergometer Rowing**

James Becker, Renae Jackson, Mimi Nakajima, Will Wu. California State University, Long Beach, Long Beach, CA. (No relationships reported)

While the forces produced at the foot stretcher during ergometer rowing have been previously documented, there is little literature examining where under the foot these forces are applied. The forces produced at the foot stretcher during passive (no rowing) and active (ergometer rowing) conditions were measured in male and female college-aged participants. Two sets of foot force sensors were placed: one set integrated with the foot stretcher木地板 (worn at the foot) and another set integrated with the foot stretcher木地板 (worn at the foot). The forces measured at each sensor during passive and active conditions were compared. The difference in force signals between the two sets of sensors was used to assess the influence of where the force is applied. The results of this study indicate that where force is applied is not constant during passive and active conditions.
forces are being concentrated. Changing where the force is applied changes both how muscles are working during the stroke and the internal loading of tissues, which may influence performance or injury.

**PURPOSE:** Examine how force parameters change during ergometer rowing when instructed to apply force to the foot stretcher in two different ways.

**METHODS:** 10 collegiate rowers (5 male, 5 female; height: 1.69 ± 0.16 m; mass: 71.2 ± 9.9 kg; rowing experience: 2.2 ± 1.3 years) participated in the study. After a self-determined warm-up, participants rowed a “power 10” on the ergometer under two different instructional conditions: “push through the balls of your feet (BoF)” or “push through your heels (HL).” The order of conditions was randomized and 3 minutes of rest was provided between sets. Forces under the foot were recorded using an in-shoe plantar pressure system sampling at 500 Hz. For each trial forces under the whole foot, heel, and forefoot were determined using a 3-box analysis. From this data peak forces, timing of peak force, rate of force development (RFD), and impulses in each region were calculated. Paired t-tests were used to compare differences between conditions.

**RESULTS:** Compared to HL, the BoF condition resulted in higher peak forces (BoF: 483.1 ± 102.1 N, HL: 425.1 ± 104.1 N, p = .002), a later time to peak force (BoF: 49.9 ± 15.1 % stroke, HL: 41.9 ± 10.6 % stroke, p = .036), and higher RFD (BoF: 1553.1 ± 391.4 N·s, HL: 1360.6 ± 493.1 N·s, p = .049). Impulses were not different between conditions (BoF: 329.0 ± 65.5 N·s·s, HL: 313.0 ± 65.7 N·s·s, p = .107).

**CONCLUSIONS:** For most rowers it appears pushing through the balls of feet yields better force curves during ergometer rowing. However, this is likely to vary on an athlete by athlete basis. While there were no differences in impulse as a whole, single subject analysis indicated 3 of the 10 participants generated higher impulses in the HL condition than the BoF condition while the remainder demonstrated the opposite pattern. Why these participants responded differently, whether this is a positive or negative response, and how it influences other aspects of the stroke such as timing, remains to be investigated.

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**膊板 #345:**

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

**Effect of Verbal Instructions on EMG During the Bench Press in Trained and Untrained Males**

Rebecca J. Daniels, Thomas D. Edmonds, Jesse C. Schwartz, Summer B. Cook, FACSM. *University of New Hampshire, Durham, NH.*

Email: rj73@wildcats.unh.edu

(No relationships reported)

It is important to strengthen and rehabilitation professionals to emphasize the usage of correct muscles during exercise. Research indicates that it may be possible to alter muscle activity during certain exercises without changing the form of the exercise.

**PURPOSE:** To determine if trained and untrained males were capable of selectively activating the pectoralis major or triceps brachi muscles according to instructions provided during the bench press exercise.

**METHODS:** Participants included 13 trained males (21.5±2.9 years old, 178.7±7.0 cm, 85.7±10.7 kg, 9.5±4.6% body fat) and 12 untrained males (20.3±1.6 years old, 178.8±9.4 cm, 74.6±17.3 kg, 15.7±8.9% body fat). Participants were prepared for electromyography (EMG) for the pectoralis major (PM), anterior deltoid (AD), and the long head (LT) and short head (ST) of the triceps brachi and then performed a bench press one repetition maximum (1-RM) test. Within 2-14 days of the 1-RM, participants returned and underwent EMG preparation for the same sites. While EMG data was collected, the participants performed one untrained set of 3 repetitions at 80% 1-RM. Two more sets of 3 repetitions at 80% 1-RM were randomly performed with instructions to isolate the chest muscles or to isolate the arms muscles. The EMG data was rectified and integrated and the maximum activity for each muscle during the concentric range of motion was averaged over the three repetitions for each set. A 2x3 repeated measures analysis of variance was used to compare the differences in EMG activity for each muscle between the un instructed, chest-instructed and arm-instructed conditions among the groups.

**RESULTS:** The 1-RM of the trained participants was 126.2±30.6 kg, which was significantly greater than the 1-RM of the untrained participants (61.6±14.8 kg) (p<0.05). There were no differences in EMG among the two groups. Both groups had 5.6% significantly higher ST activity during the arm-instructed set than the chest instructed set (p<0.012).

**CONCLUSION:** Verbal instructions are effective for increasing activity in the triceps brachii but not the pectoralis major during the bench press. Future studies should investigate whether or not these effects are able to be increased through training with instruction.

Supported by: Summer Undergraduate Research Fellowship University of New Hampshire

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**膊板 #346:**

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

**Effects of Barbell Bouncing on Joint Kinematics in Deadlifts**

Kellen Krajewski, Robert G. LeFavi, Bryan L. Riemann. *Armstrong State University, Savannah, GA.*

Email: jrh@armstrong.edu

(No relationships reported)

Different lifting strategies are utilized to complete higher repetition sets of deadlift. Some coaches emphasize pausing on the floor between repetitions while others allow the athlete to bounce the bar off the floor. To date, little is known about biomechanical differences between barbell bouncing. The purpose of this study was to determine if trained and untrained males were capable of selectively activating the arm and chest muscles during the deadlift.

**PURPOSE:** To determine if trained and untrained males were capable of selectively activating the pectoralis major or triceps brachi muscles according to instructions provided during the bench press exercise.

**METHODS:** Healthy, physically active men (n=11) aged 18-30 yrs with a minimum of one-year deadlifting experience completed two sessions. During the first session, participant’s one repetition maximum (1RM) for the conventional deadlift were determined. The second session consisted of 4 sets of 5 repetitions 75% of their 1RM for each technique (bounce and pause) performed in a randomized order. Ground reaction force and kinematic data of the feet, shanks, thighs, pelvis and trunk were collected. Additionally, marker sets placed on the bar determined bounce height and bar height when positive acceleration was restored (PAR) following the bounce. Center of Pressure (CP) to ankle joint distance and angle, knee, hip and trunk angular positions were determined at PAR. The bar reached an average bounce height of 0.57m and was not significantly related to barbell load (r= .356, P=.27). The CP was significantly anterior during the bounce condition compared to pause condition (P=.031, 95% CI: .002 to .037m). A technique by joint analysis of variance failed to reveal significant differences in joint angles between the techniques (P=.19). CONCLUSION: Although joint angles did not differ between techniques, significant change in CP location indicates a more anterior body position. Cumulative effects may result in participants using the musculature in the lower back instead of the musculature in the pelvis. The authors recommend that future research be conducted to test this hypothesis by considering joint kinetics and heavier load intensities.

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**Abstracts were prepared by the authors and printed as submitted.**
Unstable resistance exercises are performed to increase activity of stabilizing muscles. The premise is that this increase in activity will yield greater strength gains than traditional resistance exercises. PURPOSE: To determine if an unstable load increases muscle activity of stabilizing muscles during a bench press as compared to a standard bench press with a typical load. METHODS: Fourteen resistance-trained males (age 24.2 ± 2.7 yr, mass 84.8 ± 12.0 kg, height 1.77 ± 0.05 m, weight lifting experience 9.9 ± 3.4 yr, and bench press one repetition maximum (1-RM) 107.5 ± 25.9 kg) volunteered for this study. Subjects pressed two sets of 5 repetitions in both stable (75% 1-RM) and unstable (60% 1-RM) conditions using a standard barbell and a flexible Earthquake bar™, respectively. Due the increase in difficulty when using the Earthquake bar™, 1-RM percentages were standardized. The 75% load was used with the standard barbell as this is a typical load used for 5 repetitions. Surface electromyography was used to detect muscle activity of primary movers (pectoralis major, anterior deltoid, triceps) and stabilizing musculature (latisimus dorsi, middle and posterior deltoid, biceps brachii, and upper trapezius). RESULTS: Muscle activity was compared using a multivariate analysis of variance to determine significant (p ≤ .05) condition differences (Table 1). The right and left biceps and the left middle deltoid were significantly more active in the unstable condition.

CONCLUSIONS: Only some of the stabilizing muscles were significantly more active in the unstable condition. Therefore, it is unclear whether unstable load training is more beneficial than training with a standard barbell and typical load.

Table 1. Muscle activity (µV), Mean ± SD, N =14

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<tr>
<td>Left Bicep</td>
<td>139 ± 119</td>
<td>65 ± 59</td>
<td>138 ± 108</td>
<td>105 ± 54</td>
<td>96 ± 36</td>
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<tr>
<td>Right Bicep</td>
<td>169 ± 121*</td>
<td>136 ± 101*</td>
<td>188 ± 137*</td>
<td>137 ± 54*</td>
<td>132 ± 58*</td>
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<tr>
<td>Left Middle Deltoid</td>
<td>116 ± 46*</td>
<td>58*</td>
<td>119 ± 58</td>
<td>65 ± 59</td>
<td>96 ± 36</td>
<td></td>
</tr>
</tbody>
</table>

*Unstable significantly greater than stable (p < 0.05)

Research on kettlebell (KB) and indian club (IC) training is limited, particularly related to its transferability to power development. Initial research suggests KB training may be as effective for the development of vertical jump performance as more traditional strength training. However, to date there are no studies examining the relationship between KB or IC swing performance and vertical jump performance. PURPOSE: To determine how different styles of KB and IC swings predict vertical and broad jump flight time. METHODS: Fifteen active and healthy adults with KB swing experience participated in a 3D biomechanical evaluation of their overhead KB swing (OKS), shoulder height KB swing (SKS), indian club swings (IC), vertical jumps (VJ) and broad jumps (BJ). Kinematic and kinetic data were collected during three consecutive 10 repetition trials of each of the swing movements. Peak sagittal plane joint angles and joint moments as well as vertical and anterior-posterior ground reaction forces were extracted for the down and up portions of the swing movement. Extracted variables for the right side were entered into a stepwise regression to identify which variables predicted vertical jump flight time and broad jump flight time. Variables were retained if the model was statistically significant at p<.05, and each variable was extracted if the variable caused the model to exceed p=.10.

RESULTS: Biomechanical variables extracted from the OKS significantly explained VJ flight time (r-squared = .36+/- .06) and BJ flight time (r-squared = .30+/-.05). Similarly, kinematic and kinetic variables during the SKS significantly explained the VJ flight time (r-squared = .93+/-.02) and BJ flight time (r-squared = .57+/-.04). Finally, biomechanical variables during the IC performance significantly explained the VJ flight time (r-squared = .72+/-.04) and the BJ flight time (r-squared = .34+/-.05).

CONCLUSIONS: The results of this study demonstrate that biomechanics during kettlebell and indian club swings explain a large percentage of vertical and broad jump performance. Surprisingly, the greatest amount of variability in jumping performance was explained by variables present in the IC pattern. Therefore, power development from the indian club swing pattern may have the greatest potential to transfer into jumping performance.
Methods: Ten male baseball pitchers (14.9±1.1 years; 175.7±6.7 cm; 80.5±17.9 kg) threw three fastball windup pitches while three-dimensional motion data were recorded using a 10-camera digital motion analysis system (480 Hz). A total of 24 kinematic variables were analyzed at three temporal events occurring during the pitching motion: 1) Lead footstrike (FS), 2) Peak glenohumeral external rotation (GHER), and 3) Ball release (BR). Elbow varus joint moments were normalized to body weight and height. A multiple linear regression (MLR) using the stepwise procedure was employed to identify a predictive model for peak elbow varus moments.

Results: The MLR model identified five significant kinematic variables predictive of peak elbow varus moments (adj. R²=0.90, p<0.001). The model revealed that significant predictors of peak elbow varus moments included contralateral trunk lean (CTRL) at FS (β=-0.007, p<0.001), sagittal lead knee angle (LKA) at FS (β=-0.030, p<0.001), trunk rotation (TR) at FS (β=-0.011, p<0.001), longitudinal glove distance (LGD) at GHER (β=-0.002, p=0.001) and release point distance (RPD) (β=-0.011, p=0.04). Standardized β values revealed CTRL at FS (β=-0.699) as the strongest predictor of peak elbow varus moments, followed by LKA (β=-0.289), TR (β=-0.271), LGD (β=-0.232) and RPD (β=-0.139).

Conclusions: Greater CTL, less flexed LKA and counter-clockwise TR at FS, greater LGD at GHER and greater RPD at BR are tendencies associated with greater elbow varus moments in adolescent male baseball pitchers. Modifying pitching mechanics may reduce excessive elbow varus moments and decrease risk of elbow injury in adolescent pitchers.

While studies on the biomechanics of the throwing shoulder in youth and the professional baseball pitcher are abundant, few studies have evaluated changes in the pitching motion and pitch velocity during a game in high school baseball pitchers.

Purpose: To describe changes in pitching mechanics including angle measurements and pitch velocity in high school pitchers during a seven-inning simulated game. METHODS: Five high school baseball pitchers (16.20±1.31 yrs) pitched a seven-inning simulated baseball game consisting of 12 fastballs per inning (84 pitches) from an indoor pitching mound. During the seven 12-pitch innings, two video cameras recorded each subject’s 12 pitch motion analysis. Reflective markers were placed on 8 bony landmarks of the upper and lower extremity. The 1st, 7th, and 12th pitch of each inning was evaluated for angle measurements (abduction, internal rotation, external rotation, elbow flexion, trunk tilt). Pitch velocity was recorded using a radar gun for every 84 pitches. A pitching evaluation checklist was also used to identify normal and/or abnormal pitching mechanics.

Results: A significance within subjects (p=0.036) was found for shoulder abduction at the 4th inning between pitches #1 (103.92±5.28°) and #7 (106.08±3.98°) with ranges from 99.82±5.43° to 106.08±3.98°. Results were not significant with shoulder internal rotation (21.78°±2.95° to 26.16°±3.77°), external rotation (124.88°±2.77° to 135.22°±6.06°), elbow flexion (74.20°±7.91° to 83.26°±6.24°), or trunk flexion (46.88°±6.16° to 50.04°±10.29°) for any of the 7 innings for pitches #1, #7, or #12. Pitch velocity was not significant at pitch #1, #7, or #12 for any inning. Pitch velocity peaked in the second inning (68.0±1.42 mph) and showed a steady decrease between the 2nd and 5th innings (66.0±2.12 mph to 64.2±0.17 mph) with small increases in the last two innings (66.80±2.95 mph). Using the Biomechanical Evaluation Checklist, consistent anomalies were seen with the arm cocking phase at step 6, arm deceleration phase step 6, and follow-through phase 3.

Conclusions: Changes in biomechanics, joint angle measurements and pitch velocity were evident as pitch count increased throughout the course of a game. Future studies should be conducted to examine whether this is a consistent pattern in high school baseball pitchers.
produced between the arms and; (3) the angle which was produced more strength on both sides. After confirming the non-normality of the data, it was opted for the Wilcoxon test, the comparison between the average of peak torque and angle of the peak torque between the arms to the different accelerations. To the analysis of the moments of acceleration for both arms, it was opted for the Anova test to repeated measures. RESULTS: In the variable 1, differences were detected in the average peak of strength, measured in Newton Meter (Nm), being 53.1 ± 18.3 Nm (L) and 53.8 ± 16.9 Nm (R) at the angle of 60°; 41.1 ± 15.85 Nm (L) and 43.2 ± 14.9 Nm (R) at the angle of 180° and; 34.7 ± 12.7 Nm (L) and 37.4 ± 13.5 Nm (R) at the angle of 300°. In the second variable, no differences were found over the produced strength deficit, being 10.6 ± 10.2 Nm to 60°; 11.6 ± 12.1 Nm to 180° and; 14.9 ± 16.8 Nm to 300°. To the variable 3, differences were detected in the moments of acceleration at angles of 60° and 300°, it also may be observed that the angle of the peak torque was on 60°, being the produced force of 48.9 ± 7.3 the right side. CONCLUSION: Despite being detected differences in the average peak strength produced in the three types of acceleration forces (60°, 180° and 300°), no differences were detected for any of the variables when comparing the right arm with his left arm.

Table 01. Magnitude of strength produced by the open water swimmers for the average peak torque in Newton Meter on both sides of the body in the elbows extension action at three different accelerations.

<table>
<thead>
<tr>
<th>Angle</th>
<th>60° Left</th>
<th>60° Right</th>
<th>180° Left</th>
<th>180° Right</th>
<th>300° Left</th>
<th>300° Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVERAGE (SD)</td>
<td>53.1 (18.3)</td>
<td>53.8 (16.9)</td>
<td>41.1 (15.8)</td>
<td>43.2 (14.9)</td>
<td>34.7 (12.7)</td>
<td>37.4 (13.5)</td>
</tr>
</tbody>
</table>

*Indicates statistical difference between the arms. **Indicates difference between the moments of acceleration. The data are in the form of average and standard deviation (I).

Despite a widely used tool, there is still little evidence to support the use of kinesio tape. It was postulated that depending on the direction of the application, the effect on muscle function is different; the application from insertion to origin inhibits muscle function whereas from origin to insertion facilitates muscle function. The claim clearly ascertained.

CONCLUSIONS

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MEASUREMENTS: Fourteen subjects were tested, using a dynamometer, for maximum voluntary contraction (MVC) of the elbow flexors. Each subject was strapped into a chair for four different elbow positions for two different shoulder positions, a total of eight test positions. The dynamometer was stabilized by a custom built apparatus. Each subject performed 3 trials per position with least 1 minute rest intervals between each trial. The average force exerted for each position was calculated. The data collected was used to generate internal torque curves, which were compared to the external torque curves of the two different shoulder positions. Calculations determined if modifying each exercise with cables would better match the external torque curve than the original exercises against gravity.

RESULTS: The percentage of the maximum elbow flexion torque for the shoulder at 0 degrees was 60.8% for the elbow at 0 degrees, 80.9% for the elbow at 35 degrees, 97.4% for the elbow at 90 degrees, and 83% for the elbow at 125 degrees. The percentage of the maximum elbow flexion torque for the shoulder at 90 degrees was 50.0% for the elbow at 0 degrees, 65.7% for the elbow at 35 degrees, 98.1% for the elbow at 80 degrees, and 81.9% for the elbow at 125 degrees. When comparing the original exercise and the cable modified exercise at shoulder 0 degrees, the difference in errors between methods is about 0 (p=0.01). When comparing the original exercise and the cable modified exercise at shoulder 90 degrees, the difference in errors between methods is about 3.8 and this difference is not statistically different from 0 (p=0.01). When comparing the two original exercises, the exercise at shoulder 0 degrees resembles the internal torque curve more than the exercise at shoulder 90 degrees and its respective internal torque curve. CONCLUSIONS: The closer resemblance of the internal and external torque curves at shoulder 0 degrees than shoulder 90 degrees should indicate a more efficient strengthening exercise. However, modification of both exercises resulted in no statistically significant differences.

2207 Board #359 June 2, 2:00 PM - 3:30 PM
"when Is It Safe For Me To Start My Exercises?"
Alfred B. Gurney. University of New Mexico, Albuquerque, NM.
Email: bgurney@salud.unm.edu

PURPOSE: To measure indwelling electromyography activity (iEMG) of the rotator cuff muscles and surface EMG (sEMG) activity of other shoulder muscles during normal ambulation, shirt and sling donning and doffing, and rehabilitation tasks commonly performed after rotator cuff surgery.

BACKGROUND: The activity of the rotator cuff muscles has not previously been measured with iEMG comparing ambulation and other movements. Knowledge of the relative contribution of these muscles during various tasks will help guide rehabilitation progression.

METHODS: In 28 volunteers (15 men, 13 women; mean age, 32.2 years), iEMG activity was measured in the supraspinatus, infraspinatus, teres minor, and subscapularis muscles during various tasks; sEMG activity was measured in the middle deltoid, biceps, and upper trapezius muscles.

RESULTS: Using median EMG activity, in general, donning and doffing a shirt or sling recruited the rotator cuff muscles more than the other 7 tasks tested. Self-ranging motion using pulleys, especially in the scapular plane, was also consistently associated with greater recruitment of the shoulder muscles. Pendulum exercises, passive range of motion (PROM) by a physical therapist (PT), and self-ranging motion with a dowel recruited the shoulder muscles to a lesser extent.

CONCLUSIONS: Our results suggest that rehabilitation tasks early after rotator cuff repair should include pendulum exercises, PROM by a PT, and self-ranging motion with a dowel. Pulleys should be used later, with movement in the sagittal plane done before that in the scapular plane. Ambulation without a sling and donning and doffing a sling and a shirt should be performed with caution early after surgery.

D-61 Thematic Poster - Concussion Research and Policy

THURSDAY, JUNE 2, 2016

2260 Chair: Kevin Guskiewicz, FACSM, University of North Carolina, Chapel Hill, NC.

Reliability of the King-Devick Test in Baseline Concussion Evaluations of High School Athletes

James Patrick MacDonald, FACSM1, Iris Petersen2, Douglas Kyrouac3.

1University of North Carolina at Chapel Hill, Chapel Hill, NC; 2University of Minnesota, Minneapolis, MN; 3University of New Mexico, Albuquerque, NM.

Email: james.macdonald@nationwidechildrens.org

PURPOSE: The King-Devick (KD) test is a rapid, sideline screening assessment tool for concussion diagnosis and management. It is a timed test measuring visual impairment associated with concussions. There is increasing evidence for its use in younger athletes. The medical literature for the KD test suggests that i) athletes be baseline tested prior to every season and ii) any slowing of the KD in the setting of a head injury is suspicious for concussion.

METHODS: Design: Repeated measures design.Setting: Three Central Ohio high schools.Participants: High school athletes (N ~ 46) participating in American football or soccer during the 2014 and 2015 academic years with valid baseline KD tests both years were recruited. Interventions: Two baseline KD tests taken one year apart.Main Outcome Measures: Numbers of individuals who sustained a concussion between 2014/2015 KD tests were tallied. Independent samples t tests compared mean KD2014 between ‘concussed’ and ‘non-concussed’ individuals. Test-Relist reliability was assessed by measuring the intraclass correlation coefficient (ICC) between the repeated measures of the KD for 2014 and 2015. Spearman’s correlation coefficient (r) was calculated as a secondary outcome measure of reliability.

Abstracts were prepared by the authors and printed as submitted.
RESULTS: 46 individuals met inclusion criteria. Those sustaining a concussion between 2014 and 2015 (N = 7) were all symptom free by 2015 test date. Mean KD (a) for those with and without interval concussion (N = 39) were 40.2±24.57, 45.0±32.46, respectively (P = 0.238). For the cohort of individuals without interval concussion, 10 (25.60%) had slowing of baseline KD tests. For the entire cohort, ICC = 0.879 and r = 0.875 (P < 0.01, respectively).

CONCLUSIONS: Our results reveal a mixed picture for the use of KD as a baseline assessment tool. It has good test-retest reliability over the course of a year. We would argue that annual baseline testing may be sufficient for the KD. However, even in those with no interval concussion, a substantial percentage had slowing of their KD test speed, which we would suggest may confound sideline assessments in the setting of head injury. Further work needs to be done in this population prior to KD becoming routine standard of concussion care.

2262  Board #2  June 2, 3:15 PM - 5:15 PM  Diffusion of Innovations and Sports Concussions: A Mixed Methods Investigation of Policy Decision-Makers Cole Youngner, Nancy Thompson, Kirk Elifson. Emory University Rollins School of Public Health, Atlanta, GA.

Email: cyoungner1a2n@gmail.com

(NO relationships reported)

OBJECTIVE: Identify and assess key decision-makers for high school sports concussion policies, their perceptions of evidence based concussion guidelines, and implementation of these guidelines and policies using a novel application of Diffusion of Innovations and mixed qualitative and quantitative methods

BACKGROUND: Over 3 million concussions occur in the US annually. High-school athletes are susceptible since over 7 million play high-school sports, and they often hide concussions and return to play (RTP) too soon. Sports concussion research rarely incorporates socio-behavioral theory and qualitative methods. Diffusion of innovations (DOI) theory has examined social systems and preventive health intervention adoption. DOI incorporates communication and decision-making between key influencers for adopting innovations. Thus, DOI theory will elucidate sports concussion RTP decision-making processes. Finally, Georgia policy has vague RTP standards, meaning schools may have varying policies.

DESIGN: In-depth-interviews and surveys assessed key professionals’ involvement in RTP policy decision-making. Participants included school administrators, athletic trainers, concussion researchers, parent advocates, and physicians in Georgia. Study instrument topics stemmed from DOI theory: knowledge; innovation characteristics; characteristics of decision-makers: socioeconomic, personality, and communication behavior. Analyses involved codebook development for thematic analysis of key themes from 20 interviews and surveys.

RESULTS: Results yielded 13 major themes with several notable findings: school administrators have varying approaches to RTP policy. Participating decision-makers believe evidence based guidelines are necessary. From most to least important: evidence based guidelines, protocols, and communication. Policy makers are some of the impediments to implementation. Georgia has many gaps in its RTP policy.

CONCLUSIONS: Understanding decision-making for protecting athletes is critical. Qualitative applications of DOI allow individuals to describe theirs and others’ roles in decision-making processes and inform concussion prevention. Results provide suggestions for best practices and improvements of concussion policies and protocols.

2263  Board #3  June 2, 3:15 PM - 5:15 PM  A Promising New Protection Against Brain Injury During Collision Sport: A Randomized Clinical Trial Gregory D. Myer, FACSM. Cincinnati Children's Hospital Medical Center; Cincinnati, OH.

Email: greg.myer@cchmc.org

Reported Relationships: G. D. Myer: Contracted Research - Including Principle Investigator; Q30 Sports Sciences, LLC.

Sports-related mild traumatic brain injury (mTBI) is limited in available preventative strategies. Protection of the brain from outside the skull (helmet) has failed to significantly reduce mTBI incidence or degree, and equipment modification does not address acceleration or deceleration of the brain inside the cranium during impacts. PURPOSE: We utilized a jugular compression collar to minimally restrict venous outflow and promote cerebral venous sinus engorgement to promote less motion of the brain within the cranium. It is hypothesized this will reduce biomarkers of mTBI during sport. METHODS: A prospective, randomized, controlled trial design was used to evaluate effects of mild jugular vein compression among high school hockey players (mean age 16.3±1.2 years). Outcome measures included diffusion tensor imaging (DTI) and electroencephalography derived Brain Network Activation (BNA). Helmet sensors were used to collect impact data. RESULTS: In the non-collar group (n=7), DTI measures were associated with disruption of white matter microstructure - mean diffusivity (MD) and radial diffusivity (RD). This disruption increased significantly from pre- to mid-season (voxel based analysis, paired t-test, p<.05, corrected for multiple comparison) in extensive white matter regions; primarily the corpus callosum, corona radiata, and internal/external capsule. DTI changes were not observed for the collar group (n=7) despite similar accumulated linear accelerations from head impacts. BNA analysis showed concomitant changes in network dynamics in the non-collar group compared to the collar group (221 vs. 4.1; p<.05). The collar effect, derived from the group difference of longitudinal change in DTI measures was found to correlate significantly with altered network dynamics (Pearson correlation, r=.77; p<.05). CONCLUSION: Participation in hockey resulted in white matter microstructure disruption concomitant with altered network dynamics in only the non-collar group. Correlations between neuroanatomical and electrophysiological measures in the non-collar group provided initial evidence that mild jugular vein compression may be protective for sport-related mTBI. Our findings could lead to novel and effective methods for protecting the brain from sport-related head impacts.

2264  Board #4  June 2, 3:15 PM - 5:15 PM  Neurocognitive Performance and Increased Risk of Lower Extremity Injury after Concussion Kevin Hanneken1, Jennifer L. Sanfilippo2, Scott Hetzel1, Alison Brooks3, 1University of Wisconsin School of Medicine and Public Health, Madison, WI, 2Badger Athletic Performance, Madison, WI, 3University of Wisconsin - Madison, Madison, WI.

Email: khanneken@wisc.edu

(NO relationships reported)

BACKGROUND: Recent studies have shown increased risk of musculoskeletal injury for athletes returning to play from concussion. It is possible that subtle deficits in neurocognition and neuromuscular control, such as inhibited concentration, balance, or prolonged reaction times could increase risk of subsequent injury. However, there is little understanding of the variables that may help characterize risk during this time of vulnerability.

PURPOSE: To determine if concussed collegiate athletes with worse neurocognitive or balance performance are at increased risk of acute lower extremity musculoskeletal injury (LEI) following return to play (RTP) from concussion.

METHODS: This retrospective cohort study examined male (n=70) and female (n=14) athletes participating in NCAA Division I football, hockey, soccer, wrestling, and basketball, who sustained a concussion between June 2011- May 2015. Athletes completed symptom score, computerized neurocognitive (ImpACT - Immediate Post-concussion Assessment and Cognitive Testing) and balance (BESS - Balance Error Scoring System) testing at baseline and post-injury time points (0-4, 5-11, 12-18, >30 days). The remaining academic school year following RTP from concussion was reviewed for acute, non-contact LEI, and athletes were divided into two groups (LEI, No LEI). Differences in total symptom, ImpACT composite, and BESS scores were compared using repeated measures ANOVA.

RESULTS: 152 cases of concussion were identified. Following strict exclusion criteria, 104 cases in 84 athletes were used for analysis. 31 athletes sustained 32 LEI between 0-4 days (0-4 days, 5-11 days, 12-18 days, >30 days). The remaining academic school year following RTP from concussion was reviewed for acute, non-contact LEI, and athletes were divided into two groups (LEI, No LEI). Differences in total symptom, ImpACT composite, and BESS scores were compared using repeated measures ANOVA.

CONCLUSIONS: There was no significant difference in neurocognitive or balance performance in concussed athletes who sustained LEI after RTP compared to athletes who did not sustain LEI. ImpACT and BESS testing may not be sensitive enough to detect athletes with subtle impairments who may be at increased risk of LEI following concussion. Future studies may utilize different methods, such as the Sensory Organization Test or vestibular-oculomotor deficit testing.

2265  Board #5  June 2, 3:15 PM - 5:15 PM  Risk for Lower Extremity Injury Following Concussion: a Retrospective Cohort Study in Soldiers Joseph R. Kardouni, Tracie L. Shing, Craig J. McKinnon, Dennis E. Scalford, Susan P. Proctor. U.S. Army Research Institute of Environmental Medicine, Natick, MA. (Sponsor: Dr. Stephen R. Muza, FACSM)

(NO relationships reported)

Concussions may increase the risk for subsequent lower extremity injuries in physically active people. PURPOSE: Examine concussion as a risk factor for lower extremity (LE) injury in soldiers with no history of LE injury.

METHODS: Medical encounter data for all active duty US Army soldiers from 2005-2009 were used to identify soldiers who sustained a concussion by way of International Classification of Diseases, Ninth Revision (ICD-9) codes. Soldiers with a history of a LE injury were excluded from the study. LE injuries were defined according to...
Concussions affect an estimated 1.6 to 3.8 million people in the United States annually. Dizziness, which may manifest as a result of vestibular or oculomotor impairments, is a common symptom (>50%) following concussion and is associated with increased risk for protracted recovery.

**PURPOSE:** To evaluate a novel measure of vestibular and oculomotor function after sub-acute concussion in an immersive testing environment.

**METHODS:** 26 participants (age: 17.6 ± 4.8 years) presenting with dizziness or imbalance after concussion (32.9 ± 37.2 days post injury, range: 1-156 days) and 100 controls (age: 17.03 ± 3.8 years) were tested in this study. Participants visually tracked a target moving on a 180° arc trajectory toward an optical goal in an immersive visual environment. 10 trials of four conditions were performed including combinations of target speed and visibility (slow-visible, fast-visible, slow-invisible, fast-invisible). During the invisible condition the target disappeared after 60° of arc and the participant was asked whether the target would arrive at the optical goal. The angle difference, or error, between the stopped target and the goal was recorded for each trial. A one-way ANOVA was performed for each condition to compare the concussed and control groups.

**RESULTS:** Concussed participants demonstrated increased mean error during the visible-fast (concussed: 5.9 ± 3.9, controls: 4.5 ± 3.7; p < 0.01) and invisible-fast (concussed: 16.6 ± 9.8, controls: 14.3 ± 10.3; p < 0.05) conditions compared to controls. There were no detectable performance differences tracking slow targets.

**CONCLUSION:** The combination of fast visual target tracking and time estimation may be a suitable measure to assess vestibular and oculomotor dysfunction following concussion. The current findings support the inclusion of vestibular and oculomotor testing presented in a virtual reality or immersive technology format in the assessment of concussion. This project was supported by the Head Health Challenge II (sponsored by Under Armour, Inc, the National Football League, and General Electric Institution) and the US Army Medical Research Acquisition Activity #W81XWH-12-C-0203.
CARDIOVASCULAR IMPAIRMENT AMONG FIREFIGHTERS

PURPOSE: To estimate CAI prevalence among firefighters and its association with physical fitness and heart rate (HR) profile using exercise testing. METHODS: We performed a cross-sectional study within a large fire department, applying a weighted sampling strategy, selecting randomly 100 participants from the eligible population: 75 at low cardiovascular risk and 225 at high risk. Inclusion criteria were: male with a recorded submaximal Bruce-treadmill test and no restrictions on duty. CAI was defined as at least one of the following: failure to achieve 75% of age-predicted maximum HR; HR recovery (HRR) <18bpm at the 1st or <42bpm at the 2nd min of the recovery period; autonomic index (resting HR/HRR) ≥3× tertile value at 1st and 2nd min of recovery and max blood pressure ≥220/90 mmHg. 30 participants were excluded due to incomplete data. Crude associations were estimated by the odds ratio (OR-95%CI) and the multivariate analysis was assessed by logistic regression. Mann-Whitney test was used when applicable, at the 5% level of significance. Results: FF were 46.5±8.3 yrs and BMI=31.1±4.7 kg/m2. Prevalence estimates were 50.7% for CAI and 55.4% for obesity. Analyses are shown on Table 1.

Table 1: Cardiac autonomic function (CAF) analyses (n=370)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Impaired CAF n (%)</th>
<th>Normal CAF n (%)</th>
<th>Crude-OR (CI 95%)</th>
<th>Adjusted-OR (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (&gt;30.0 kg/m2)</td>
<td>122 (65.6)</td>
<td>80 (44.2)</td>
<td>2.47 (1.58-3.67)</td>
<td>1.64 (1.00-2.69)</td>
</tr>
<tr>
<td>Obese</td>
<td>32 (17.2)</td>
<td>51 (28.2)</td>
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</tr>
<tr>
<td>Non-obese</td>
<td>76 (40.9)</td>
<td>119 (65.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>≥ 40</td>
<td>154 (82.8)</td>
<td>130 (71.8)</td>
<td>1.89 (1.15 - 3.11)</td>
<td>1.06 (0.57 - 1.98)</td>
</tr>
<tr>
<td>&lt; 40</td>
<td>20 (12 - 28)</td>
<td>25 (17 - 31)</td>
<td>0.001</td>
<td>0.98 (0.95 - 1.00)</td>
</tr>
<tr>
<td>CRF</td>
<td>110 (59.1)</td>
<td>62 (34.3)</td>
<td>2.78 (1.82 - 4.25)</td>
<td>2.18 (1.30 - 3.65)</td>
</tr>
<tr>
<td>Low</td>
<td>76 (40.9)</td>
<td>119 (65.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>32 (17.2)</td>
<td>51 (28.2)</td>
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</tr>
</tbody>
</table>

CRF: cardiorespiratory fitness; Max_HR: max HR at exercise testing; #: Mann-Whitney test

CONCLUSION: The odds of having CAI were higher in obese FF and among those with lower CRF and weaker upper-limb strength. Lower CRF was the strongest predictor of CAI. Our data support the need for better physical fitness among firefighters.

CARDIOVASCULAR IMPAIRMENT AMONG FIREFIGHTERS

PURPOSE: Fire suppression is physically demanding and often results in significant stress and hypohydration. Guidelines for the number of work intervals allowed before a structured recovery were consensus derived and have not been tested. METHODS: Firefighters were randomly assigned to complete either two or three intervals of live fire training separated by short rest breaks before entering a 20 minute structured recovery period. Immediately following recovery, the firefighters were timed on a short, high intensity circuit of firefighting skills. The shorter work duration (SWD) group completed two work intervals: one period of firefighting and one period of recovery and the longer duration group (LWD) completed three work intervals: two periods of firefighting followed by one period of recovery. RESULTS: 42 firefighters completed the study. Total work was longer in the LWD group compared to the SWD group (27.2 ± 1.0 vs. 20.1 ± 0.4 min, p < 0.001). During the roof chopping station, the LWD group reached fatigue and exited that bout before the SWD group (8.3 ± 1.1 vs. 11.5 ± 1.0 min, p=0.04). Time to complete the skills test after recovery was longer in the LWD group. Heart rate was near maximal immediately after fire suppression. There was a strong effect of time on heart rate (p<0.001) but the heart rate responses did not differ by group. Core temperature increased during the work periods and peaked when subjects entered the recovery phase (p<0.001). Core temperature was higher in LWD at the beginning of the recovery phase. Blood pressure and rate pressure product all changed over time (p<0.001) but did not differ by group. There was a modest decrease in systolic blood pressure and a marked decrease in
diastolic blood pressure in the recovery phase. Sweating sensation, thermal comfort, and thermal sensation were 75-80% of maximum when entering the recovery period in both groups.

**CONCLUSIONS:** Increasing the number of work intervals from two to three, before structured recovery, increases core body temperature and reduces subsequent performance but does not alter heart rate and blood pressure responses. Additional studies are required to determine the interaction of firefighter fitness and work to rest ratios and on the long-term recovery following fire suppression.

Heat shock proteins (HSP) are a group of proteins that serves to protect cellular integrity during exposure to heat stress. **PURPOSE:** To assess extracellular HSP (eHSP) responses following 5- and 10-days of heat acclimation to compare the degree of adaptation at cellular level. **METHODS:** Thirty fire-fighting trainees were randomly divided into two evenly match groups to undergo 10-days of low-intensity heat acclimation (HA) or 5-days of moderate-intensity accelerated HA (AHA). Both HA and AHA sessions were conducted outdoor in a warm and humid climate (dry bulb temperature: 27.9±1.1°C, relative humidity: 73±6%, WBGT: 27.2±1.3°C). Heat Stress Tests (HSTs) were done before and after the HA/AHA programmes, which comprised of a 9 min treadmill walk followed by a time trial inside an enclosed heated maze. Blood samples were taken at baseline and end of each HST to analyse for serum eHSP27 and eHSP72 concentrations. **RESULTS:** Participants showed 23±11% (p<0.001) and 26±9% (p<0.001) improvement in time trial performance following the HA and HA programmes respectively. No differences in baseline body core temperature, heart rate and Core scale were observed following both programmes (p>0.05 for all). Nonetheless, sweat rates during HST were increased following the HA (Pre-HA: 1.88±0.57 L/h; Post-HA: 2.11±0.59 L/h; p=0.01) and HA (Pre-HA: 1.41±0.52 L/h; Post-HA: 1.63±0.61 L/h; p=0.01) programmes. Baseline eHSP 27 was reduced by 7±0.2 fold (p<0.001) following AHA but was similar after HA (p=0.30). Baseline eHSP 27 remained unchanged following the HA and HA programmes (p>0.05 for both). Both eHSP 27 and eHSP 72 increased in response to HSTs before (eHSP27: 1.3±0.4 fold; eHSP72: 1.4±0.4 fold) and after (eHSP27: 1.7±0.7 fold; eHSP72: 1.4±0.4 fold) the AHA programme (p<0.05 for all). In contrast, only eHSP 72 increased in response to HSTs before (1.3±0.4 fold; p=0.02) and after (1.2±0.3 fold; p=0.01) the HA programme. **CONCLUSION:** An HA programme induces similar physiological and cellular heat adaptations as compared to a HA programme, which validated the effectiveness of an accelerated HA programme for fire-fighters. In addition, changes in baseline eHSP 27 concentration showed potential as an indicator for improved cellular heat adaptation.

**CONCLUSIONS:** An usual 12-hour work period was physically active for most of the firefighters but associated with a significant reduction in the parasympathetic response at active standing, which might represent an increased cardiovascular risk. Supported by CNPq grant Universal 480092/2013.

**D-63 Thematic Poster - Hormone Responses and Physical Activity**

**THURSDAY, JUNE 2, 2016**

**Board #1 June 2, 3:15 PM - 5:15 PM**

**Microdialysis-Assessed Exercised Muscle Reveals Localized And Differential IGFBP Responses To Unilateral Stretch Shortening Exercise Until Exhaustion**

Bradley C. Nindl, FACSM¹, Juha Ahtianen², Sheila S. Gagnon³, Ritva S. Taipale⁴, Joseph R. Pierce⁵, Maarit Lehti⁶, Keijo Hakkinen⁷, Heikki Kyrolainen, FACSM⁸, ¹University of Pittsburgh, Pittsburgh, PA. ²University of Jyväskyla, Jyväskyla, Finland. ³University of Jyväskyla, Jyväskyla, Finland. ⁴US Army Research Institute of Environmental Medicine, Natick, MA. Email: bnnindl@pitt.edu

**No relationships reported**

**Abstracts were prepared by the authors and printed as submitted.**
and control legs through 2 h into recovery (Rec vs. Pre, p>0.01). Dialysate BP-3 also demonstrated an elevation over Pre SSC concentrations, but in the exercise leg only (Ex and Rec vs. Pre, p>0.04). Dialysate BP-5 decreases in the exercise leg only (Ex and Rec vs. Pre, p>0.03). There were no changes relative to Pre SSC in dialysate BP-2, -4, or -6. CONCLUSIONS: Unilateral exercise drives differential regulation of the IGF-I system at both local and systemic levels. Specifically, localized exercise increased IGFBP-3 and decreased IGFBP-5 in muscle. The views, opinions and/or findings contained herein are those of the authors and should not be construed as an official Department of the Army position, or policy.

Thurs., June 2, 3:15 PM–5:15 PM
Comparing Bioactive And Immunoassay-Based Measurements Of The Growth Hormone Response To Short-Term Resistance Training At Three Intensity Levels
Shawn D. Flanagan, Tunde K. Szivák, William H. DuPont, Lydia K. Caldwell, Emily C. Barnhart, Emily C. Borden, Catherine Saenz, Robert S. Staron, Wesley C. Hymer, Bradley C. Nindl, FACSM, William J. Kraemer, FACSM. 1The Ohio State University, Columbus, OH. 2Ohio University, Athens, OH. 3The Pennsylvania State University, University Park, PA. 4University of Pittsburgh, Pittsburgh, PA. (Sponsor: William J. Kraemer, FACSM)
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Growth hormone (GH) plays an important regulatory role in metabolic homeostasis. However, since GH represents a hormonal superfamily, numerous subtypes have been developed to target specific variants, aggregates, and complexes.

PURPOSE: To examine changes in the resistance exercise-induced growth hormone response as measured by immunoassay and bioassay after short-term resistance training using different intensity levels. METHODS: Thirty-two untrained men (22.5±5.5 yr: 178.3±7.2 cm height; 77.8±11.9 kg weight) were placed into one of four groups, including three eight-week progressive resistance-training interventions and a control condition. Subjects in the training groups performed three exercises (leg press, squat, and knee extension) two days per week for the first four weeks, and three days per week for the remaining four weeks. The programs varied in intensity and rest period length, but were equated in terms of volume and exercise order. Nine subjects performed heavy exercise (3-5 repetition maximum (RM)) for four sets with three min of rest between sets. Eleven subjects performed moderately heavy resistance exercise (9-11RM) for three sets with two min of rest between sets. Seven subjects performed light resistance exercise (20-28RM) for two sets with one min of rest between sets. At the first and last exercise session, blood samples were obtained at rest and immediately after exercise. Serum GH was measured using a Nichols monoclonal radioimmunoassay (RIA), and bioactive GH was measured using a rat lymphoma cell line Nb-2 bioassay. RESULTS: CONCLUSIONS: A short eight-week training program produced few adaptations in the pattern of GH responses at rest or immediately after a workout. Both methods detected a greater increase in GH after higher repetition training protocols, and the Nb-2 assay detected an order of magnitude more GH compared to the standard monoclonal RIA. Ostensibly, because hypertrophy was only associated with the use of

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BACKGROUND: Physical inactivity in combination with poor nutrition promotes obesity and is the second leading cause of death in the US. It is well known that physical activity (PA) mitigates the incidence of obesity related diseases. Yet, most individuals fail to meet daily recommended PA requirements. Available animal literature suggests that one primary factor that regulates PA is sex hormones.

PURPOSE: This study examined the effects of a high fat/high sugar (HF/HS) diet on Testosterone (T) and 17β-Estradiol (E2) concentrations in female mice with and without physical activity.

METHODS: All procedures were approved by TAMU IACUC. The offspring of SENCAR breeder pairs (Charles River) were weaned and co-caged at three weeks of age and randomly assigned to a HF/HS diet (45% fat/10% fructose drinking water) (n=6) or ad-lib (AL) control diet (10% fat) (n=4). At four weeks of age, mice were provided with running wheel access. Running speed, distance, and duration were recorded daily until termination at 26wks of age. Serum T and E2 concentrations were analyzed via ELISA. A 2-way ANOVA was used to assess significant differences.

RESULTS: E2 concentrations in the AL fed mice with- and without-PA (0.30±0.03; 0.26±0.03 ng/ml) and in the HF/HS fed mice with- and without-PA (0.28±0.04; 0.27±0.23 ng/ml) were not affected by diet type, but were significantly affected by PA (p=0.03). T concentrations in the AL fed mice with- and without-PA (0.33±0.01; 0.31±0.34 ng/ml) and in the HF/HS fed mice with- and without-PA (0.46±0.22; 0.21±0.14 ng/ml) demonstrated no significant effect of diet or PA.

CONCLUSION: In this study neither T nor E2 concentrations were altered by HF/HS diet. However, PA increased the serum concentrations of E2, but not T. Therefore, physical activity can affect estradiol levels independent of diet.

Effect of High Fat/High Sugar Diet & Physical Activity on Sex Hormone Concentrations
Jorge Z. Granados, 1Heather L. Vellers, 2Ayland C. Letzinger, 3Nick R. Walker, 4Madison E. Spier, 5Isabel Lambertz, 6Robin Fuchs-Young, 4J. Timothy Lightfoot, FACSM. 1Texas A&M University, College Station, TX. 2Texas A&M Health Science Center, College Station, TX. (Sponsor: Dr. J. Timothy Lightfoot, FACSM)
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ACSM May 31 – June 4, 2016
Boston, Massachusetts

MEDICINE & SCIENCE IN SPORTS & EXERCISE®
Prolonged Effects of Estrogen on Physical Activity Levels Following Orchidectomy

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Email: nstott@truet.edu

The prevalence of several chronic diseases is associated with habitually low physical activity. The biological mechanisms that regulate physical activity patterns appear to be linked to the sex steroids. Elucidation of these regulatory mechanisms may aid in developing therapeutic strategies to enhance individual physical activity patterns.

**PURPOSE:** The purpose of this study was to evaluate the prolonged effects of estrogen on physical activity in orchidectomized mice. **METHODS:** The physical activity patterns of C57BL/6j male mice (n=29) were observed beginning at nine weeks of age. Wheel running distance, duration, and speed were assessed under physiological conditions in all animals for seven days. Next, physical activity patterns were evaluated following bilateral orchidectomy (n=15) or sham orchidectomy (n=14) for an additional seven days. Lastly, bilateral orchidectomy treated mice were provided estrogen containing capsules for three weeks. Sham treated mice were provided an estrogen-free control capsule. Wheel running distance, duration, and speed were analyzed by two-way (treatment group x phase of study) analysis of variance. **RESULTS:** Wheel running speed was unaffected (p=0.684) by orchidectomy, but was significantly increased (p=0.0002) following estrogen treatment. The distance traveled by orchidectomy mice increased significantly and sustained in increase in daily distance (dry=0.0117 km). Duration exhibited a similar trend throughout the study (baseline: 251±58 min; post-orchidectomy: 102±53 min; prolonged exposure: 170±63 min). **CONCLUSION:** Wheel running behavior was reduced significantly following orchidectomy and slowly recovered over a prolonged period of time following the reintroduction of estrogen. The estrogenic mechanisms that regulate wheel running behaviors in mice appear to be dependent upon extensive and slow acting or delayed modifications to genes or cellular biomolecules in order to elicit the hormone’s effects.

Progressive Resistance Exercise Elicits Significant Brain-Derived Neurotrophic Factor Expression

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Exercise-mediated neuroplasticity occurs via upregulation of neurotrophins. Specifically, the neurophin brain-derived neurotrophic factor (BDNF) is particularly reactive to aerobic exercise and promotes cell survival, differentiation, and subsequently enhanced cognition. Despite the neuroprotective benefits of exercise, there is limited data examining the BDNF response to resistance exercise. **PURPOSE:** To examine the effect of progressive resistance exercise on acute changes in peripheral BDNF levels over a 6-week resistance training program and to compare the response between volume-equated high repetition (HR) and low repetition (LR) training programs. **METHODS:** Sixteen males (Age: 23.3±3yrs, Body Mass: 84.8±12.3Kg, Body Fat Percentage: 11.7±4.7%) with at least two yrs. of resistance training experience were counterbalanced by relative strength and assigned to one of two groups, which performed the squat and bench press exercises 3x/wk. for 6 weeks: 1) HR (n=8): 12 repetitions (Mon.), 10 repetitions (Wed.), and 8 repetitions (Fri.). 2) LR (n=8): 6 repetitions (Mon.), 4 repetitions (Wed.), and 2 repetitions (Fri.). Blood samples were collected 30min. prior to and immediately following the Monday session in both groups (i.e. 12 or 6 repetition day) on weeks 1 and 6. Blood was centrifuged and plasma was separated and stored in aliquots at -80ºC until analysis. A 2x2 repeated measures ANOVA was used at each time point to examine the acute BDNF response. Significance was set at p<0.05. **RESULTS:** There was no difference (p>0.05) in BDNF between groups prior to training at either time point. At week-1 there was no main time effect (p>0.05) for BDNF response (1929.73±287.91 to 1922.68±294.16 pg/mL). However, analysis revealed a significant main time effect (p=0.018) at week-6 demonstrating acute elevation of peripheral BDNF from pre-training (1723.54±244.23pg/mL) to post-training (2087.39±285.31pg/mL; +21.11%). No group differences (p>0.05) were detected. **CONCLUSION:** Our results indicate that progressive resistance exercise utilizing multi-joint compound movements can sufficiently enhance the BDNF response independent of repetition range. The lack of BDNF response in week-1 suggests that an accumulation of training volume may be necessary for resistance training to promote neuroplasticity.

The inability to quantify knee loading deficits without the use of 3D motion capture systems (MoCap) following anterior cruciate ligament reconstruction (ACLR) may contribute to their long term persistence during dynamic tasks. The strong relationship between thigh angular velocity, measured with wearable inertial measurement units (IMU), and knee power absorption, calculated with MoCap, suggests that IMU may be used as a proxy for quantifying knee power absorption deficits clinically.

**PURPOSE:** To determine the clinical accuracy of using angular velocities measured with IMUs to detect asymmetrical knee loading during a dynamic single limb loading (SLL) task in individuals following ACLR.

**METHODS:** 21 subjects 5.1±1.5 months post-ACLR participated. MoCap and IMU data were collected concurrently during SLL (3 trials). Peak sagittal plane knee power absorption (kPW) was calculated using 3D kinematics (250 Hz), ground reaction forces (1500 Hz) and anthroprometric (inverse dynamics). Peak sagittal plane thigh angular velocity (ThAV) was extracted from IMU gyroscopes (z plane, 128 Hz). Between limb ratios (repeated right and left pectoral) for kPW and ThAV were calculated as 

\[ \text{kPW}_{\text{right}} / \text{kPW}_{\text{left}} \]

and 

\[ \text{ThAV}_{\text{right}} / \text{ThAV}_{\text{left}} \]

Regression analyses were performed to determine the relationship between kPW and ThAV ratios. Sensitivity and specificity of ThAV in diagnosing asymmetrical knee loading, kPW ratio <0.85, was determined using receiver operating characteristic (ROC) curve analysis. **RESULTS:** ThAV ratios (0.62 ± 0.29; range 0.21±1.22) were strong predictors of kPW ratios (0.73 ± 0.24; range 0.15±1.25) explaining 66.4% of the variance in kPW ratios (R^2 = 0.664; p<0.001). 15 of 21 subjects were categorized as asymmetrical kPW. ROC analysis determined that ThAV ratios can discriminate between asymmetrical and symmetrical kPW (AUC=0.90; p=0.008). ThAV ratios less than 0.81 can classify individuals performing the SLL task with asymmetrical kPW at 81.2% sensitivity and 100% specificity.

**CONCLUSIONS:** Between limb ThAV ratios can identify individuals with knee power absorption asymmetries greater than 15% during this SLL task with high sensitivity and specificity. These data support the use of more cost effective wearable IMUs as a clinical surrogate for identification of knee loading deficits following ACLR.
one-way repeated measures ANOVA with alpha level 0.05. RESULTS: As shown in Table 1, there was a significant effect of pack condition on time to complete the course, vertical angular velocity, and normal acceleration at the turns. There was no significant effect of pack condition on average horizontal speed, pelvic tilt, or tangential acceleration at the cones.

Table 1: Mean (SE) of dependent variables for the agility course task

<table>
<thead>
<tr>
<th></th>
<th>MOLLE</th>
<th>EHB</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to complete (s)</td>
<td>11.72 (0.11)</td>
<td>12.00 (0.09)*</td>
<td>0.002</td>
</tr>
<tr>
<td>Speed (horizontal; m·s⁻¹)</td>
<td>1.49 (0.08)</td>
<td>1.49 (0.08)</td>
<td></td>
</tr>
<tr>
<td>Angular velocity (vertical; deg·s⁻¹)</td>
<td>1.78 (0.04)</td>
<td>1.85 (0.03)*</td>
<td>0.014</td>
</tr>
<tr>
<td>Acceleration (tangential; m·s⁻²)</td>
<td>1.09 (0.15)</td>
<td>0.98 (0.11)</td>
<td></td>
</tr>
<tr>
<td>Acceleration (normal; m·s⁻²)</td>
<td>4.64 (0.12)</td>
<td>4.34 (0.11)*</td>
<td>0.009</td>
</tr>
<tr>
<td>Tilt (tangential; deg)</td>
<td>18.67 (2.78)</td>
<td>16.43 (2.46)</td>
<td></td>
</tr>
<tr>
<td>Tilt (normal; deg)</td>
<td>22.94 (2.29)</td>
<td>19.57 (1.15)</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION: Use of an EHB system significantly decreased several important performance measures of a five-cone agility test.
Results: Significant difference was found between sound leg and injured leg under both eyes-open and eyes-closed conditions (eyes-open: sound leg 0.051±0.018 vs injured leg 0.072±0.034, p=0.027; eyes-closed: sound leg 0.100±0.031 vs injured leg 0.123±0.038, p=0.001; unit: g). Significant difference was also found between eyes-open and eyes-closed conditions under both single leg standing with sound leg and injured leg (sound leg: eyes-open 0.051±0.018 vs eyes-closed 0.100±0.031, p<0.001; injured leg: eyes-open 0.072±0.034 vs eyes-closed 0.123±0.038, p=0.001, unit: g).

The results demonstrated that the smartphone can be used to discriminate the different performance between sound leg and injured leg, and also between eyes-open and eyes-closed conditions.

Conclusion: The study shows that smartphone may have the potential to be a convenient, easy-used and valid tool for assessment of postural control ability on chronic ankle instability.

Higher landing forces are predictive of lower extremity injury. Traditional biomechanical analyses use ground reaction forces to quantify magnitudes of lower extremity joint loading. However, these traditional analyses are resource-intensive and restricted to laboratory environments. Today’s micro-sensor technology may provide accessible and mobile approaches to quantify variables of biomechanical loads in real-world environments.

PURPOSE: To determine if there are associations between peak vertical acceleration (vACCL), measured by a trunk-mounted accelerometer (TMA), and peak vertical ground reaction force (vGRF) during a jump-landing task. METHODS: A tri-axial TMA was secured and centered proximal to the xiphoid process. Two piezoelectric force plates (1,000 Hz) and a TMA (200 Hz; + up, - down) sampled vertical ground reaction forces (vGRF) and vertical trunk accelerations during a jump-landing task. 59 jump-landing trials from 7 participants (age=22.8±1yr; height=166.3±9.3cm; weight=59.3±6.8kg) were included for analysis. Per TMA manufacturer guidelines, 1g=2000 arbitrary units (AU). Associations between raw and normalized TMA-derived and vGRF-derived peak loading magnitude variables were calculated using Pearson Product-Moment coefficients. A vector sum of the left and right vACCL was calculated (vACCL = vGRFR + vGRFL) to quantify total-body vACCL for both raw and normalized vGRF data. RESULTS: There was a moderate positive correlation between raw peak vACCL and peak vGRF (vACCL: 8403.37±3596.89 AU, vGRF: 1686±395.89 AU, r=0.40, p<0.05) and a weak positive correlation between normalized peak vACCL and peak vGRF (vACCL: 14.98±7.51 AU, vGRF: 2.92±0.78 N/kg; r=0.317, p<0.05). The vector sum of total-body vGRF was weakly associated with vACCL for both raw (vACCL: 8403.37±3596.89 AU, vGRF: 2175.91±549.53 N; r=0.381, p<0.05) and normalized (vACCL: 14.98±7.51 AU, vGRF: 3.78±0.94 N/kg; r=0.29, p<0.05) data, respectively. CONCLUSION: Our results indicate that there are moderate associations between peaks in vACCL and vGRF, suggesting that the TMA may be a promising tool to detect vertical joint loading in a real-world environment. Further research should explore associations between asymmetry in side-to-side limb loading and peak vertical acceleration.

## Physical Activity is associated with cognitive improvements in children.

Physical activity is associated with cognitive improvements in children. However, school systems across the country are reducing time allotted for structured physical activity (i.e., recess and physical education) to allow for more instructional time to prepare for standardized exams. Although classroom instruction is important, the lack of physical activity in the school day may come at a cost to children’s academic performance. Intermittent physical activity, a form of exercise that can be integrated into a classroom curriculum, may be an effective way to increase physical activity and improve cognition in school-age children.

**PURPOSE:** The purpose of this study was to examine the effects of intermittent physical activity on immediate mental performance (IMP). **METHODS:** Thirty-nine children (18 males, 21 females; ages 7-11 years; 33% overweight/obese; 59% non-white) completed four experimental conditions in random order: (1) 8 hours of sitting interrupted with 2-min light-intensity activity breaks performed at 25% of maximal heart rate (HRmax) every 18 minutes; (2) 8 hours of sitting interrupted with 2-min moderate-intensity activity breaks (50% HRmax); (3) 8 hours of sitting interrupted with 2-min high-intensity activity breaks (75% HRmax); and (4) 8 hours of sitting interrupted with 2 minutes of sedentary screen time. Throughout each condition, participants completed a total of 20 breaks. IMP was assessed three times during the day using a 90-second math test consisting of 40 single-digit addition and subtraction questions; scores were marked as number correct out of attempted. Results: Across all conditions, IMP scores were significantly lower after 20 compared to 10 activity breaks (-2.4% vs. -0.4%, p<0.02). Compared to the sedentary condition, IMP scores were significantly higher during the moderate-intensity condition (-2.5% vs. 0.1%, p<0.047). There were no significant time-by-condition interactions (p>0.05). **CONCLUSION:** This data suggest intermittent activity breaks interspersed throughout the school day may be an effective way to increase structured physical activity in schools without negatively impacting cognition in children. Future research should determine the optimal dose of intermittent activity needed to improve IMP in this age group.
There is a call for multidisciplinary studies examining independent associations of physical activity and physical fitness characteristics with executive function and academic performance. Purpose: To examine the independent associations of objectively measured physical activity, cardiorespiratory fitness and motor skill with executive function and academic performance in 10-year-old children. Methods: We included 787 children (mean SD age) 10.2 (0.3) years, body mass index 18.0 (3.0), 50.8 % girls) from 57 schools in Sogn og Fjordane county, Norway. Independent variables were physical activity (moderate to vigorous and sedentary time measured by accelerometry), cardiorespiratory fitness (measured by the Andersen test) and a sum-score of motor skills (measured by Aiming and Catching 1 and 2 from the Movement ABC test battery (ageband 3) and the shuttle-run (10x5m) from the Eurofit test battery), as well as age, puberty stage, skinfold thickness and socioeconomic status. Dependent variables were two composite scores: 1) executive function (measured by Stroop, Verbal fluency, WISC-IV (digit span) and Trail Making) and 2) academic performance (reading, English and numeracy). A linear mixed model was used to analyze the data. Due to interactions with sex, analysis was run separately for girls and boys. Clinicaltrials.gov ID number NCT02132494. Results: Executive function was significantly associated with moderate to vigorous physical activity (regression coefficients (CI) p) (0.17 (0.01-0.33) p = 0.035), sedentary time (OR: 0.82 (0.63-1.07) p = 0.086) and motor skills (0.12 (0.01-0.24) p = 0.036) in boys. Academic performance was only associated with motor skills (0.18 (0.07-0.30) p = 0.001) in girls and with cardiorespiratory fitness (0.24 (0.11-0.38) p < 0.001), sedentary time (0.17 (0.02-0.31) p = 0.026) and motor skills (0.12 (0.01-0.24) p = 0.036) in boys. Academic performance was only associated with motor skills (0.18 (0.07-0.30) p = 0.001) in girls, and for cardiorespiratory fitness (0.18 (0.04-0.31) p = 0.013) and sedentary time (0.16 (0.01-0.31) p = 0.033) in boys. Conclusion: Sex differences in associations for physical characteristics with executive function and academic performance. Comprehensive physical activity targeted to increase both physical fitness and motor skill holds potential to positively affect executive function and academic performance.

Inhibitory control refers to the ability to resist distractions and exert self-control. Higher inhibitory control is associated with academic success and a healthy weight status among youth. Identifying other, health-related factors associated with inhibitory control is of value. Activity variables (such as physical activity [PA] and sleep) are associated with inhibitory control among adolescents and adults; less is known about these associations among preschool-aged children. Purpose: To examine associations among activity variables (PA and sleep duration) and pre-schoolers’ inhibitory control. METHODS: Sixty-four children (48% male; 75% Caucasian; mean SD age) 4.3 (0.8) years; mean SD BM percentile 61.4% (25.5) wore an accelerometer for one week. Minutes per hour spent in moderate-to-vigorous PA (MVPA) were calculated. During the same week, participant’s parents reported the child’s sleep duration. Participants performed a computer task, which assessed inhibitory control. Response accuracy interference scores were calculated for the computer task, with higher interference scores indicating poorer inhibitory control. Regression models were used to examine associations among activity variables and interference scores. RESULTS: Regression models indicated a negative association between sleep duration and interference scores (R2=0.127, β=–.356, p<.01; n=58) and a positive association between MVPA and interference scores (R2=0.119, β=.344, p=.03; n=58). CONCLUSIONS: Consistent with previous findings, longer sleep duration was associated with better inhibitory control among young children. Contrary to observations among older youth and adults, higher PA was associated with poorer inhibitory control. It is plausible that among this age group, lower inhibitory control may result in a greater tendency to move, although the cross-sectional study design prohibits causal inference. Longitudinal research is needed to confirm or refute a causal relationship among these variables, and additional studies with larger, more diverse samples are needed to substantiate the findings. Funded by the North American Society for Pediatric Exercise Medicine

Purpose: Aerobic bouts as short as 10 minutes have been shown to positively affect impulsivity and mood in clinical settings among typically developing children. Recent studies show similar effects in children with neurodevelopmental or affective disorders. However, little research has been conducted on effects of exercise on behavior and affect among populations with behavioral health challenges in naturalistic settings like schools. Manerve Moves is an exercise intervention using exergame-cycling in physical education (PE) classes at a therapeutic day school serving children with complex behavioral health challenges. This study examined if minutes of riding had a dose-response relationship with impulsivity and emotional liability scores. Methods: A 14-wk cycling intervention was used. Children (n=105, 81.3% male, age 11.9±2.3, 70.0% with multiple diagnoses, 72.2% taking medication) were randomly assigned by classroom to receive the 7-wk intervention during fall or spring, during which they used the bikes 2x/wk in PE and could elect to ride during self-breaks (rest). Real-time data on PA and sedentary time was collected via bikes using student ID codes. School staff completed the Conners Abbreviated Teacher Rating Scale (CATRS-10) (n=5,252 daily for each student. Clinically relevant a priori thresholds were established for CATRS-10 score (≥2.15), impulsivity sub-scale (≥2.9) and emotional liability sub-scale (≥3.6). Duration of riding was categorized as reference (0 min), short (0-9min<10) and long (≥10 min). Mixed effects logistic regression was used to assess relationships between score thresholds and ride duration category accounting for individual and classroom random effects and controlling for elective rides occurring in response to behavioral episodes. Results: Both short and long riding categories were significantly associated with reduced odds of elevated CATRS-10 (short: OR=0.46, p=0.001; long: OR=0.64, p=0.035) and impulsivity (short: OR=0.58, p=0.004; long: OR=0.62, p=0.030) versus no riding. Short rides were associated with reduced odds of elevated emotional liability (OR=0.58, p=0.008). Conclusions: Even short duration school-based exergaming rides of 10 minutes or less may meaningfully improve impulsivity and affect among children with behavioral health challenges.
negative relationships between depression scores and average moderate PA ($r = -0.656$, $p = 0.006$), vigorous PA ($r = 0.656$, $p = 0.006$), MVPA ($r = -0.735$, $p < 0.001$), and average total counts ($r = -0.637$, $p < 0.008$).

CONCLUSIONS: While PA did not differ significantly between groups, a significant negative relationship between PA and depression in TD but not ASD suggests that a greater dose of intentional PA may be required to demonstrate an effect on symptoms of depression in children with ASD.

Board #7
June 2, 3:15 PM - 5:15 PM
Psychological Responses to Intermittent Physical Activity in Elementary School-Age Children
Matthew R. Nagy, Molly P. O’Sullivan, Shannon S. Block, Trevor R. Tooley, Rebecca E. Hasson. University of Michigan, Ann Arbor, MI.
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(No relationships reported)

It is well-established that intermittent physical activity has a positive impact on children’s physical health. However, less is known regarding the psychological outcomes associated with intermittent activity in children. PURPOSE: The purpose of this study was to examine the acute effects of intermittent physical activity on enjoyment and mood in children ages 7-11 years and (2) to determine the association between sedentary behavior and intermittent physical activity.

METHODS: Thirty-nine children (18 males, 21 females; 33% overweight/obese; ages 3-13), as well as reported on the family’s income and indicators of early adversity (e.g. single-parent household, maternal psychopathology, parental arrest, foster care, physical abuse, sexual abuse, and inability to meet the family’s financial needs).

Results: This study applied growth mixture modeling to physical health problems and found two distinct trajectories of physical health problems: a stable, low group indicating good physical health across time and a high, increasing group indicating poor physical health across time and a high, increasing group indicating poor physical health across time.

Conclusions: These findings indicate the importance and predictive power of early indicators of risk: low family income-to-needs ratios, high social adversity, and psychiatric disorders occurring during the preschool period predicted these trajectories.

Purpose: To determine if self-reported negative social interaction acts as a mediator of the relationship between objectively-measured sedentary behavior and body mass index (BMI) percentile for age in boys, in a controlled environment.

Methods: Twenty six boys (10.5 ± 1.5 years old) were assessed for height and weight and BMI percentile for age was calculated. Twelve boys were overweight/obese (i.e., >85th BMI percentile) and 14 were non-overweight (<85th BMI percentile). Children completed validated surveys that assessed overt peer victimization (OV) and relational victimization (RV) such as physical violence and/or threats of violence and relational victimization (RV) such as ostracism. Children were then individually given access to a gymnasium with a variety of physical activity equipment options (e.g., balls, obstacle courses) and a table with sedentary activities (e.g., books, toys) for 30 minutes. If a child played with sedentary options they did so while seated. Children could play with any of the equipment options in any pattern they wished for the entire session. The amount of time children allocated to sedentary activities (i.e., sitting time) was recorded via stopwatch.

Results: Both OV and RV were positively associated with BMI percentile ($r = 0.46$, $p < 0.02$ for OV, $r = 0.40$, $p < 0.04$ for RV) and sitting time ($r = 0.60$, $p < 0.05$ for OV, $r = 0.42$, $p < 0.04$ for RV) and sitting time was positively associated with BMI percentile ($r = 0.4$, $p < 0.05$). When individually controlling for both OV and RV the previously significant positive correlation between sitting time and BMI percentile was rendered non-significant ($r = 0.28$, $p = 0.18$ for OV, $r = 0.26$, $p = 0.21$ for RV).

Conclusion: The relationship between BMI percentile and sedentary behavior was mediated by both measures of negative social interaction: OV and RV.

Overweight/obese children spend more time sitting (i.e. are more sedentary) than their non-overweight peers. Additionally, overweight/obese children are more likely to encounter negative social interaction (e.g., bullying) than non-overweight children and this negative social interaction is associated with greater sedentary behavior regardless of a child’s weight status. It is unknown if negative social interaction mediates the relationship between overweight status and sedentary behavior in children.

Purpose: The purpose of this study was two fold: (1) to examine the acute effects of intermittent physical activity and found two distinct trajectories of physical health problems: a stable, low group indicating good physical health across time and a high, increasing group indicating poor physical health across time and a high, increasing group indicating poor physical health across time.

Conclusions: These findings indicate the importance and predictive power of early indicators of risk: low family income-to-needs ratios, high social adversity, and psychiatric disorders occurring during the preschool period predicted these trajectories.

Results: This study applied growth mixture modeling to physical health problems and found two distinct trajectories of physical health problems: a stable, low group indicating good physical health across time and a high, increasing group indicating poor physical health across time and a high, increasing group indicating poor physical health across time.

Conclusions: These findings indicate the importance and predictive power of early indicators of risk: low family income-to-needs ratios, high social adversity, and psychiatric disorders occurring during the preschool period predicted these trajectories.

Purpose: To determine if self-reported negative social interaction acts as a mediator of the relationship between objectively-measured sedentary behavior and body mass index (BMI) percentile for age in boys, in a controlled environment.

Methods: Twenty six boys (10.5 ± 1.5 years old) were assessed for height and weight and BMI percentile for age was calculated. Twelve boys were overweight/obese (i.e., >85th BMI percentile) and 14 were non-overweight (<85th BMI percentile). Children completed validated surveys that assessed overt peer victimization (OV) and relational victimization (RV) such as physical violence and/or threats of violence and relational victimization (RV) such as ostracism. Children were then individually given access to a gymnasium with a variety of physical activity equipment options (e.g., balls, obstacle courses) and a table with sedentary activities (e.g., books, toys) for 30 minutes. If a child played with sedentary options they did so while seated. Children could play with any of the equipment options in any pattern they wished for the entire session. The amount of time children allocated to sedentary activities (i.e., sitting time) was recorded via stopwatch.

Results: Both OV and RV were positively associated with BMI percentile ($r = 0.46$, $p < 0.02$ for OV, $r = 0.40$, $p < 0.04$ for RV) and sitting time ($r = 0.60$, $p < 0.05$ for OV, $r = 0.42$, $p < 0.04$ for RV) and sitting time was positively associated with BMI percentile ($r = 0.4$, $p < 0.05$). When individually controlling for both OV and RV the previously significant positive correlation between sitting time and BMI percentile was rendered non-significant ($r = 0.28$, $p = 0.18$ for OV, $r = 0.26$, $p = 0.21$ for RV).

Conclusion: The relationship between BMI percentile and sedentary behavior was mediated by both measures of negative social interaction: OV and RV.
**D-66** Free Communication/Slide - Exercise Training in Chronic Disease

**Chair:** Cemal Ozemek, University of Colorado Denver, Denver, CO.

**PURPOSE:** Exercise interventions have shown to reduce cancer-related fatigue and pain in breast cancer patients undergoing radiotherapy. Within a randomized controlled trial, aimed to explore the mediating role of inflammatory parameters in the development of these symptoms during adjuvant radiotherapy and its mitigation by resistance exercise.

**METHODS:** The randomized trial compared a 12-week progressive resistance exercise training (EX) with a 12-week relaxation control group. In 103 chemotherapy-naïve participants, interleukin-6 (IL-6) and interleukin-1 receptor antagonist (IL-1ra) were measured in serum samples collected before, at the end, and 6 weeks post-radiotherapy. Fatigue was assessed with the multidimensional Fatigue Assessment Questionnaire (FAQ), and pain with the EORTC QLQ-C30. Analysis of covariance (ANCOVA) models, partial correlations, Friedman-Schatzkin tests, and R² effect-size measures for mediation were calculated.

**RESULTS:** The ANCOVA models revealed a significant intervention effect on IL-6 (p < 0.010) and the IL-6/IL-1ra ratio (p < 0.018), characterized by a marked increase during radiotherapy among controls, but no significant change in EX. IL-1ra did not change significantly in either group (p = 0.88). Increased IL-6 and IL-6/IL-1ra levels at the end of radiotherapy were significantly associated with increased physical fatigue and pain 6 weeks post-radiation. The effect of resistance exercise on physical fatigue was significantly mediated by IL-6 and IL-6/IL-1ra levels, but not by IL-1ra. IL-6 and IL-6/IL-1ra mediated between 15% and 24% of the variance of physical fatigue and pain explained by the intervention.

**CONCLUSIONS:** This randomized controlled trial showed a significantly increased pro-inflammatory cytokine level after adjuvant radiotherapy in breast cancer patients. This effect was counteracted by progressive resistance exercise training. IL-6 and the IL-6/IL-1ra ratio appeared to mediate the beneficial effect of exercise on physical fatigue and pain, but only to a small extent.

Supported by Intramural Funding of the National Center for Tumor Diseases (NCT), Heidelberg, Germany.

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**2300** June 2, 3:15 PM - 3:30 PM

**Inflammation and Resistance Exercise in Breast Cancer Patients undergoing Adjuvant Radiotherapy: A Mediation Analysis**

Karen Steindorf1, Martina E. Schmidt1, Anna Meynköh1, Nina Habermann1, Joachim Wiskemann2, Jan Oelmann1, Oliver Klassen1, Juergen Debus2, Karin Potthoff1, Cornelia M. Ulrich1

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(No relationships reported)

**PURPOSE:** Radiation therapy (RT) and androgen deprivation therapy (ADT) impair muscular, mitochondrial and immune function, and result in weakness and cancer-related fatigue (CRF) among prostate cancer patients. We investigated the influence of an exercise intervention (EXCAP©), including resistance and aerobic training, on expression of 4825 mitochondrial and nuclear genes, muscular strength, and CRF.

**METHODS:** In this phase II randomized clinical trial, prostate cancer patients (N=58; mean age=67), receiving RT (47%) or ADT (53%), were randomized to 6 wks of EXCAP© (7 days/wk) or standard care (RT or ADT with no exercise). RNA was isolated from muscle biopsies for microarray analyses of 4825 mitochondrial and nuclear genes. Muscular strength was assessed using multiple repetition maximum testing (chest press and leg extension). CRF was assessed via valid self-report questionnaires (BFI, MFSI). Assessments were pre- and post-intervention. Analyses included robust multi-array average normalization, analyses of covariance (ANCOVA), correlations and partial least squares (PLS) with cross-validation.

**RESULTS:** Analyses revealed >2-fold down regulation in MYH8 and XR1P1 in the exercise group, no >2-fold changes in expression in the control group, and a >2-fold difference between groups on MTTM where MTTM was down-regulated >1.5-fold in controls with no change in exercisers (all p < 0.05). ANCOVAs revealed a trend for group differences in muscular strength (all p < 0.10) with significant group differences in CRF on the BFI (p < 0.05) and a trend on the MFSI (p < 0.10): exercisers improved while controls worsened. MYH8, MYL5, ACTN3, XR1P1, MTTM, and HLA-DQB1 were significantly correlated with muscular strength and CRF (all p < 0.05). PLS suggested down-regulation of MYL5, ACTN3, and HLA-DQB1 may optimally predict increases in CRF.

**CONCLUSIONS:** Results suggest exercise alters gene expression, muscular strength and CRF in prostate cancer patients. Expression changes in genes that are involved in muscle atrophy and inflammatory myopathies are related to and may mediate the relationship between exercise and CRF. Future research is needed to confirm these findings in larger phase III clinical trials.

ClinicalTrials.Gov: NCT00815672 Funding: DOD W81XWH-07-1-0341

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**2302** June 2, 3:45 PM - 4:00 PM

**Strength-Training Induces Skeletal Muscle Adaptations in Patients with Myotonic Dystrophy Type I: A Case Study**

Marie-Pier Roussel1, Marika Morin1, Émile Petitclerc2, Anne-Marie Fortin2, Cynthia Gagnon3, Luc J. Hebert4, Mario Leonie5, Elise Duchesne6, 1Université du Québec à Chicoutimi, Chicoutimi, QC, Canada. 2Université de Sherbrooke, Sherbrooke, QC, Canada. 3Université Laval, Québec, QC, Canada.

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(No relationships reported)

**PURPOSE:** Myotonic dystrophy type 1 (DM1) is the most prevalent inherited neuromuscular disease in adults. This multisystemic disease is characterized by skeletal muscle impairments including muscle wasting. Slowing muscle wasting in this population using strength training seems a promising strategy, but it remains unknown if it would trigger cellular and molecular responses similar to the ones observed in healthy people. The objective of this case study is to evaluate the effect of a strength-training program on skeletal muscle adaptations in a DM1 patient.

**METHODS:** One male with DM1 (age = 36) underwent a 12-week strength-training program, twice a week, consisting of 2 sets of 6 exercises at 6 RM supplemented by functional tasks. Vastus lateralis muscle biopsy samples were obtained pre- and post-training program. The proportion of type I and II myofibers and the cross-sectional area (CSA) of each type were determined by immunohistochemistry. The percentage of centrally nucleated fibers (CNF) was obtained following staining with hematoxyline/eosine Two blinded evaluators analyzed the data.

**RESULTS:** Following the 12-week strength-training program, the patient showed an increase in the CSA of type I myofibers evaluated at 46% (p < 0.05) by evaluator #1 and 51% (p < 0.05) by evaluator #2. For type II myofibers, the increase in CSA was evaluated at 24% (p < 0.05) and 29% (p < 0.05) by evaluator #1 and #2, respectively. A muscle fiber-type switching was also induced by the 12-week strength-training program as shown by the increase in the proportion of type II myofibers from 29% to 71% (p < 0.05) noted by the evaluator #1 and the similar observation noted by evaluator #2 (28% to 72%, p < 0.05). No change was observed in the percentage of CNF by both evaluators.

**CONCLUSIONS:** Our results suggest that skeletal muscle of patients with DM1 could undergo adaptations linked to muscle growth as demonstrated by the increase in the CSA of type I and type II myofibers. It also seems that strength-training parameters used in this study could also influence the distribution of myofibers, in favour of type I and II myofibers. However, the distribution of type I and II myofibers remains to be elucidated by future studies.
2303
June 2, 4:00 PM - 4:15 PM
High Intensity Interval- Vs Moderate Intensity- Training For Improving Cardiometabolic Health In Overweight or Obese Males: A Randomized Controlled Trial.
Gordon Fisher, FACSM1, Andrew W. Brown1, Michelle M. Bohan-Brown2, Amy Alcorn1, Corey D. Noles1, Leah Winwood1, Holly Reschult1, Brandon George1, Madeline M. Jeansonne1, David B. Allison1. 1University of Alabama - Birmingham, Birmingham, AL. 2Clemson University, Clemson, SC.
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(No relationships reported)

Purpose: To compare the effects of six weeks of high intensity interval training (HIIT) vs continuous moderate intensity training (MIT) for improving body composition, insulin sensitivity ($S_i$), blood pressure, blood lipids, and cardiovascular fitness in a cohort of sedentary overweight or obese young men. We hypothesized that HIIT would result in similar improvements in body composition, cardiovascular fitness, blood lipids, and $S_i$ compared to the MIT group, despite requiring only one hour of activity per week compared to five hours per week for the MIT group.

Methods: 28 sedentary overweight or obese men (age, 20 ± 1.5 years, body mass index 29.5 ± 3.3 kg/m$^2$) participated in a six week exercise treatment. Participants were randomly assigned to HIIT or MIT and evaluated at baseline and post-training. DEXA was used to assess body composition, graded treadmill exercise test to measure cardiovascular fitness, oral glucose tolerance test to measure $S_i$, nuclear magnetic resonance spectroscopy to assess lipoprotein particles, and automatic auscultation to measure blood pressure.

Results: A greater improvement in VO$_{2\text{max}}$ was observed in MIT compared to HIIT (11.1% vs 2.83%, P=0.0185) in the complete-case analysis. No differences were seen in the intention to treat analysis, and no other group differences were observed. Both exercise conditions were associated with temporal improvements in % body fat, total cholesterol, medium VLDL, medium HDL, triglycerides, and VO$_{2\text{max}}$(P < 0.05).

Conclusion: Participation in HIIT or MIT exercise training may improve cardiometabolic risk factors in previously sedentary overweight or obese men, with no clear advantage between these two specific regimes (Clinical Trial Registry number NCT01935323).

2306
June 2, 4:30 PM - 4:45 PM
Heterogeneity in Fitness Response to a Lifestyle Intervention: The Dextile Intervention Study
Kristine Faerch1, Aileen Kennedy2, Grainne O’Donoghue2, Eoin Durkan2, Helen Kenny2, Stephen Cleary2, Noel McCaffrey2, Gregers S. Andersen1, John J. Nolan1, Donal O’Gorman2. 1Steno Diabetes Center, Gentofte, Denmark. 2Dublin City University, Dublin, Ireland.
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(No relationships reported)

The term pre-diabetes covers subgroups of individuals with distinct pathophysiology. Despite this heterogeneity, the current approach to diabetes prevention is uniform.

Purpose: To examine the heterogeneity in fitness responsiveness to a self-selected lifestyle intervention in individuals with normal glucose tolerance (NGT), isolated impaired fasting glucose (i-IFG), isolated impaired glucose tolerance (i-IGT), combined IFG&IGT, and screen-detected type 2 diabetes (T2D).

Methods: A total of 243 high-risk individuals (mean age 54 (11) y; BMI 31 (5) kg/m$^2$; 50.1% men) participated in a 12-week supervised exercise training programme accompanied with dietary advice. At baseline and follow-up, oral glucose tolerance and VO2max tests were performed. Heterogeneity in VO2max response to the lifestyle intervention was analysed by linear regression analysis with baseline glucose tolerance status as explanatory variable. Analyses of VO2max changes were adjusted for age, sex, and baseline level of VO2max.

Results: At baseline, VO2max levels were significantly lower in i-IGT and IFG&IGT compared with NGT and i-IFG (P<0.05, Fig A). Heterogeneity was observed in 12-week changes in VO2max (P=0.034). Improvement in VO2max was significantly higher in NGT, i-IFG and IFG&IGT than in i-IGT and T2D (P<0.01, Fig B).

Conclusion: Cardiorespiratory fitness level was lower in pre-diabetic individuals with i-IGT and IFG&IGT but not in those with i-IFG compared with NGT. Paradoxically, improvement in fitness level after a 12-week lifestyle intervention was not seen in individuals with i-IGT. Our findings suggest that lifestyle strategies for prevention of type 2 diabetes may not be equally beneficial for all pre-diabetic individuals.

The continuous demand for insulin in the face of insulin resistance, coupled with the glucolipotoxic environment associated with the metabolic syndrome (MetS), adversely affects the ‘quality’ of insulin produced and secreted by the pancreatic beta cells. This is depicted by increased circulating intact proinsulin concentration (IPC) which affects the ‘quality’ of insulin produced and secreted by the pancreatic beta cells.

PURPOSE: We therefore aimed to investigate the impact of MIT and different volumes of HIIT on circulating IPC. METHODS: Sixty-six individuals with the MetS were randomized into 16 weeks of either: i) MIT (n=21, 30mins at 60-70%HRpeak, 5x/week); ii) 4HIIT (n=22, 4x4min bouts at 85-95%HRpeak, interspersed with 3min rest); 3) decreased % body fat, and 4) improved cardiovascular fitness. While both exercise groups led to similar improvements for most cardiometabolic risk factors assessed, MIT led to a greater improvement in overall cardiovascular fitness. Overall, these observations suggest that a relatively short duration of either HIIT or MIT training may improve cardiometabolic risk factors in previously sedentary overweight or obese young men, with no clear advantage between these two specific regimes (Clinical Trial Registry number NCT01935323).
PURPOSE: To determine the effects of 3 months of supervised exercise training plus chronic dietary provision of an inorganic nitrate (4.2mmol in the form of concentrated beetroot juice, BR) beverages (EX+BR) versus exercise training and placebo beverage (EX+PL) on COT and rate of tissue oxygenation recovery (T50% HBO).

METHODS: At baseline testing, all subjects underwent a maximal graded cardiopulmonary exercise test using a modified Gadient protocol. The oxygenation status of the gastrocnemius muscle of the leg with the worst PAD symptoms and ABI measures was monitored at 850 and 764nm using Near Infrared Spectroscopy (NIRS). Subjects were then randomized to either the EX+BR (n=9) or EX+PL (n=10) group. Exercise training involved 3 sessions per week consisting of at least 30 minutes walking at a moderate claudication pain level. Subjects consumed BR or PL 3 hours prior to each exercise session. The 3-month protocol was identical to baseline. Comparisons were made using a two-way ANOVA with repeated measures.

RESULTS: COT was not different between groups at baseline and was correlated with prior to each testing protocol. Walking at a moderate claudication pain level. Subjects consumed BR or PL 3 hours exercise training increased pain-free exercise performance time and decreased the time required to re-oxygenate the ischemic tissue. This suggests a capacity to increase performance of activities of daily living in patients with PAD.

CONCLUSIONS: Chronic administration of a high nitrate drink plus supervised exercise training increased pain-free exercise performance time and decreased the time required to re-oxygenate the ischemic tissue. This suggests a capacity to increase performance of activities of daily living in patients with PAD.

Prolonged Elevated Cardiac Troponin After Marathon Running Is A Sign For Myocardial Damage

Johannes Scher1, Fabien Hyafil1, Viola Grabs1, Bernhard Haller1, Siegmund Braun2, Tim Roep1, Markus Schwaiger1, Martin Halle1, Johannes Scherr1

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No relationships reported

PURPOSE: The pathophysiological mechanism of cardiac troponin (cTn) elevation after marathon running is still not clear. It is discussed controversially whether (especially a prolonged) elevation reflects rather physiological than pathological processes.

METHODS: We examined cTn T values in 162 healthy male marathon runners (age: 42.1 ± 10.9 years) before (V2) and immediately (V3), 24 hrs (V4), and 72 hrs (V5) after a marathon race. A pecTn was defined as follows: a high-sensitive cTnT > 25 ng/L at V4 or > 14 ng/L at V5. The participants with pecTn were compared to controls without pecTn which were similar with respect to age and previous finished long-distance races. Both groups were examined with CMR in the days post-race and those with LGE in the first CMR also with a second CMR approximately 3 month post-race.

RESULTS: We examined in total 22 out of 162 runners (13.6%). 12 of 162 (7.4%, age: 38.7 ± 10.4 yrs) had prolonged elevated cTn T values. 7 in the pecTn group (58.3%) presented LGE. In the ROC analyses, cTnT values immediately post-race were not associated with LGE (1st CMR: AUC = 0.671, p = 0.182, 2nd CMR: AUC = 0.474, p = 0.162) presented LGE. In the ROC analyses, cTnT values immediately post-race were not associated with LGE (1st CMR: AUC = 0.671, p = 0.182, 2nd CMR: AUC = 0.474, p = 0.162). However, LGE in first CMR was significantly associated with cTnT at V4 (AUC = 0.769, p = 0.035) and LGE in second MRI with cTnT at V5 (AUC = 0.807, p = 0.030), however not reaching level of significance for V4 (AUC = 0.750, p = 0.077). Regarding mean cTn values at V4 and V5, LGE in both CMRs were significantly associated with cTnT (first CMR: AUC = 0.752, p = 0.049; second CMR: AUC = 0.828, p = 0.020).

CONCLUSIONS: Prolonged elevation of cTn after marathon running is associated with late gadolinium enhancement (LGE) in cardiac magnetic resonance (CMR) imaging as a sign of myocardial damage.

Effects of an Exercise Intervention on Gestational Weight Gain: Preliminary Results Of The PAMELA Trial

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No relationships reported

PURPOSE: Overweight & obesity is a growing health concern in the US, affecting over one-third of children and adolescents, which increases the risk of premature all-cause mortality and heart disease. The purpose of this study was to compare the effects of exercise mode throughout pregnancy on neonatal health outcomes.

METHODS: Participants completed 1 sessions weekly of aerobic, circuit, or resistance training from 16 to 36 weeks gestational age compared to non-exercising controls. At birth, neonatal morphometrics were assessed, including abdominal circumference (AC), head circumference (HC), and weight, from which ponderal index (PI) and body mass index (BMI) were calculated. Statistical analyses included t-tests and multiple ANOVAs.

RESULTS: Maternal exercise during pregnancy, regardless of the type, had no adverse effect on weight gain and development. Children exposed to maternal aerobic exercise training had significantly smaller abdominal circumferences compared to controls (p<0.001), resistance (p=0.003), and control (p=0.034) groups. BMI of children exposed to maternal circuit training was significantly different from the resistance group (p=0.028).

CONCLUSIONS: These results suggest that abdominal fat and BMI may be influenced in utero, which may influence future disease risk and diagnosis at a later age. These findings have further implications for the general public in combating cardiovascular disease and obesity by intervening during a key time of development to improve childhood health and wellbeing, utilizing an effective, safe, low-cost intervention.

Effects of a supervised exercise intervention on fetal growth in women with a high cardiovascular risk profile: Results of the PAMELA Trial

Amanda F. McGuire1, Amanda P. Lewis1, Avery G. Summerbell1, Linda E. May2

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No relationships reported

PURPOSE: Overweight & obesity is a growing health concern in the US, affecting over one-third of children and adolescents, which increases the risk of premature all-cause mortality and heart disease. The purpose of this study was to compare the effects of exercise mode throughout pregnancy on neonatal health outcomes.

METHODS: Participants completed 1 sessions weekly of aerobic, circuit, or resistance training from 16 to 36 weeks gestational age compared to non-exercising controls. At birth, neonatal morphometrics were assessed, including abdominal circumference (AC), head circumference (HC), and weight, from which ponderal index (PI) and body mass index (BMI) were calculated. Statistical analyses included t-tests and multiple ANOVAs.

RESULTS: Maternal exercise during pregnancy, regardless of the type, had no adverse effect on weight gain and development. Children exposed to maternal aerobic exercise training had significantly smaller abdominal circumferences compared to controls (p<0.001), resistance (p=0.003), and control (p=0.034) groups. BMI of children exposed to maternal circuit training was significantly different from the resistance group (p=0.028).

CONCLUSIONS: These results suggest that abdominal fat and BMI may be influenced in utero, which may influence future disease risk and diagnosis at a later age. These findings have further implications for the general public in combating cardiovascular disease and obesity by intervening during a key time of development to improve childhood health and wellbeing, utilizing an effective, safe, low-cost intervention.

Excessive weight gain (EWG) during pregnancy increases the risk of adverse outcomes for the mother and the newborn, such as gestational hypertension, diabetes mellitus, preterm birth and obesity. Some randomized controlled trials indicate an inverse association between EWG and exercise during pregnancy, but few of these trials are adequately powered. PURPOSE: This study evaluated the effect of a supervised exercise - based intervention performed during 16 weeks of pregnancy on maternal weight gain.

METHODS: The PAMELA (Physical Activity for Mothers Enrolled in a Longitudinal Analysis) is a randomized controlled trial nested into the 2015 Pelotas (Brazil) Birth Cohort Study. A total of 394 healthy pregnant women were randomly assigned to a control group (n=263) or exercise intervention group (n=131). The intervention included moderate-intensity aerobic and resistance exercises performed three days/ week for 60 minutes/session. Gestational weight gain was calculated on the basis of the weight measured at the baseline (16-20 weeks’ gestation) and weight measured at the last visit to the clinic after the end of the intervention program (32-36 weeks’ gestation). Analyses were performed using T-tests for mean differences.

RESULTS: To date, a total of 291 women, 198 in the control group and 93 in the intervention group, completed the study. The intervention and control groups did not differ at baseline regarding their mean age (27.2 years ± 0.5 vs. 27.1 years ± 0.4) and mean pre-pregnancy weight (44.6 ± 2.7 kg vs. 46.1 ± 2.8 kg). Women in the intervention group gained less weight (mean difference, 0.89 kg; 95% confidence interval: 0.02-1.76 kg; p< 0.05) compared with those in the control group after 16 weeks of intervention.

Oh Baby!

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No relationships reported
CONCLUSIONS: Our preliminary findings show that the exercise intervention contributed to reduced weight gain during pregnancy. Future studies on the effect of adherence strategies to enhance motivation for regular participation in exercise during pregnancy are warranted.

Trial registration: Clinicaltrials.gov identifier: NCT02148965.

2311 June 2, 3:45 PM - 4:00 PM Antenatal Weight Training and Maternal Health Conditions among Postpartum Runners Liga Blyholder1, Elizabeth Chumanov2, Bryan Heiderschüt1.
1University of Wisconsin-Madison, Madison, WI. 2University of Wisconsin Hospital and Clinic, Madison, WI. (Sponsor: Josep Wels, FACSM)
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(No relationships reported)

Exercise during pregnancy has many known maternal health benefits. While most research on antenatal exercise has investigated the effects of aerobic training, few studies have examined how weight training during pregnancy may impact maternal health conditions. PURPOSE: To examine relationships between antenatal weight training and stress urinary incontinence (SUI), rectus abdominis (RA) separation, and musculoskeletal pain in an active postpartum population. METHODS: Thirty running organizations throughout the U.S. were contacted to distribute an anonymous, online survey to their female members. Participants included 648 women with at least 1 child who were running a minimum of once per week. The survey consisted of questions regarding maternal history, exercise during pregnancy, and postpartum health conditions. Statistical analyses were restricted to women who reported giving birth within the last 2 years (n=244), unless otherwise specified. Associations were calculated using two-sided Chi-square tests and logistic regression. RESULTS: Antenatal weight training was significantly associated with lower odds of postpartum SUI (OR=0.49, 95% CI=0.24—0.99, p=0.044) and RA separation (OR=0.46, 95% CI=0.25—0.83, p=0.009), as well as postpartum musculoskeletal pain after adjusting for antenatal musculoskeletal pain (OR=0.52, 95% CI=0.28—0.95, p=0.033). Among women who did not weight train during pregnancy, antenatal pain was significantly associated with postpartum pain (OR=3.14, 95% CI=1.51—6.70, p=0.002). This association was insignificant among women who reported weight training during pregnancy (OR=1.97, 95% CI=0.42—7.53, p=0.167). When analyses were expanded to include women who gave birth within the last 10 years (n=531), vaginal delivery was significantly associated with postpartum SUI among women who did not weight train during pregnancy (OR=1.76, 95% CI=1.00—2.97, p=0.029). This association was insignificant among women who reported weight training during pregnancy (OR=3.30, 95% CI=0.59—1.34, p=0.513). CONCLUSION: Antenatal weight training may be beneficial in reducing postpartum pain, SUI, and RA separation.

2312 June 2, 4:00 PM - 4:15 PM Physical Activity during Pregnancy and Postpartum Depressive Symptoms Ashley Haslep, David L. Nichols, FACSM, Kyle Biggerstaff, Vic Ben-Ezra. Texas Woman’s University, Denton, TX. (No relationships reported)

PURPOSE: To determine the association of physical activity during the third trimester of pregnancy with postpartum depression symptoms. METHODS: Data were obtained from the Centers for Disease Control (CDC) through the Pregnancy Risk Assessment Monitoring System (PRAMS). Phase 5 of PRAMS was used for the current study. Women who participated in PRAMS completed a survey with questions regarding pregnancy-related issues, physical activity frequency, depression symptoms, demographic, and other health-related items. Participants received access to the survey 2-4 months postpartum. For the current study, women were classified as having feelings of postpartum depression (yes or no) based on their responses to two questions on the survey. Logistic regression was then used to examine the association between physical activity and feelings of postpartum depression in 20,258 mothers. Additional data from PRAMS on income during pregnancy, stress, and health conditions. Statistical analyses were restricted to women who reported giving birth within the last 2 years (n=244), unless otherwise specified. Associations were calculated using two-sided Chi-square tests and logistic regression. RESULTS: While serum lipid levels increase during pregnancy, excessively high lipids in mid-pregnancy are associated with adverse pregnancy outcomes. Smoking has been associated with adverse lipid profiles in non-pregnant adults, but this association has not been adequately explored during pregnancy.

PURPOSE: To examine relations between smoking and lipids among women in their second (T2) and third trimesters (T3).

METHODS: Seventy-eight gravida were recruited for a Midwest OB/GYN clinic. Women completed a questionnaire on health behaviors, which included current smoking (any/none) and pre-pregnancy smoking (any/none). Non-fasting finger stick blood draws measured total cholesterol (TC), triglycerides (TG), high- (HDL) and low-density lipoprotein (LDL) in mg/dl. Data were analyzed separately for women in the T2 and T3. Independent t-tests were used to determine whether mean lipid levels differed by current or pre-pregnancy smoking.

RESULTS: Among 2nd trimester women, 9 (19%) reported current smoking while 21 (45%) reported pre-pregnancy smoking. Five (18%) of 3rd trimester women were current smokers, while 11 (41%) smoked pre-pregnancy. There were no significant differences in lipid levels by pre-pregnancy or current smoking for 2nd or 3rd trimester women. However, TC, LDL and TG levels tended to be higher among current smokers in both trimesters, and these differences approached statistical significance when comparing TG levels for smokers in the 3rd trimester (mean: 254 mg/dl) to non-smokers (mean: 203 mg/dl, p-value = 0.08).

CONCLUSION: While our results were not significant, current smokers tended to have higher lipids, particularly in the 3rd trimester. This pilot study is limited by a small sample size, thus larger studies are warranted to see if the relationship between smoking and serum lipid levels during pregnancy shows significance. Future studies should examine how other health behaviors, like physical activity and diet, may also contribute to lipid changes during pregnancy.

2314 June 2, 4:30 PM - 4:45 PM Maternal Physical Activity during Pregnancy: Association With The Newborn’s Bone Health Michele Bisson1, Etienne Pronovost2, Odette St-Onge3, Julie Robitaille4, Isabelle Marc3, CHU de Québec-Université Laval, Québec, QC, Canada. 1INAF-Université Laval, Québec, QC, Canada. (Sponsor: Joseph Snodgrass, FACSM)
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(No relationships reported)

PURPOSE: Maternal physical activity during pregnancy influences infant’s birth weight and body composition, but its association with bone health has been poorly evaluated. This study aims at documenting in a longitudinal study the effect of objectively measured physical activity during pregnancy on infant’s bone mineral content (BMC) and density (BMD). METHODS: 7-day accelerometry recordings (Actigraph GT3X+®) were performed in low-risk pregnant women at 17 and 36 weeks of gestation. BMC and BMD were evaluated by DXA in mothers and infants within 2 weeks after birth. Sociodemographics, maternal lifestyle habits, pre-pregnancy physical activity, medical history and pregnancy outcomes were collected through interview and charts’ review. Mean counts per minute (CPM) and daily time spent at moderate and vigorous physical activity (MVPA) were calculated for each period from accelerometry content (BMC) and density (BMD).

RESULTS: Weir, FACSM)
Wisconsin Hospital and Clinic, Madison, WI.
(Sponsor: Joseph Snodgrass, FACSM)
Email: meyercam@msu.edu
(No relationships reported)

MWACS Abstract
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While serum lipid levels increase during pregnancy, excessively high lipids in mid-pregnancy are associated with adverse pregnancy outcomes. Smoking has been associated with adverse lipid profiles in non-pregnant adults, but this association has not been adequately explored during pregnancy.

PURPOSE: To examine relations between smoking and lipids among women in their second (T2) and third trimesters (T3).

METHODS: Seventy-eight gravida were recruited for a Midwest OB/GYN clinic. Women completed a questionnaire on health behaviors, which included current smoking (any/none) and pre-pregnancy smoking (any/none). Non-fasting finger stick blood draws measured total cholesterol (TC), triglycerides (TG), high- (HDL) and low-density lipoprotein (LDL) in mg/dl. Data were analyzed separately for women in the T2 and T3. Independent t-tests were used to determine whether mean lipid levels differed by current or pre-pregnancy smoking.

RESULTS: Among 2nd trimester women, 9 (19%) reported current smoking while 21 (45%) reported pre-pregnancy smoking. Five (18%) of 3rd trimester women were current smokers, while 11 (41%) smoked pre-pregnancy. There were no significant differences in lipid levels by pre-pregnancy or current smoking for 2nd or 3rd trimester women. However, TC, LDL and TG levels tended to be higher among current smokers in both trimesters, and these differences approached statistical significance when comparing TG levels for smokers in the 3rd trimester (mean: 254 mg/dl) to non-smokers (mean: 203 mg/dl, p-value = 0.08).

CONCLUSION: While our results were not significant, current smokers tended to have higher lipids, particularly in the 3rd trimester. This pilot study is limited by a small sample size, thus larger studies are warranted to see if the relationship between smoking and serum lipid levels during pregnancy shows significance. Future studies should examine how other health behaviors, like physical activity and diet, may also contribute to lipid changes during pregnancy.

Abstracts were prepared by the authors and printed as submitted.
Maternal obesity is associated with complications and adverse outcomes during labor and delivery. In pregnant women with a healthy body weight, maternal physical activity during pregnancy is associated with better obstetric outcomes (e.g. shorter labors, less incidence of surgical delivery); however, the effects of maternal physical activity during pregnancy on obstetric outcomes in obese women is not known.

**PURPOSE:** To determine the influence of self-reported physical activity on obstetric outcomes in pregnant obese women.

**METHODS:** A retrospective chart review was performed on 48 active obese women and 48 inactive obese women (N=96) who had a group meeting with a dietitian once during the pregnancy and twice during the postpartum period. The control group (n=122) received standard antenatal care. Self-rated health was assessed by a single question with five response options ranging from good (1) to poor (5). Baseline adjusted mean changes in self-rated health level were assessed using the mixed-model for repeated measure methods.

**RESULTS:** The baseline mean (SD) for self-rated health at baseline was 1.8 (0.8) in the intervention group and 2.1 (0.9) in the control group. Self-rated health changed over time across the six time-points (time effect p<0.001) and was poorest in the third trimester. There was a trend that self-rated health improved in the intervention group and 2.1 (0.9) in the control group. Self-rated health changed over time across the six time-points (time effect p<0.001) and was poorest in the third trimester.

**CONCLUSION:** Self-rated health level varied over time during pregnancy and the postpartum period but the lifestyle counseling intervention did not improve self-rated health when compared to the control group.
2321  June 2, 3:35 PM - 3:55 PM
Successful Treatment Of The Underlying Cause Of ITB Syndrome
Lindsay Troilo, Irene Davis, FACSM. Spaulding Outpatient Center Cambridge, Cambridge, MA. (Sponsor: Irene Davis, FACSM)

(History not reported)

HISTORY: Patient is a 28 yr. old female who developed pain at her L lateral knee at the end of a marathon. Pain persisted after the marathon and gradually extended to the hip and lateral thigh. She was treated with Active Release Therapy and foam rolling, as well as yoga to address her core strength. She returned to running with low-grade pain, which increased with more than 3-4 miles of running or an increase in her speed. Patient reported a VAS of 1/10 pain in the L hip and leg today, but symptoms will increase to a 7/10.

PHYSICAL EXAMINATION: Pain noted along the L iliac crest, gluteals, along the iliotibial band (ITB) down to Gerty’s tubercle. Weakness of her L hip extensors, abductors and external rotators was also noted. The patient presented with a (++) Ober’s test, L>R. During running, she presented with a contralateral hip drop L>R during mid stance. Patient also exhibited increased femoral adduction L>R. At the foot, she presented with pes planus, decreased ankle dorsiflexion and lack of intrinsic and extrinsic foot strength. This was associated with prolonged midfoot pronation. Patient landed with increased impacts L>R. Impacts were reduced by half when running with a forefoot strike pattern.

DIFFERENTIAL DIAGNOSIS:
Sciatica from lumbar spine, LCL strain

FINAL/WORKING DIAGNOSIS:
ITB syndrome, associated with abnormal foot and hip mechanics.

TREATMENT:
1. Hip strengthening with an emphasis on ITBs
2. Soft tissue mobilization of tight ITB, increase ROM of ankle dorsiflexors to reduce ground contact
3. Gait training to decrease contra-lateral hip drop, femoral adduction and foot pronation
4. Transition to a forefoot running pattern, in minimal footwear, to reduce impact loading as well as facilitate foot strengthening.

OUTCOME:
Hip adduction and foot pronation was reduced and patient was able to run for 3 miles pain-free at discharge.

2322  June 2, 4:05 PM - 4:25 PM
Thigh Compartment Syndrome in a Factor VII Deficient High School Football Player
Jeremy M. Burnham, Jessica McQuerry, Raymond Wright, Mary Lloyd Ireland, FACSM. University of Kentucky, Lexington, KY. (Sponsor: Mary Lloyd Ireland, FACSM)
Email: jeremy.burnham@uky.edu

(History not reported)

HISTORY: 16 year old male football player presented to the ER 1 week after sustaining a direct blow to his right thigh. He complained of increased thigh pain, difficulty bending his knee, and trouble sleeping. He reported that the pain had worsened steadily since the initial injury, with significantly increased pain in the last 12 hours. He denied any numbness or tingling.


DIFFERENTIAL DIAGNOSIS:
1. Delayed onset compartment syndrome
2. Thigh hematoma
3. Muscle strain
4. Fracture

TEST AND RESULTS:
1. Imaging: Plain films of the hip, femur, and knee showed no acute bony abnormalities. A CT scan of the thigh showed a large hematoma in the anterior compartment.
2. Labs: WBC and CBC within normal limits. INR was 1.6 and PTT was 33 (normal is 20-31)

FINAL WORKING DIAGNOSIS: Delayed onset thigh compartment syndrome due to a traumatic thigh hematoma and possible undiagnosed clotting abnormality.

2323  June 2, 4:15 PM - 4:35 PM
Thigh Pain-football
Joseph Edison1, Mark Rogers1, Anthony McPherron2, Kieith Doolan1, Matt Wallman1, Michael Polascik2, Matt O’Reilly3, Delmas Bolin, FACSM1.
1Virginia Tech/TCOM, Blacksburg, VA. 2Virginia Tech, Blacksburg, VA. 3YCOM, Blacksburg, VA. (Sponsor: Delmas Bolin, FACSM)

(History not reported)

HISTORY: 18 year old NCAA Division 1 football player presents with right quad pain during a scrimmage. The exact mechanism was unclear but review of video and witnesses shows he was tackled from behind. Right hip in extension with the knee in full flexion feeling a pop as he was falling back. Immediate pain in the Vastus Medialis Obliquus (VMO) region and he was unable to continue. Evaluation after practice and the following morning demonstrated worsening pain and swelling.

Past History includes high ankle sprain. No surgeries. Medications include Doxycycline for acne, Celecoxib and Hydrocodone-Acetaminophen for pain. Vital signs: BP 118/64, HR 62, weight 193 pounds, Height 5’11” General: Well developed, no acute distress. He had significant guarding. Right thigh marked tenderness to palpation over VMO, rectus femoris - quad tendon junction, and insertion of quad tendon at the superior pole of the patella. Patella stable with no apprehension sign. Negative patellar grind. No joint effusion. Joint was stable. Tolerates SLR; patient reports pain in the quad tendon, and VMO region. Neuro: No sensory deficits. Vascular intact and 2+ pulses.

DIFFERENTIAL Diagnosis
1. VMO tear
2. Quad tendon tear
3. Quad contusion
4. ACL tear
5. Patella Fracture
6. Patella Avulsion Fracture

Tests and Results
-Initial US shows edema and fluid in the VMO region, but the quad tendon itself was intact on its most superior aspect
-IFU US 24 hours post injury showed partial quad tendon and/or VMO tear
-MRI results showed a vertical quad tendon tear with horizontal involvement.

Final Diagnosis
1. Quad Tendon Tear

Treatment
1. Orthopedic consultation
2. Platelet Rich Plasma injection to tear
3. Placed in immobilizer - Initial mobilization to begin at 6 weeks
4. Sports specific rehabilitation beginning in 6 weeks

THURSDAY, JUNE 2, 2016
On exam he ambulates with right leg externally rotated and significant limp. There is no pelvic bony tenderness throughout. 4/5 strength right quadriceps and hamstring limited due to pain. Pain with active and passive range of motion of right ankle and knee. Tender to palpation of right thigh and right calf. Right thigh swollen and 4 cm greater than left. Right calf swollen and 2 cm greater than left. Non-pitting edema of the right ankle with 2+ posterior tibial pulse and 1+ dorsalis pedis pulse. Sensation and reflexes intact.

DIFFERENTIAL DIAGNOSIS:
Pelvic mass/space occupying lesion
DVT
Stress fracture femoral neck
Muscular strain

TEST AND RESULTS:
Radiographs of the pelvis, femur and tibia demonstrated no osseous abnormality.
Right lower extremity ultrasound demonstrated extensive occlusive venous thrombus extending from posterior tibia and peroneal veins to the level of the proximal superficial femoral vein and common femoral vein.

LAB STUDIES:
D-dimer > 50

FINAL WORKING DIAGNOSIS: Unprovoked DVT

TREATMENT AND OUTCOMES
He had catheter placement and TPA infusion in the right lower extremity for thrombolysis. The TPA was continued for 14 hours without any event and clot in the femoral vein resolved. He was transitioned enoxaparin subcutaneous for residual clot in below the knee. At two week follow up the ultrasound demonstrated full resolution of thrombus.

SUMMARY
Investigation for his spontaneous clot included inherited and acquired causes of thrombosis. Mildly low protein C levels were found. At 3 month follow up he remains on enoxaparin SQ, shows no signs of post-thrombotic syndrome, and is awaiting genetic testing PROC1 gene.

D-69 Clinical Case Slide - Oncology II
Thursday, June 2, 2016, 3:15 PM - 4:35 PM
Room: 202

2325 Chair: Benjamin Hasan. Northwest Community Hospital Medical Group, Arlington Heights, IL.
(No relationships reported)

2326 Discussant: Jeffrey M. Mjaanes, FACSM. Rush University Medical Center, Chicago, IL.
(No relationships reported)

2327 Discussant: David Smith. University of Minnesota, Minneapolis, MN.
(No relationships reported)

2328 June 2, 3:15 PM - 3:35 PM
Malignant Ovarian Tumor In A Tennis Pro: A Case Report
Donald L. Hoover, William R. VanWye, M. Laurie Branstetter. Western Kentucky University, Bowling Green, KY. (Sponsor: Alan E. Mikesky, FACSM)
Email: don.hoover.pt.phd@gmail.com
(No relationships reported)

HISTORY: A 12-year old male presented with right groin pain that started immediately after a quick cut during basketball. He felt a pop with immediate pain, localized to the proximal adductor. Pain improved after a week of rest but increased with return to basketball. Pain was worse with hip flexion and better with rest.

Physical Examination: Right hip: There was moderate tenderness along the proximal adductor muscle extending to the lesser trochanter but no tenderness over the ASIS, AIIS, greater trochanter or pubic symphysis. There was pain with active flexion, adduction and abduction and full passive ROM with flexion, internal rotation and external rotation. Strength was 5/5, except for 4+/5 with abduction. Log roll was negative. There was anterior pain with FABER and FADIR testing.

Differential Diagnosis:
1. Adductor strain
2. Avulsion fracture of the lesser trochanter
3. Slipped capital femoral epiphysis
4. Acetabular labral tear
5. Athletic pubalgia
6. Avascular necrosis of the femoral head/Legg-Calvé-Perthes Disease
7. Femoral neck stress fracture
8. Iliopsoas bursitis

Test and Results:
Right Hip Ultrasound:
• Small area of hypoechogenicity in the proximal adductor musculotendinous unit
• Right Hip/Pelvis X-ray:
• Sclerosis of medial intertrochanteric region of the right femur
• MRI with and without contrast to evaluate cystic lesion

Whole Body Nuclear Bone Scan:
• Increased uptake in the bilateral long bones

MRT Right Hip
• Multilocular regions of intramedullary signal abnormality involving bilateral proximal femurs
• Lobulated fluid signal lesion within the right posterior acetabular column/ischium
• No bone marrow edema, stress fracture or reaction, or soft tissue injury

Final/Working Diagnosis:
Right Proximal Adductor Strain with underlying Polyostotic Fibrous Dysplasia

Treatment and Outcomes:
1. Labs showed elevated Alkaline Phosphatase, normal PTH and Calcium
2. Referral to Orthopedic Oncology
3. Biopsy confirmed Polyostotic Fibrous Dysplasia
4. MRI with and without contrast to evaluate cystic lesion
5. Endocrinology evaluation
6. Physical Therapy

Outcome - Five weeks after initial visit, patient was pain free and cleared to return to sport with Orthopedic Oncology and Endocrinology follow up.
A 33-year-old healthy female runner presents to clinic with concerns of a lump on her left thigh. She initially noticed a small, painless lump two years ago. She saw her primary care physician who told her to observe closely and notify him if any growth or pain. She did not notice any changes until two months ago when she was unable to set her foot on the ground at a movie theatre secondary to pain in her leg. She felt her thigh and noticed the lump was larger. She had also intentionally lost ten pounds over the last several months, which had made the lump more prominent. She currently has intermittent aching pain. She has had to cease all running due to pain in the thigh. She denies numbness, tingling, fevers, chills or sweats. She has no medical history, takes no medications and has no family history of cancer.

PHYSICAL EXAMINATION:
Well appearing female. 5’7” and 150 lbs. Normal vital signs. There is a palpable firm, non-mobile, non-tender mass along the medial aspect of her proximal left thigh. The mass can be traced posteriorly to lateral aspect of the mid-thigh. No warmth or erythema. Full hip range of motion, negative FADIR/FABER tests and normal straight leg raise. No pain with any resisted motions of hip and knee, except for minimal discomfort with hamstring strength testing. She has a normal sensation to light touch and 2+ peripheral pulses throughout. Skin exam is normal.

DIFFERENTIAL DIAGNOSIS:
1. Tumor: Malignant (i.e. rhabdomyosarcoma, liposarcoma) vs Benign (i.e.rhabdomyoma, lipoma)
2. Chronic Muscle Tear
3. Abscess

TEST AND RESULTS:
AP and Lateral Radiographs of Left Femur:
— No bony abnormalities. The mass is visible in the soft tissue.
MRI w/ & w/o Contrast of Left Femur:
— Ill-defined cerebrof ross appearing mass in deep medial compartment of the thigh deep to the semimembranosus and semitendinosus.
— 18.0 x 13.0 x 10.5 cm in the CC, TV and AP dimensions, respectively
— Heterogeneous enhancement and multiple central areas of necrosis
— Adjacent femur with no periosteal reaction or narrow abnormalities

Tissue Biopsy: Myxoid Liposarcoma

FINAL WORKING DIAGNOSIS:
Myxoid Liposarcoma, left thigh

TREATMENT AND OUTCOMES:
1. Referred to Orthopedic Oncology
2. Beginning chemotherapy followed by radiation therapy, then surgical resection
3. Further outcome pending

A 34-year-old woman has severe back and radiating right leg pain applied to our clinic. This was the second time coming to our clinic. When she came fist, she applied with back and radiating pain to both legs. As to Magnetic Resonance Imaging (MRI) she had tear of annulus lomber 4 and 5 level intervertebral disc and severely bilateral lowered neural canal. A large, posterior median and right paramedian extrude disc protrusion was seen at L5-S1 level. At this level bilateral nerve canal narrowed and right S1 nerve root was compressed. After 21 sessions of non-invasive spinal decompression therapy applied, her pain was over. One week ago, after she weighted heavy bags, she felt back pain again.

PHYSICAL EXAMINATION: Paravertebral and right quadratus lumborum muscle spasm were palpated. Straight leg raise test were positive at 60° on right side. Valleeix sign was positive on right sciatic nerve. There was no strenght and sensorial deficit. Lumbar lordosis decreased and lumbar “C” shaped scoliosis were noted.

DIFFERENTIAL DIAGNOSIS:
Strain of lumbar paravertebral muscles
Radiating pain
Positive sciatic nerve provocation test

TEST AND RESULTS:
Lumbar spine T1 and T2 weighted MRI:
— Posterior protrusion and annular tear at lumbar 4-5 level (annular tear and protrusion still exists)
− Broad-based posterocentral and right posterolateral transligamentous extrude herniation (extrude fragment's volume decreased from 12 mm to 8 mm comparing the first MRI)

**FINAL WORKING DIAGNOSIS:**
Lumbar Disc Herniation (L5-S1 and L4-L5 level)

**TREATMENT AND OUTCOMES**
− 21 sessions of Non-invasive Spinal Decompression Therapy conservative protocol applied.
− During the first two weeks of therapy, lumbar orthoses was used to stabilization.
− Physiotherapist guided lumbar stabilization exercise applied to prevent reherniation (after non-invasive spinal decompression therapy was over).
− Advanced lumbar stabilization exercised taught as home programme.
− After therapy she has painless straight leg raise test and no radiating pain.

### THURSDAY, JUNE 2, 2016

#### 2335

**June 2, 3:35 PM - 3:55 PM**

**Sacrum Injury**
Email: ozlemulger@yahoo.com
(No relationships reported)

Özlem Ülger, Aynur Demirel, Altan Şahin, Hacettepe University, Ankara, Turkey
e-mail: ozlemulger@yahoo.com
(Sponsor: FACSM)

**HISTORY:** A 44-year-old secretary fell down from 4 meter above from the ground. After detailed physical and neurologic examination she had fixation operation due to fracture of left sacrum and pubic bones. While staying at the hospital, she had an decubitus ulceration on left sacroiliac joint and posterior inferior iliac spine. In spite of decubitus ulceration needed flapping, she rejected operatively treatment. After decubitus ulceration healed itself, she had pain on right side of sacrum and she had an corticostreoid injection on right sacroiliac joint. After injection, pain decreased but still exists.

**PHYSICAL EXAMINATION:** Examination of paravertebral muscles and T12-L5 spinos processes pain and moderate tenderness detected. There was no numbness, allodynia and reflex deficits. Both flexion and extension movements of back were painful. Active lumbar flexion, her hands reached knee level. She could not sit symetrically. When she sits longer than ten minutes, she felt severe pain on sacrum.

**DIFFERENTIAL DIAGNOSIS**
- Strain of paravertebral, piriformis and Quadratus Lumborum muscles.
- Sacroiliac dysfunction
- Facet Joint Syndrome

**TEST AND RESULTS**
- Special provocation tests for sacroiliac joint
- Lumbar facet Joint stress tests
- Pressure Pain Thresholds
- Back Performance Scale

**Treatment and Outcomes**
- Myofascial releasing technics applied to muscles and thoracolomber fascia.
- Post-isometric relaxation technics for Piriformis and Quadratus Lumborum muscles on right side.
- Physiotherapist guided lumbar stabilization exercise
- Kinesiotaping application for scar tissue on decubitus ulceration area.
- After 4 months later she had painless sitting, standing and walking abilities.

### 2336

**June 2, 3:55 PM - 4:15 PM**

**A High School Football Player with Mid-back Pain**
Nancy Vuong, Melody Hrubes, Terry Nicola, FACSM.
University of Illinois at Chicago, Chicago, IL. (Sponsor: Terry Nicola, MD, FACSM)
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(No relationships reported)

**A High School Football Player with Mid-back Pain**

**History:**
AR is a 17-year-old football player with mid back pain for the past two years. The pain began after he was thrown onto his back during a tackle, with the opposing player landing on top of his chest. He had some initial coughing that resolved within minutes and was able to complete the game. The pain started a few hours later. Since then AR has had intermittent episodes of achy dull pain that worsens with prolonged sitting and exercise. He denies any tingling, numbness, or weakness. He also denies any shortness of breath, coughing, or wheezing. AR has been able to continue playing football despite the pain.

**Physical Examination:**
Exam reveals normal respiratory effort with lungs clear to auscultation. Spine range of motion is full. There is no tenderness over the spinous processes. There are multiple taut bands palpable along the thoracic paraspinals that reproduce pain. Neurological testing is otherwise normal for gait, strength, sensation, and reflexes.

**Differential Diagnosis:**
1. Myofascial pain/thoracic paraspinal strain
2. Occult thoracic vertebral body fracture
3. Thoracic facet fracture

**Tests and Results:**
- T-spine XR
- No evidence of fracture.
- T-spine MRI
- Healed but displaced left medial T5 rib fracture with exuberant callus producing a pseudoarthrosis with a healed left T6 medial rib fracture.
- Indentation of the left posterior lung pleura by exuberant callus with atelectasis.
- T-spine CT
- Unhealed bone callus along medial portion of the left T5 creating a pseudoarthrosis with the 6th rib, indenting the pleura.

**Final Working Diagnosis:**
Healed 5th and 6th rib fractures with hyperostosis resulting in a pseudoarthrosis and pleural effacement.

**Treatment and Outcomes:**
1. Physical therapy with focus on costovertebral and thoracic vertebral joint mobilization.
2. Deep breathing techniques and monitoring for respiratory symptoms.
3. Return to full contact play.

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**Back Pain in a Lacrosse Player**
Ashley D. Zapf, Kevin R. Vincent, FACSM. University of Florida, Gainesville, FL. (Sponsor: Dr. Kevin R. Vincent, FACSM)

(No relationships reported)

**History:**
A 14yo male lacrosse player presented to sports medicine clinic with an acute exacerbation of chronic low back pain. The pain had originally started several years prior without inciting event or trauma. The patient had noted worsening of his back pain while participating in a lacrosse tournament 3 months earlier. In particular, he noticed pain during during hard overhead lacrosse shots. His back pain improved with rest after the tournament, however, he had a persistent “tightness” along the bilateral lumbar paraspinal muscles.

**Physical Exam:**
Examination revealed mild hypertonicity and tenderness to palpation of the bilateral lumbar paraspinal muscles. The remainder of the examination was normal.

**Differential Diagnosis:**
1. Lumbar Strain
2. Spondylolysis
3. Spondylolystes
4. Spondylolthesis
5. Sacroiliitis

**Test and Results:**
X-Ray of the Lumbar Spine revealed a subacute ring apophysis fracture of the superior endplate of the L4 vertebral body anteriorly with similar changes in the inferior endplates of L1 and L2 anteriorly.
MRI of the Lumbar Spine revealed a subacute superior L4 apophyseal ring fracture, and irregularity of multiple additional endplates (T11, T12, L1, L2, and L3 with Schmor's node) reflecting chronic ring fractures or anatomic variants. Final/Working Diagnosis: Juvenile Disc Disorder

Treatment and Outcomes

The patient was started in a physical therapy program for strengthening of the spine and core. The athlete was instructed on the importance of maintaining these exercises and the need for symptomatic rest, as he will likely encounter intermittent episodes of lumbar back pain throughout his life. Neither bracing nor surgery were required, as the patient did not have Scheuermann's Kyphosis.

The athlete completed a physical therapy program, and was able to return to full play in lacrosse. He has remained asymptomatic during play, including participation in several lacrosse tournaments. Radiographic imaging helped differentiate this athlete's back pain from a common lumbar strain. Further advanced imaging with MRI demonstrated that a new lesion and end plate compression which coincided with his most recent exacerbation of pain. The imaging modalities in this case helped expedite proper diagnosis and treatment, allowing the athlete to return to play in a safe and timely manner.

PURPOSE: Helmets have been redesigned to reduce the incidence of concussion in sports, but research has shown that even newer helmets are ineffective at preventing concussions. We propose a novel device, worn around the neck, as a solution to reduce concussions in sport. The collar causes mild jugular vein compression, which may be a protective mechanism against change in BNA score than subjects who did not wear the collar. These data support the contention that mild jugular vein compression may be a protective mechanism against concussion while playing ice hockey exhibited changes in their EEG data, as measured by BNA assessment; Helmet sensors were used to collect head impact and acceleration data. Randomized clinical trial. Subjects underwent pre-season and mid-season EEG visits following ACLR, bilateral strength (quadriceps, hamstrings, hip abductor, and hip extensor), Y-balance (anterior, postero-lateral, and postero-medial reach), and hop (single, triple, cross-over, and timed hops) tests were assessed from adolescent males. Differences between ACLR and uninvolved limb was compared using paired t-tests. The deficits were further compared among graft types with analysis of covariance (ANCOVA) including demographics (height, weight, and age) and meniscus tear differences.

RESULTS: A total of 71 male ACLR patients (mean age: 16.7±2.7 years) participated in a prospective, visual-based dual task paradigms- which negate the effectiveness of compensatory strategies and help clinicians to identify athletes with SRC and monitor recovery from SRC.

Previous research indicates that dual task paradigms- which negate the effectiveness of compensatory strategies- may augment current single task (e.g., balance only, cognitive only) assessments of athletes with SRC. However, most dual task paradigms employ auditory-cognitive stimuli that may not sufficiently disrupt compensatory strategies.

Purpose: To compare athletes with SRC to matched healthy controls on a novel, visual-based, cognitive-balance dual task paradigm and commonly used symptom reports and assessments of balance, cognitive, vestibular, and ocular motor impairment.

Methods: A prospective, case control design was used to compare 21 athletes with SRC (8-F, aged 15.2 ± 1.8 years) to 11 healthy age/sex-matched controls (4-F, aged 15.2 ± 2.7 years). Participants completed a visual, cognitive-balance dual task- involving incongruent stimuli/response-patterns and Balance Error Scoring System (BESS) with force plate data. Immediate Post-concussion Assessment and Cognitive Test (ImpACT); Post-concussion Symptom Scale (PCSS); and Vestibular and Ocular Motor Screening (VOMS) tool with near-point convergence (NPC) distance. Athletes with SRC were tested at 1-10 and 11-21 days post-injury. Controls were tested once.

Independent samples t-tests were used to examine differences between groups, and dependent samples t-tests were used to examine change from 1-10 to 11-21 days post-injury. Statistical significance was set at a p < .05 (Bonferroni-corrected).

Results: Results revealed worse scores in concussed athletes for the incongruent component of the dual task (p=.03), PCSS (p=.001), visual memory (p=.05), reaction time (p=.05), VOMS (p=.001), and NPC (p=.02). Balance performance on BESS and during the dual task was consistent between groups. Results supported slower performance (57.3 to 44.9 ms) from 1-10 to 11-21 days on the incongruent component of the dual task (p=.01), in spite of improvements (p=.05) on PCSS, ImpACT, and VOMS.

Conclusions: An incongruent visual, cognitive dual-task detected persistent deficits at 11-21 days post injury when other measures demonstrated improvements. Visual-based dual task paradigms involving incongruent stimuli-responses patterns may negate compensatory strategies and help clinicians to identify athletes with SRC and monitor recovery from SRC.
 safe return to sports, especially BTB and HS graft types. Rehabilitative emphasis need be placed on optimal physical and functional development, particularly in muscle groups involving donor sites.

2350  Board #4
Effects of Sports Specialization on the Rates of Iliotibial Band Syndrome in Pediatric Athletes
Sarah S. Jackson, Dai Sugimoto, David R. Howell, William P. Meehan, III, Andrea Stracciolini, FACSM. Boston Children's Hospital, Boston, MA. (Sponsor: Pierre d'Hemecourt, FACSM) (No relationships reported)

Sports specialization has recently been defined as participation in year round intensive training in a single sport at the exclusion of all other sports. Studies suggest an increased risk of overuse injuries among athletes who are specialized to a single sport when compared to multisport athletes. The effect of sports specialization on rate of specific injuries such as iliotibial band (ITB) syndrome has not been reported.

PURPOSE: To examine the effect of sports specialization on rates of ITB syndrome history in pediatric athletes.

METHODS: In this cross-sectional study, participants completed electronic questionnaires describing their current sport participation and previous injury history (N=549). Participants were categorized into three groups: those that participated in 1, 2, or 3 sports throughout the year. The proportions of athletes with a history of ITB syndrome were compared between the three groups using a chi-square analysis.

RESULTS: 18 ITB cases were reported (mean age of athletes = 15.2±1.9 years). The mean age in which athletes reported beginning organized sport(s) participation was;
1 sport athletes: 5.5±2.3 years, 2 sport athletes: 5.7±2.5 years, and 3 sport athletes: 5.1±1.8 years. Thus, the athletes participated in organized sport(s) for approximately 10 years. A higher proportion of 1 sport athlete reported a history of ITB syndrome than 3 sport athletes (9% vs. 2%, p=0.045). No significant differences in the proportion of ITB cases were found between 1 and 2 sport athletes (p=0.294) or between 2 and 3 athletes (p=0.707).

CONCLUSION: Pediatric athletes who participate in a single sport reported a higher proportion of history of ITB syndrome when compared to multiple sport athletes. The findings of this study support the notion that training in a single sport place pediatric athletes at an increased risk for overuse injuries. Future research is needed to evaluate the effect of sports specialization on other musculoskeletal injuries in pediatric athletes.

2351  Board #5
The Incidence of Osteochondritis Dissecans in Adolescents Complaining of Chronic Anterior Knee Pain
James MacKenzie¹, Michael Shadrer², Carla Boan¹, Jeffrey Vaughn¹. University of Arizona Medical School-Phoenix, Phoenix, AZ. (Sponsor: Pierre d'Hemecourt, FACSM) (No relationships reported)

PURPOSE: Osteochondritis dissecans (OCD) is a rare condition in which avascular necrosis of subchondral bone may lead to fragmentation of the avascular portion commonly into the joint space. OCD can progress to become crippling for adolescents and may require multiple surgeries. If detected in a timely manner, conservative treatment may be utilized to prevent considerable morbidity. We hypothesized that OCD has a high prevalence in pediatric orthopaedic patients complaining of chronic anterior knee pain without inciting trauma. We also hypothesized that 4 view x-ray screening in these patients is an effective diagnostic technique for OCD.

METHODS: This was a retrospective chart review. The inclusion criteria consisted of chronic anterior knee pain (greater than two weeks) without causal trauma. Charts from 2009 through 2010 were reviewed. It is standard practice in this clinic to use 4-view radiographs to assess these patients (anteroposterior, lateral, tunnel, and sunrise views). We reviewed radiographs, clinical notes, and demographic data.

RESULTS: A total of 134 pediatric patients between the ages of 5-18 were identified over the two year period. Four-view screening radiographs were performed on all 134 patients. Of the 134 patients, 10 were identified and diagnosed with OCD (7.5%). Of the diagnoses were in female subjects (9.5% incidence), while 3 were in males (5%). The lesion was in the medial femoral condyle in 7 patients, the lateral femoral condyle in 2, and the patella in one.

CONCLUSIONS: This study demonstrates that the incidence of OCD in pediatric patients with chronic anterior knee pain without causative trauma was considerably higher than that of the general adolescent or adult population. The elevated incidence of OCD in this subset of pediatric patients and the importance of its early diagnosis supports the use of four view radiographs in these patients. Failure to identify OCD in its early stages can allow the lesion to progress, with a potentially more invasive treatment and poorer prognosis.

2352  Board #6
A Prospective Examination Of Abnormal Menstrual Patterns In Adolescent Female Athletes Following Concussion
Meredith L. Snoon¹, Luke C. Henry², Joseph S. Sanfilippo¹, Anthony J. Zelzni¹, Anthony P. Kontos². Magee-Womens Hospital of UPMC, Pittsburgh, PA. UPMC Sports Concussion Program, Pittsburgh, PA. (Sponsor: Barbara Warren, FACSM) (No relationships reported)

Retrospective studies suggest that brain injury may interrupt menstrual patterns in adult women via its effects on hypothalamic-pituitary function. Investigators have yet to evaluate the effects of concussion on menstrual patterns in adolescent athletes. Accordingly, menstrual status is not routinely assessed or managed following a concussion.

PURPOSE: To prospectively compare menstrual bleeding patterns of adolescent athletes with a sport-related concussion (SRC) to those with an orthopaedic sport-related injury during the first 120 days following injury.

METHODS: Female athletes ages 13-21 years with either a SRC (n=58) or orthopaedic sport-related injury (n=34) who presented to a concussion or sports medicine clinic within 30 days of injury were enrolled. Inclusion criteria included: greater than two years from menarche, regular menses, no use of hormonal contraception. Menstrual patterns were assessed for 120 days post-injury using a weekly text message link to an online survey inquiring about bleeding episodes each week. Response rate was 94% across all weeks. Abnormal menstrual patterns were defined by intermenstrual interval < 21 (short) or > 35 (long) days, or bleeding duration <3 days.

RESULTS: A significantly higher proportion of menstrual patterns were abnormal following SRC (47/237, 19.8%) than orthopaedic sport-related injury (20/163, 12.3%) (OR 1.77, 95% CI 1.00-3.12, p=0.047). Although a prolonged intermenstrual interval was the most common abnormality observed (49/67, 73.1%), menstrual patterns were 5 times more likely to be short following SRC (OR 5.05, 95% CI 1.13-22.5, p=0.019). Female athletes with SRC were over 10 times more likely to have two or more abnormal bleeding patterns following injury (OR 10.5, 95% CI 1.13-59.69, p=0.008). Among athletes with SRC, initial signs/symptoms of injury severity, neurocognitive testing, and vestibular/ocular screening were not predictive of abnormal menstrual patterns.

CONCLUSIONS: Adolescent female athletes were at increased risk for abnormal menstrual patterns following SRC. Because abnormal menstrual patterns are likely associated with disruptions in ovarian estrogen production, monitoring menstrual patterns following SRC is warranted in order to avoid potential consequences of estrogen deficit.

2353  Board #7
Bilateral Leg Pain in a 15 Year Old Runner
Melissa Roscher, David Stone. University of Pittsburgh Medical Center, Pittsburgh, PA. (No relationships reported)

HISTORY
A 15 year old female complained of bilateral posterior lower leg pain and paresthesias during running that resolved with rest. Symptoms occurred during track and soccer but not between seasons. Her PCP suggested a stretching program and adding salt to her Gatorade. Work up showed an abnormal ankle-brachial index and mildly elevated ESR.

PHYSICAL EXAM
In our clinic, she had mild tenderness of the posterior tibia and deep compartments of the lower legs, as well as pain with stretch of the anterior compartments bilaterally. Ankle musculature was diffusely weak with paresthesias in the feet during dorsiflexion of the lower legs, as well as pain with stretch of the anterior compartments bilaterally.

DIFFERENTIAL DIAGNOSIS
Hamstring/Calf Strain, Exertional Compartment Syndrome, Popliteal Artery Entrapment, Medial Tibial Stress Reaction

TESTS AND RESULTS
Arterial Dopplers: No popliteal entrapment. Small thrombus at the left distal superficial femoral artery at the adductor canal CTA Left leg: Occlusion of the distal superficial femoral artery with associated thrombus. Multiple collaterals. With plantar flexion, narrowing of the popliteal artery due to displacement of the popliteal artery from hyper trophy of the medial gastrocnemius CTA Right leg: Normal vasculature at rest. With plantar flexion, narrowing of the infragenicular popliteal artery between the gastrocnemius heads. Placement of the supra genicular popliteal artery due to hypertrophy of the medial gastrocnemius CT Knees: Hypertrophy of both medial gastrocnemius displacing the popliteal arteries. Occlusion of the proximal Right popliteal artery Factor V Leiden, antithrombin, fibrinogen, prothrombin, thrombin, factor VIII, protein C/S WNL.
D-dimer elevated; hexagonal lipid neutralization (LAC), anticardiolipin IgG/IgM
POSITIVE
Pathology: Vascular tissue with organizing thrombus
TREATMENT AND OUTCOMES
Left superficial femoral to popliteal artery bypass with transection of the Left adductor hiatus by Vascular Surgery
Release of the Right superficial femoral artery by division of the Right adductor magnus
Treated with daily aspirin
Returned to competitive soccer in 4 months
FINAL DIAGNOSIS
Bilateral Exertional Compartment Syndrome due to Arterial Thrombus and Compression

2354 Board #8
A Rare Cause of Progressive Paresthesias, Cramps, Fasciculations and Weakness in a Collegiate Volleyball Player
James Presley, Stephen Wisniewski. Mayo Clinic, Rochester, MN.
(No relationships reported)

HISTORY:
A 21 year old female collegiate volleyball player presented with exertional paresthesias involving her cheeks, lips and chest. Her symptoms evolved to include twitching, stiffness and cramping of the thighs and calves, which forced discontinuation of participation in volleyball. She went on to develop upper extremity cramping and abnormal posturing of her hands, even at rest. She noticed symmetric hypertrophy of her calves and quadriceps muscles and increased sweating and salivation. Her cramping and leg stiffness worsened to the point that she needed aid of a walker for ambulation.

PHYSICAL EXAMINATION:
General medical exam was unremarkable. Her quadriceps and calves seemed abnormally muscular for body habitus. Movements of the upper and lower limbs were slow and stiff with visible cramping of calf and quadriceps muscles with activation. Neurological exam showed diminished reflexes. Strength testing was difficult due to non-painful muscle cramps with isolated testing of muscles. Sensation was normal.

DIFFERENTIAL DIAGNOSIS:
1) Myotonia (DM1, DM2)/Neuromyotonia
2) Diffuse Myopathy
3) Multiple Sclerosis
4) Peripheral Neuropathy

TEST AND RESULTS:
MRI brain and cervical spine:
- No evidence of demyelination, inflammation, or infarction
EMG:
- Nearly persistent motor unit activity in upper and lower limb muscles with spontaneous, iterative, high frequency discharges consistent with neuromyotonia
Laboratory Testing:
- Blood tests for hereditary and acquired causes of myotonia/neuromyotonia were inconclusive
PET Scan/MRI:
- Showed focal, hypermetabolic activity in the thymus with two peripherally enhancing soft tissue nodules

FINAL WORKING DIAGNOSIS:
Hodgkin’s Lymphoma with presentation of paraneoplastic neuromyotonia (Isaac’s Syndrome)

TREATMENT AND OUTCOMES:
1. Intravenous immunoglobulin was poorly tolerated with no clear benefit.
2. Gabapentin and mexiletine were started as membrane stabilizing agents with significant improvement in symptoms.
3. With imaging findings concerning for neoplasm, anterior mediastinal mass resection with total thymectomy was performed.
4. Surgical pathology showed interfollicular Hodgkin’s lymphoma with no abnormality in the thymus.
5. The patient recovered well from surgery, reports 80% improvement in symptoms and is exercising consistently

PE: Pox 99%, HR 104, lungs CTAB but shallow. Abdomen: BS (+), TTP LUQ, no mass or rebound. Kehr’s sign (+). Evaluated in ER and released. Next morning: c/o LUQ and suprapubic pain, did not sleep well. Appetite and urination decreased, no N/V; afrelebi; HR 90-100, BP 128/74, Pox 98%. Waves of diaphoresis; TTP suprapubic and LUQ areas. BS (+), no rebound. No rash or bruising. That afternoon: continued pain and urine retention; diaphoretic and intermittently pale with BP 148/94, HR 100, Pox 96%, afrelebi, shallow breathing due to pain.
- DD:
  1. Rib fracture
  2. Splenic injury
  3. Pancreatic injury
  4. Small bowel injury
  5. Traumatic ileus
  6. Renal trauma
  7. Left lung injury
  8. Retroperitoneal hemorrhage
TESTS/RESULTS:
- US fast scan - WNL
- Istat - Hgb and Cr WNL
- Stat CT abd - only showed 12th rib fracture

FINAL/WORKING Dx:
Jejunum perforation
Tx OUTCOMES:
1. Transported to the ER. Fast scan US was normal. CT scan showed 12th rib fracture. Given IV dilauid, toradol, Percocet for overnight pain.
2. Next morning reported urinary retention and decreased appetite which he felt due to the medication. Had an US which showed full bladder and no splenic injury.
3. D/c meds and gave IM toradol and PO tramadol for the pain.
4. No improvement and was admitted to the hospital for IV hydration and pain control, further lab testing, observation.
5. Pain continued into the night. Labs showed increased pancreatic enzymes and CPK. CXR and AAS showed B pleural effusion and possible free air under diaphragm.
6. Local surgeon consulted did not think there was free air but concerned with pancreatic injury.
7. Transferred to tertiary care center.
8. Observed in the ICU for a day and started declining in status. An MR cholangiogram ordered to evaluate the pancreatic duct but stopped due to the presence of free air.
9. Emergent exploratory laparotomy showed a jejunum perforation. Resected and repaired.
10. Two days postop, taken back to OR for a leak at the repair site.
11. Small abscess developed under the diaphragm; treated percutaneously.
12. Currently doing great. Working out at pre-injury levels.

2356 Board #10
Decline Of Function And Weakness In A Special Olympian With Trisomy 21
Brennan J. Boettcher, Jeffrey A. Strommen. Mayo Clinic, Rochester, MN. (Sponsor: Karen L. Newcomer-Aney, FACSM)
(No relationships reported)

HISTORY: A 46 year-old gold medalist Special Olympian in softball, basketball and swimming presented in February 2013 to his local care provider with right leg weakness. He did not undergo any further diagnostics or treatment initially. In March he began to fall and became dependent on a walker for ambulation. Subsequent evaluation felt as if his decline in function was related to knee osteoarthritis which was symptomatically treated with injections of corticosteroid x 2 in the right knee. By June, the patient was requiring his arms to help pull himself up stairs to get into his apartment. He once again presented for further evaluation.

PHYSICAL EXAMINATION: Muscle Strength (L/R, scale 0-5):
- Iliopsoas 3/4; Adductors 4/4; Adductors 4/4; Knee Extension 1/3; Knee Flexion 1/3; Dorsiflexion 1/3; Plantarflexion 5/5. Upper limb strength was normal.
- Reflexes (Scale 0-4) were hypoactive but symmetric in the upper extremities at +1; Patellar were +3; Ankle reflexes were +4 bilaterally with sustained clonus. Blood pressure was 128/66. Moderate vibration and proprioception deficits at the bilateral MTP joints.
- Able to ambulate but locked his knees for stability.

DIFFERENTIAL DIAGNOSIS: Extramaleular compression of cord (tumor or infection)
Intramaleular tumor or infection
Spinal stenosis
Transverse Myelitis
Central Nervous System Demyelinating Syndrome
Paraneoplastic Syndrome
Vascular Malformation

TEST AND RESULTS: An MRI was obtained and an intramaleular T2-T3 spinal cord lesion was noted. He was transferred to Mayo Clinic after a short rehabilitation course locally for further treatment and workup. A short trial of IV
steroids decreased his weakness, but this returned quickly after discontinuation. Based on imaging findings and steroid responsiveness, neurosarcoidosis was felt to be the most likely diagnosis.

FINAL WORKING DIAGNOSIS: T2-3 neurosarcoidosis with myelopathy

TREATMENT AND OUTCOMES: 1- Treatment with prednisone 60 mg daily
2- Inpatient rehabilitation- 3 hours of PT/OT 5 days/week
3- Continues on prednisone taper at 14 months following discharge, down to 6 mg daily.
4- He continues to attend physical therapy sessions regularly.
5- At his 1 year followup, patient is back to living independently with his wife.

Some weakness persists; he remains unable to participate in Special Olympics.

2357 Board #11
Quantification Of Physical Activity As An Exercise Vital Sign In A Pediatric Population

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(No relationships reported)

PURPOSE
Physical inactivity has become an increasing problem in our youth today and physical inactivity is an important independent factor in the development of chronic disease. Conversely, there is a rise in overuse injuries due to children specializing in sports earlier in their youth. The exercise recommendations by the American Academy of Pediatrics are 60 minutes of moderate to vigorous activity for all school aged youth daily, but research is limited to how many children actually meet these requirements. The goal of the survey was to quantify days, minutes, and exercise activity type of those presenting with an injury to a sports medicine clinic.

METHODS
All new patients presenting to outpatient sports medicine clinic were asked questions about their current exercise habits. Subjects self-reported the number of days per week, and minutes per day of moderate to vigorous activity. Moderate activity was described as sweating. Vigorous activity was described as breathlessness. Additionally subjects self-reported current activity participation in organized or unorganized activity.

RESULTS
120 subjects consisting of 50 males and 70 females responded to the survey. The mean age of respondents was 13.2 ±2.8 years. Mean days of exercise reported were 4 ±1.6 days. Mean minutes of daily exercise reported was 91.4±42.7 minutes. Mean minutes per week of exercise reported was 450.7±290.0 minutes. Mean activities responded per week was 2.35±1.2.

CONCLUSION
The questions provided a screening and quantified activity type, amount, and duration for children presenting to outpatient Sports Medicine clinic for a musculoskeletal complaint. The data gathered in this study demonstrate children are not meeting the daily exercise recommendation. Rather, this population exercised on fewer days with greater than 60 minutes of MVPA. 20% (24) of subjects reported greater than 150 minutes per day MVPA. The high volume training per session is a risk factor for musculoskeletal injury. 52% (63) of these subjects met the minutes per week recommended, and this cohort consists of organized sport participants. Currently, these screening questions serve as forum to discuss activity type, duration, and length as well as council patients on appropriate exercise habits.