Improving physical performance of athletes is an important goal to succeed in sports achievements. Aging influences both body composition and results in a decline in maximal oxygen consumption (VO2max). This decline results from several factors, including increased body fat and reduced maximal cardiac output. Sex differences in age-related decline in VO2max and lean body mass (LBM) in Masters Athletes is still not fully understood. PURPOSE: To examine the sex differences in the age-related decline in VO2max and LBM in Masters Athletes. METHODS: A total of 26 master athletes (females: n=14, males: n=12), 26 to 60 years of age, participated in this cross-sectional study. VO2max was determined via Vmax Encore metabolic system. Lean body mass was evaluated by dual energy X-ray absorptiometry (DXA). RESULTS: There were no significant differences in VO2max (40.1±8.7 and 38.2±12.1 mL/kg/minute) (t (24) = 1.29, P = 0.208) and age (36.5±5.4 and 41.4±9.1 years) (t (24) = -0.784, P = 0.441) between males and females, respectively. Males had a significantly greater LBM than females (t (24) = 5.59, P = 0.000) (61.7±8.1 kg and 44.2±6.9, respectively). For males, there was a significant correlation between age and VO2max (r = -0.31, P = 0.32), age and LBM (r = -0.23, P = 0.47), or VO2max and LBM (r = 0.04, P = 0.89). For females, there was a significant negative correlation between age and VO2max (r = -0.603, P = 0.02), but no significant correlations were found between age and LBM (r = -0.244, P = 0.40) and VO2max and LBM (r = 0.121, P = 0.68). There was not a significant age-related decline in VO2max in males and females (r² = 0.04, P = 0.36, respectively) or in LBM (r² = 0.05, P = 0.06, respectively). CONCLUSION: Although there were declines in VO2max in both men and women, these age-related declines were not significant. In addition, age-related declines in LBM were not significant in this sample of Masters Athletes. These represent data from an unfunded research project.

Increased visceral adipose tissue (VAT) is strongly associated with insulin resistance and cardiometabolic diseases. It is difficult to separate subcutaneous from visceral adipose tissue using standard body composition techniques, but recently dual energy x-ray absorptiometry (DXA) has emerged as a method to quantify VAT. PURPOSE: The objective of the current study was to assess the correlation between VAT derived from DXA and multi-slice magnetic resonance imaging. METHODS: Twenty-two pairs of DXA and MRI scans were obtained from obese participants with metabolic syndrome. All matched DXA and MRI scans were completed within 72 hours of each other. VAT was imaged using both 3T MRI scanner and DXA. MRI VAT calculation was estimated via a novel program which automatically segments and measures VAT as well as subcutaneous adipose tissue. Pearson product moment correlations were assessed to determine the strength of association between the MRI and criterion DXA. Bland-Altman analysis was completed to assess the bias and limits of agreement of the two methods. RESULTS: Mean MRI VAT and DXA VAT were 3744.48 cm³±1366.59 cm³ and 3377.1±1.020.07 cm³, respectively. A strong correlation was observed between MRI and DXA (r = 0.891, p < 0.05). Bland-Altman analysis demonstrated bias, upper and lower limits of agreement were 2266.16 cm³, 3548.73 cm³ and 903.58 cm³, respectively. Conclusion: Large differences in means were expected due to the MRI imaging a larger anatomical region (1.5 to 79) compared to DXA (20% distance from iliac crest to base of skull). Our results indicate that quantification of VAT determined from DXA and a novel multi-slice MRI protocol are highly correlated, suggesting that either method could be used to provide important insight into disease risk status and effectiveness of therapeutic interventions.

The chaotic eating behavior, with or without periods with restrictive eating and compensatory behavior, in bulimia nervosa (BN) and binge eating disorder (BED) can metabolic health challenges, with negative implications for regulation of body weight and composition. Despite the knowledge on how body composition and specifically abdominal fat mass relates to various health variables, body mass index (BMI) is still widely used as a health indicator for individuals and populations. Few studies have investigated the fat distribution and the prevalence of abdominal adiposity among women with BN and BED. PURPOSE: To investigate the prevalence of abdominal adiposity and examine the ability of BMI to identify women with increased abdominal adiposity in a group of treatment seeking women with BN and BED. METHODS: Baseline data from an ongoing RCT treatment study for females meeting the DSM-5 criteria for BN or BED (BN n = 62 and BED n = 26, aged 28 ± 5 years) were used. Height (cm) and weight (kg) were measured. Abdominal adiposity was measured with dual-energy X-ray absorptiometry (DXA) ( Lunar IDX, GE Healthcare, enCORE Software, Version 14.10.02) by performing a whole-body scan. Android gonad fat mass ratio (AG ratio) were calculated by the DXA software (AG ratio = % android fat mass / % gynoid fat mass). Abdominal adiposity was defined as an AGRatio > 0.7. RESULTS: The prevalence of abdominal adiposity was 63 % in the BN and 73 % in the BED group. In all, 54 % and 81 % of cases with abdominal adiposity in the BN and BED group, respectively, were identified by BMI. CONCLUSIONS: The results indicate that unhealthy fat mass is being disguised by a healthy BMI in females with eating disorders. Furthermore, our findings highlights the importance of 1) assessing body composition and abdominal obesity rather than only body weight.
and/or BMI in females with BN and BED and 2) the need for utilizing interdisciplinary treatment (including physical exercise and dietary therapy) to properly address this physiological and metabolic challenge.

**Purpose:** Dual-energy x-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are common methods of body composition assessment, but the agreement between these methods varies. The present analysis sought to identify both fixed and proportional biases between DXA and BIA in young active adults under strictly standardized conditions.

**Methods:** Bias between DXA and single-frequency BIA was evaluated at six different time points in 48 young, active male and female adults consuming standardized diets. Bland Altman plots were generated to assess the agreement between devices for fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%). Fixed bias was evaluated via mean differences (DXA value - BIA value) and 95% confidence intervals, and proportional bias was evaluated via linear regression analysis.

**Results:** Substantial fixed and proportional bias was present for body composition estimates. Mean differences for DXA and BIA were present in males and females for BF% (5%; 6%), FM (2.6 kg; 3.9 kg), and FFM (-3 kg; -4.6 kg). Both genders also exhibited proportional bias for FM and FFM, but the magnitude of bias was greater in females, as indicated by regression coefficients (FM: r = -34 in F; r = -25 in M; FFM: r = .63 in F; r = .25 in M). In individuals with less FM, the mean difference between DXA and BIA was high, indicating that BIA underestimated FM relative to DXA. However, in individuals with greater FM, better agreement was seen. Similarly, the mean difference in FFM estimates was greater in individuals with less FFM. In some individuals with high quantities of FM or FFM, the relationship between devices was reversed such that BIA overestimated FM and underestimated FFM.

**Conclusions:** Fixed and proportional biases exist between DXA and BIA when used in young predominantly normal weight adults. Although this limits the ability to compare body composition information obtained by these technologies, the degree of disagreement varies substantially based on quantity of fat mass and fat-free mass such that all-encompassing statements regarding the comparability of these technologies cannot presently be made. While BIA commonly overestimated fat-free mass and underestimated fat mass relative to DXA, this relationship was reversed in some individuals.

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**Effects Of Aerobic Exercise Training Intensity On Inflammatory Cytokines In Obese Hispanic Females**

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**(No relationships reported)**

Inflammatory cytokines are useful biomarkers in predicting development of metabolic and cardiovascular diseases and may be positively affected by physical activity and weight loss. Despite much interest in chronic low-level inflammation in obese population, effect of aerobic training intensity on inflammatory cytokines remains elusive.

**Purpose:** The purpose of this study was to investigate effects of 12-week aerobic exercise training at high and low intensities on changes in pro- or anti-inflammatory cytokines.

**Methods:** Forty-one inactive obese Hispanic females (mean BMI = 34.5 kg/m², aged 21-39 years), were divided into three of groups: high intensity training group (HIT; r = 14), low intensity training group (LT; walking at 50% VO2max; n = 14), and control group (CON, n = 13). Exercise METs·h/w and EE was increased by 4.5 METs·h/w every four weeks in both training groups. Volume was similar for both training groups [initial energy expenditure (EE): 13.5 (6.23 ±.52 mg/L → 5.92±.68, P=.035), but not in LT (6.13 ±.71 mg/L S → 6.01±.77, P= .416). However, level of adiponection was not significantly changed in any groups.

**Conclusions:** Significant decreases in TNF-α and CRP were found following high intensity aerobic exercise training while low intensity training reduced TNF-α only. The greater changes of pro-inflammatory cytokines in HL indicates high intensity aerobic exercise training may be more beneficial than low intensity training for controlling low-grade inflammation and immune function in obese Hispanic females. The amount of training or fat loss in this study may not be enough to induce changes in adiponectin.
Sclerostin is a hormone secreted by osteocytes that inhibits bone formation and is affected by mechanical loading. Few studies have investigated serum sclerostin levels in athletes and no investigations have focused on elite long-distance runners.

**PURPOSE:** The aim of this study was to investigate serum levels of sclerostin in male and female long-distance runners and to explore their association with bone mineral density (BMD), bone turnover, energy and vitamin D status.

**METHODS:** Twenty-five elite distance runners (23±6 yrs; M=13, F=12) had their BMD assessed by dual energy x-ray absorptiometry (DXA) and blood samples taken in the fasted state and before exercise on one occasion. Blood samples were analysed for serum sclerostin, N-terminal propeptide of procollagen type 1 (PINP), C-terminal telopeptide of type 1 collagen (CTX), 25 hydroxy vitamin D [25(OH)D] and free triiodothyronine (fT3) levels. Comparisons between M and F were made using independent t-tests on bone mineral density, bone turnover, energy and vitamin D status.

**RESULTS:** Serum sclerostin levels were not significantly different between males and females (t-test, P=0.398). In males, serum sclerostin correlated positively with CTX (r=0.72, p=0.006) and fT3 (r=0.62, p=0.023) and this association remained significant after adjustments (Bonferroni correction). Analysis of covariance was used to control for potential confounders when making comparisons and Pearson correlations analysed variables for relationships.

**CONCLUSIONS:** Serum sclerostin levels in elite distance runners were not influenced by sex, but were significantly associated with biomarkers for age and weight. No other significant associations were observed for sclerostin and any other biomarkers. fT3 (r=0.62, p=0.023) and vitamin D correlated positively with CTX (r=0.72, p=0.006) and fT3 (r=0.62, p=0.023) and this association remained significant after adjustments (Bonferroni correction). Analysis of covariance was used to control for potential confounders when making comparisons and Pearson correlations analysed variables for relationships.

**CONCLUSIONS:** The results of this investigation indicate that runners may experience small changes in BMD at the hip over the course of a training year with no measurable changes at other bone sites. Even though whole body lean mass increased in this group over the one year training period, BMD was not affected. Further investigation is needed to explore reasons for annual BMD maintenance in young-adult, male and female collegiate runners experiencing seasonal fluctuations in skeletal health.

**RESULTS:** The results of the statistical analysis show a significant increase (p = 0.039) in whole body lean mass for the group between the first scan and the third scan. When whole body lean mass was accounted for, there were no significant differences in BMD across the three scans or between the sexes for anterior-posterior spine, lateral spine, femoral neck, radius/ulna ultra-distal, or whole body analyses. There was a significant interaction between scan and sex for total hip BMD (p = 0.023). The males had a significant increase (p = 0.025) in total hip BMD between scans 1 and 2 and a significant decrease (p = 0.006) in total hip BMD between scans 2 and 3. The females showed a trend (p = 0.086) toward an increase in total hip BMD between scan 1 and 2 and a trend (p = 0.057) toward a decrease in total hip BMD between scans 2 and 3.

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differences in bone characteristics occur. Method: Fifty-nine elite team sport players (17 soccer players, 12 cricketers and 30 rugby players) gave informed consent to take part in a study approved by the National Research Ethics Service. Bone scans were performed before pre-season training, after pre-season training, during mid-season and at the end of the season. The timeframe between each scan varied between sports. Dual-energy X-ray absorptiometry (DXA) was used to assess whole body bone mineral density (BMD) (g/cm²), bone area (BA) (cm²) and bone mineral content (BMC) (g).

Peripheral quantitative computed tomography (pQCT) was used to assess tibial cross sectional area (mm²), cortical thickness (CT) (mm), periosteal circumference (PC) (mm) and strength strain index (SSI) (mm³) at the 4, 14, 38 and 66% sites. Results: In rugby players whole body BA was higher after pre-season training in comparison to mid-season (2854.8 ± 173.3 vs 2584.9 ± 177.0 g, P = 0.013) and was lower (38%) at mid-season compared with before pre-season (2586.7 ± 551.6 vs 2769.1 ± 307.2 mm²; P = 0.003). Cricketers had a reduced SSI (14%) at the end of the season compared with before pre-season (2387.5 ± 433.2 vs 2513.3 ± 412.6 mm³; P = 0.04). Soccer players showed no seasonal changes in the bone characteristics assessed. Rugby players had greater BMD, BA and BMC in comparison to soccer players and cricketers at all time points (P<0.05). When adjusted for body mass, however, soccer players had higher BMD, BA, CT, PC and SSI in comparison to cricketers and rugby players at all time points (P<0.05). Discussion: These data suggest that the specific loading patterns occurring during soccer training and match-play are more osteogenic than those during rugby and cricket. Seasonal differences in bone characteristics suggest that bone structural properties change over a playing season in elite team sport players, which is an important consideration for periodisation of training load and injury prevention.

INTRODUCTION: Bone mineral density (BMD) is a measure that can be used to determine density of a bone, bone region, or skeleton relative to a sample size or a standardized population. Shown in previous studies, runners and swimmers can show lower BMD than athletes in ball sports or inactive controls PURPOSE: Compare BMD between swimmers, runners and soccer players. METHODS: Volunteers from collegiate cross country, women’s soccer, and women’s swimming teams were recruited. Ages ranged from 19-25 years with male (n=15) and female (n=36) athletes. DEXA was used to measure BMD. Age and gender were self-reported by the participants, all subsequent data was generated from the DEXA scan. Total and regional BMD data were collected from the DEXA output. Results are reported as a mean and standard deviation. One-way ANOVA was used to analyze differences between groups in total and regional BMD and Tukey post hoc testing determined significance between two groups. Significance was set at p < 0.05 and when Tukey’s post hoc comparison of 95% confidence intervals did not contain zero. RESULTS: Regional BMD included the arms, legs, pelvis, spine, and head. The values for arms and legs are averages of the left and right arm, and left and right leg. Men’s endurance running (1.256 g/cm², 0.948 g/cm², and 1.529 g/cm²) was significantly higher than women’s endurance running (1.187 g/cm², 0.828 g/cm², and 1.351 g/cm²) in total BMD, arms, and legs. Also, men’s endurance running (1.529 g/cm²) had significantly higher BMD in the legs than women’s soccer (1.427 g/cm²) and women’s swimming (1.293 g/cm²). Women’s swimming (0.912 g/cm²) was found to have higher arm BMD than women’s endurance running (0.828 g/cm²). Women’s soccer (1.427 g/cm² and 1.356 g/cm²) had a higher BMD in the legs and pelvis than the women’s swimming (1.293 g/cm² and 1.228 g/cm²) and higher pelvis than the women’s endurance runners (1.221 g/cm²). No significant difference was found between any of the sports for spine and head regional BMD. CONCLUSION: Running may have a slight benefit in female athlete’s BMD and that swimmers may have a higher arm BMD than female runners. Of note is the sport involving multi-planar, multi-speed directional forces (women’s soccer) demonstrated the densest bones in the lower extremity in comparison to the other sports.
Drink temperature disproportionately influences sweating rate and volume during low intensity exercise in temperate conditions that permit full sweat evaporation. Specifically, cold drinks may reduce sweat production and hot drinks are thought to increase it by stimulation of a gut thermoreceptor. Consequently, cold drinks may have a negative influence on thermoregulatory responses during exercise in the heat. PURPOSE: The effect of drink temperature has yet to be examined on the sweat response, thermoregulation and performance in hot, dry conditions using an ecologically valid protocol with measurement of regional sweating responses.

METHODS: Ten trained cyclists completed three trials prior to and during which they ingested 3.2 mL.kg⁻¹ of a COLD (5.3 ± 1.7 °C) or HOT drink (49.0 ± 1.9 °C), which was contrasted to a no drink CONTROL. They cycled in hot, dry conditions (rectal temperature Trec, 8-site skin temperature Tmsk) and local sweat rate responses were higher (p<0.05) in the CONTROL than both drink conditions at the intensity exercise period, local sweat responses at the bicep and upper back were not worse in the CONTROL (170 [132] s) condition (p<0.05) than the COLD (371 [272] s) or HOT (122 [55] s) drink conditions. However, thermoregulatory behaviour may also be modified by non-thermal cooling interventions, such as an L (-) Menthol mouth rinse. PURPOSE: To investigate the effects of an L (-) Menthol rinse on thermal sensation, thermal comfort, power output and physiological responses to cycling exercise at a fixed rating of perceived exertion (RPE-16) in the heat.

METHODS: Eight well-trained, non-acclimated males (Age 26 ± 5 years; VO₂max 57.3 ± 4.1 ml kg⁻¹ min⁻¹) completed a familiarisation and two fixed RPE 16 trials. Participants swilled either L (-) Menthol rinse (M) (0.01%, 0.64 mM) or apple flavoured placebo (P) FlavDrops, MyProtein) for 5 s immediately before and at 10 min intervals during an exercise trial in the heat (Tamb 35.2 ± 0.6 °C; RH 47 ± 3%) whilst blinded to the purpose of the study. Exercise terminated when power output fell to ≤70% of the initial power output. Peak power was measured with isokinetic sprints pre- and immediately-post trial. Skin and core temperature, thermal sensation, thermal comfort, VO₂ and heart rate were recorded during all trials. Data are presented as the mean ± SD; and analyzed with a two-way repeated measure ANOVA with significance set at p<0.05.

RESULTS: Trial duration was 5% longer in M condition (M vs P: 23.0 ± 3.5 vs. 21.8 ± 2.3 min, p<0.05). Power in the M condition had a tendency to be higher for the first 50% of trial duration but was not different overall (172.0 ± 18.7 vs 167.2 ± 18.5 W, p=0.196). Post-trial isokinetic peak power was reduced in M condition but unchanged in P (M: 9.0 ± 7.6%, p<0.05; P: 2.7 ± 6.2%, p>0.05). There was no change in, core and skin temperature, VO₂ and heart rate between conditions (p>0.05). Thermal sensation reduced across the M trial (2.4 ± 1.1 vs 2.8 ± 0.9, p<0.05), but thermal comfort was unchanged.

CONCLUSIONS: Swilling an L (-) Menthol mouth rinse appears to lower the perception of heat reflected by an alternate pacing strategy increasing both exercise time and workload, during a fixed RPE cycling exercise trial in ~35°C. The decrease in post-trial peak power in the L (-) Menthol condition may have been due to an increased level of peripheral fatigue caused by higher work maintained during the first 50% of the trial.

**Bibliography**

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The standard of care for initial cooling of a suspected exertional heat illness (EHI) in military training environments is application of ‘ice sheets’ to a casualty. Beginning in 2011 Ft Benning emergency medical services implemented cold (4°C) saline infusion to the pre-hospital transport protocol. PURPOSE: To determine the effects of en-route cold saline infusion on biomarkers of EHI severity and length of hospitalization. METHODS: A retrospective cohort chart review of 290 hospitalized EHI casualties was conducted. Casualties that occurred in 2009-10 (N=153) were the control (CON) group; those in 2011-12 (N=137) received cold saline infusion (CSI) en route to the hospital and were the experimental group. Admission and discharge dates were recorded and length of stay (LOS) was calculated. Biomarkers of organ and tissue damage, including peak creatinine (Cr), creatine kinase (CK), alanine aminotransferase (ALT) and aspartate aminotransferase (AST) concentrations were recorded. Data were not normally distributed and were analyzed using the Mann-Whitney-Wilcoxon (MWW) Ranked Sum Test; median and inter-quartile range (IQR) are reported. RESULTS: Median LOS was longer for CON: 154±38mm compared to CSI (147±23mm P<0.01 and NEC (137±32; P<0.05). TSwb was cooler (P<0.05) in CSI in mean TSwb: 122±38 mm compared to CON (142±20 mm) and ABD (145±24 mm). CONCLUSIONS: The lowest thermal strain occurred with CSI, but the coolest whole-body and neck thermal sensation occurred with MEN; however none of these differences yielded performance benefits in the heat.


cold saline infusion and reduced severity of Exertional Heat Illness

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CONCLUSIONS: These data suggest that the initiation of cold (4°C) saline infusion while en route to a medical treatment facility results in reduced length of stay and lessened severity, as indicated by significantly lower peak ALT and Cr concentrations. Body core temperature data were not available and the effect of CSI on cooling rate remains to be determined.

D-10 Thematic Poster - High Intensity Exercise and Blood Marker Responses

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 404

1742 Board #1

An Exploratory Investigation of Inflammation-Associated Circulating MicroRNAs Following Acute High-Intensity Interval Exercise

Fanchen Bao1, Michael Whitehurst, FACSM1, Aaron L. Slusher2, Arun Maharaj3, Thomas Mock1, Chun-Jung Huang, FACSM. 1Florida Atlantic University, Boca Raton, FL. 2Virginia Commonwealth University, Richmond, VA. 3Florida State University, Tallahassee, FL.

PURPOSE: The expression of inflammation-associated circulating microRNAs (ci-miRNAs) has been shown to be upregulated following acute aerobic exercise in both obese and normal-weight individuals. Research has recently discovered that acute high-intensity interval exercise (HIE) promotes the release of specific ci-miRNAs as regulators of skeletal myogenesis; however, no study has examined the effects of acute HIE on inflammation-associated ci-miRNAs. Therefore, this study attempted to conduct an exploratory investigation on serum expression of inflammation-associated ci-miRNAs (miR-21, -126, -130b, and -221) after acute HIE in healthy young males. METHODS: Eight males were recruited to participate in HIE on a cycle ergometer, which consisted of 10 bouts of 1 min cycling at 90% maximum power output, separated by 2 minutes of active rest. Blood samples were collected prior to, immediately after exercise, 30, and 60 minutes into recovery. RESULTS: Acute HIE did not elicit significant alteration on the expression of miR-21, -126, -130b, and -221 across the four time points. CONCLUSION: Unlike aerobic exercise, acute HIE may not regulate the expression of inflammation-associated ci-miRNAs in healthy young males. Further investigation is warranted to recruit individuals with inflammatory conditions (e.g., obesity), as well as modify the work-to-rest ratio of HIE protocol, to gain a better understanding of the potential role of these inflammation-associated ci-miRNAs in response to exercise.

1744 Board #2

The Comparison Of High-Intensity Interval Exercise-Vs. Continuous Moderate-intensity Exercise-mediated Calprotectin And Inflammatory Mediators

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PURPOSE: Calprotectin is an antimicrobial peptide primarily released from neutrophils and monocytes/macrophages and acts as an immune cell activator during initial stage of innate immune responses. In addition, calprotectin promotes the release of inflammatory mediators (e.g., monocyte chemoattractant protein-1 [MCP-1] and myeloperoxidase [MPO]) to augment chemotaxis and phagocytosis. High-intensity interval exercise (HIE) has been demonstrated to be more time effective to provide a similar improvement of cardiovascular health in cardiac patients compared to traditional continuous moderate-intensity exercise (CME). Therefore, the purpose of this study was to compare plasma calprotectin, MCP-1 and MPO between acute CME vs. HIE.

METHODS: Nine healthy males (25±3 yrs) were recruited to participate in HIE and CME on a cycle ergometer. HIE consisted of 10 repeated 60 seconds of cycling at 90% max watts (Wmax) separated by 2 minutes of cycling without resistance, while CME was 28 minutes of cycling at 60% Wmax. Blood samples were collected prior to, immediately post, and 30 and 60 minutes into recovery following exercise. A linear mixed model for repeated measures was conducted to control for total work output (kilojoules).

RESULTS: A significant condition by time interaction was found for calprotectin (p < 0.001) and MPO (p = 0.007) with a greater elevation in CME. Furthermore, an increase in MCP-1 (p < 0.001) was observed across time in both exercise protocols.

CONCLUSIONS: Our findings indicate that acute HIE may potentially attenuate the expression of inflammatory mediators (calprotectin and MPO) compared to CME.
**DIFFERENCES IN PLASMA AND SERUM BDNF IN RESPONSE TO ACUTE HIIE**

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(No relationships reported)

**Purpose**: Circulating concentrations of brain-derived neurotrophic factor (BDNF) are reported to increase with acute exercise in a dose-dependent manner; however, the sources of elevated plasma and serum BDNF may differ as workload increases. Elevated plasma BDNF concentrations are believed to reflect release by the brain, whereas serum concentrations may reflect increased platelet release by the spleen. The popularity and documented benefits of high intensity interval exercise (HIIE), prompted the aim of this study to clarify the acute effects of low-volume, supramaximal HIIE on circulating BDNF.

**Methods**: Healthy, sedentary males (N=11) participated in HIIE on a cycle ergometer (10 x 20 seconds of maximal pedaling against 5.5% of the subject’s body weight x 10 seconds of rest). Whole blood samples were collected from the antecubital vein prior to, immediately after (POST), and 15 minutes after (15POST) HIIE for BDNF and irisin analyses.

**Results**: At rest, serum BDNF concentrations were nearly 40-fold greater compared to plasma. Although no changes in plasma BDNF were observed after HIIE, serum BDNF increased at POST and 15POST (F (2,40) = 7.277, p = 0.002). Plasma irisin concentrations significantly decreased at POST (p = 0.029). In addition, a positive bivariate relationship was noted between ΔBLLIF and ΔBLFSTL1 (r = 0.834, p = 0.01). This suggests that the intensity of physical activity can differentially affect plasma and serum levels of BDNF. Additional research on HIIE volume and the mechanisms underlying BDNT responses is warranted.

**Conclusions**: LIF concentrations were attenuated at 60P in response to an acute bout of RE after 7-weeks of training. Similarly, FSTL1 concentrations, collapsed across groups, were attenuated after exercise. Changes in LIF were highly correlated to changes in FSTL1 suggesting that adaptations regulating these myokines may be linked.

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**THE RESPONSE OF LEUKEMIA INHIBITORY FACTOR TO HIGH-INTENSITY AND HIGH-VOLUME RESISTANCE TRAINING IN MEN**

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(No relationships reported)

**Purpose**: Leukemia inhibitory factor (LIF) and Follistatin like-1 (FSTL1) are two potential myokines involved in muscle adaptation. The purpose of this study was to characterize the LIF and FSTL1 response to a high intensity and high volume (HI and HV) bout of resistance exercise (RE) and after (POST) 7-weeks of HI and HV resistance training (RT).

**Methods**: Twenty resistance trained men (23.5±2.6 y, 1.79±0.05 m, 75±13.75 kg) volunteered for this study. Following a 2-week preparatory phase, participants were randomized into either a HV (n = 10, 4 x 10-12RM, 1-min rest) or HI (n = 10, 4 x 5-3RM, 3-min rest) training protocol for 7 weeks (4 day/wk). Blood samples were obtained prior to (BL), immediately (IP), 30 min (30P), and 60 min (60P) post-exercise at PRE and POST. Plasma LIF and FSTL1 concentrations were determined using a multiplex signaling assay kit and analyzed with MAGPIX® technology. Data were collected after training on HIIE volume and the mechanisms underlying BDNT responses (e.g. irisin) is warranted.

**Results**: LIF concentrations were attenuated at 60P in response to an acute bout of RE after 7-weeks of training. Similarly, FSTL1 concentrations, collapsed across groups, were attenuated after exercise. Changes in LIF were highly correlated to changes in FSTL1 suggesting that adaptations regulating these myokines may be linked.
Little research exists on behavioral outcomes utilizing wrist-worn activity trackers (ATs). Recent information from Endeavour Partners wearable research shows that sales of ATs have tripled. An estimated 33% of the US population are predicted to own a wearable AT by 2017. Therefore, it’s important to conduct behavioral evaluations exploring wrist-worn AT use in combination with physical activity (PA) programming.

**PURPOSE:** This three-year university community engagement study revealed how student coaching in combination with wrist-worn AT’s impacted participant’s perceptions of PA and self-reported sitting time. **METHODS:** Quantitative questions regarding sitting time, importance of PA, and confidence in sustaining PA were utilized pre/post 10 week Ready to Move (RTM) program intervention. Six separate groups of employee participants (n=173) received student coaches (n=100) and wrist-worn AT’s. Intervention included AT’s being distributed to participants along with a student coach to provide instructions on use of AT’s. **RESULTS:** PA importance, pre-survey results showed that participants placed an importance of 8.2/10. Post results showed that participant’s importance of PA significantly (p<.001) increased to 8.92/10. Confidence in PA showed pre-scores of 7.5/10 and significantly (p<.001) increased in post-scores to 8.24/10. 82% of participants self-reported sitting ½ of the time or greater. Post-RTM results demonstrated a self-reported significant (p<.001) decrease in general sitting time with 73.7% of participants reporting sitting ½ of the time or greater. The BRFSS sitting at work question revealed that 93.75% of participants pre-RTM reported mostly sitting while at work. Post-RTM results of 92.1% of participants indicated that sitting at work was not impacted. **CONCLUSION:** Overall, the RTM survey results revealed that a combination of coaching and wrist-worn AT usage increased the importance of regular PA for participants, their confidence in sustaining PA and movement, and success in reducing general sitting time. Further policy changes in the workplace are necessary to allow employees to move more while at work.
Information technology (IT) provides efficiency and convenience, however it also reinforces physical inactivity. To provide a remedy the IT industry has designed products that combine mobile apps, websites, and movement detection technologies in Hong Kong School Students.

**Methods:** A total of 185 primary and 178 secondary students were recruited and randomly assigned (by schools & grades) into either an intervention group (n=189) or control group (n=174). The intervention group engaged in a 3-month 7-minute moderate intensity interval exercise training (MIIT) program (at least 3 time a week) that incorporated the use of an instructor-led video demonstration website, mobile apps and a wearable movement device (wrist-band); whereas the control group engaged in the same exercise training but without movement detection devices. Major outcome measures were the exercise compliance and health-related fitness before and after intervention.

**Results:** Two-way repeated measured MANCOVA revealed that, all students regardless of group assignment, improved fitness significantly (p<.05). However, the intervention group indicated higher fitness improvement (p<.05). The intervention group demonstrated higher (P<0.05) exercise compliance (80.53±59.42%) than the control group (65.32±57.20%).

**Conclusion:** With the inclusion of a wearable movement detection device(e.g. mobile apps + wrist bands) in an exercise training program, exercise compliance and physical fitness could be better improved, and may be considered when planning health and fitness promotion for school students.

Healthy people 2020 and the American College of Sports Medicine’s (ACSM) program, “Exercise is Medicine” have called for an increase in the amount of physician office visits that include discussions on physical activity and health promotion. However, physicians are not counseling their patients on physical activity at sufficient rates. It has been shown that physicians who are more physically active and who have positive health habits are more likely to counsel their patients. Currently under 20% of physicians indicate they counsel their patients about regular physical activity.

**Purpose:** To examine exercise compliance of a 7-min exercise programme through the provision of combining exercise website, mobile apps and movement detection technologies in Hong Kong School Students.

**Methods:** 80 first-year medical students were randomized into 2 groups. Both groups were given activity trackers. Group 1 (n=40) was given educational seminars on nutrition and healthy lifestyle habits. Additionally, Group 1 attended weekly mentored walks or runs along with fitness challenges given weekly updates on their activity level. The intervention group engaged in the same exercise training but without movement detection devices. Major outcome measures were the exercise compliance and health-related fitness before and after intervention.

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**Conclusion:** With the inclusion of a wearable movement detection device(e.g. mobile apps + wrist bands) in an exercise training program, exercise compliance and physical fitness could be better improved, and may be considered when planning health and fitness promotion for school students.

Previous research has focused on the accuracy of smartphone pedometer apps in laboratory settings, however less information is available in outdoor (free living) environments.

**Purpose:** To determine the accuracy of 5 smartphone pedometer apps at recording steps at a walking speed in a laboratory versus an outdoor setting.

**Methods:** Twenty-three healthy college students consented (11Male; Mean±SD; 22±3.8yrs; BMI 24.9±4.13kg/m²) to participate in 2 separate visits. During the first visit participants walked 500 steps at 3mph on a treadmill while wearing a pedometer and a smartphone placed in the pocket using 5 pedometer apps concurrently (Moves, Google Fit (G-Fit), Runtastic, Accupedo, S-Health).

**Results:** During the second visit, participants walked 400 meters at 3mph on a sidewalk outside. Actual steps for each visit were recorded using a hand tally counter device. Zero and negative values were replaced with the mean value for that trial. Statistical analyses were performed using IBM SPSS 23.0. Mean bias scores were calculated between the step count for each app and the respective tally count for each trial. Mean bias scores were correlated between trials for each app using Pearson correlations and significance was set at p<0.05. Mean Absolute Percent Error (MAPE) values were also calculated for each app for both trials.

**Conclusions:** Apps with the lowest error in a controlled setting may be less affected when used in other settings, while apps with greater variation in a controlled setting may be affected when used in a different environment.

Many consumer activity trackers (AT) can be worn at different locations such as the hip, shoe, or wrist. The versatility of wear locations makes these devices attractive to the consumer. However, there is limited data on the differences between wear locations of the dominant (D) and non-dominant (ND) wrist location when estimating steps, physical activity and sedentary behavior.

**Purpose:** To compare estimates of total steps (TS) obtained from a consumer AT and a research accelerometer (ARA) worn simultaneously on the dominant (D) and non-dominant (ND) wrist location when estimating steps, physical activity and sedentary behavior.

**Methods:** Twenty healthy adults wore an AT and RA on the D and ND wrist and completed three 1-hour laboratory conditions: 1) sedentary (SED), 2) sedentary plus walking (SW), and sedentary plus jogging (SJ). During the SED condition, participants completed 60 minutes of sitting. During the SW and SJ conditions, participants completed 30 minutes of sitting plus 30 minutes of continuous walking or jogging at 3.0 or 5.0 mph, respectively. Means and 95% confidence intervals were used to assess differences of TS between the D and ND wrist locations for the AT and RA among all three conditions.

**Results:** Within devices, similar TS estimates were produced from the D and ND wrist across all three conditions. Between devices, the AT and RA placed at the D and ND wrist produced similar estimates of TS during the SED and SW conditions. For the SJ condition, the AT produced significantly higher TS estimates, compared with the RA, which was less sensitive to TS detection with increasing intensity.
CONCLUSIONS: Researchers should use caution when using TS detected from a wrist-worn RA. An additional criterion measure, such as manual step counting, would more clearly identify under- and over-reporting of TS output from AT and RA during controlled laboratory settings. Supported by: Seed Grant from the Institute of Applied Life Sciences at University of Massachusetts, Amherst and by Fossil Inc.

Evidence is equivocal regarding the benefits of wearable technology for increasing physical activity. Use of these devices in combination with health coaching strategies like motivational interviewing (MI) may be more effective. PURPOSE: The study examined if physical activity trackers increase activity levels in healthy adults and if the addition of MI results in greater benefits. A secondary purpose was to examine characteristics of those who were successful in increasing physical activity versus those who were not in order to determine who is more likely to benefit from this type of intervention. METHODS: Ninety-four healthy men and women (mean age 41 ± 9 years) were randomly assigned to one of two groups for a 12-week intervention. Groups received either 1) a physical activity tracker (PAT) alone, or 2) a physical activity tracker and three sessions of MI (PAT+MI). Physical activity was assessed pre and post-intervention using accelerometers. Average steps per day were compared within and between groups pre- and post-intervention using paired and independent sample t-tests. Participants were then split into two groups based on whether they increased their mean daily step count from baseline. These post-hoc groups were then compared on demographic and baseline physical activity characteristics.

RESULTS: An interaction between time and surgical limb was observed for the vertical GRF and impulse (p=0.049) the NSx side demonstrated an increased value when compared to the Sx side. The peak vertical GRF and impulse were asymmetric up to 12 months after ACLR. However, loading rate and peak posterior GRF demonstrated asymmetry up to 6 months after ACLR, while limb stiffness asymmetry perpetuated until 5 months after ACLR. CONCLUSIONS: Movement and load asymmetry remain up to 12 months following surgery indicating that these patients are at risk for subsequent injuries even if the addition of MI results in greater benefits. A secondary purpose was to examine characteristics of those who were successful in increasing physical activity versus those who were not in order to determine who is more likely to benefit from this type of intervention. METHODS: Ninety-four healthy men and women (mean age 41 ± 9 years) were randomly assigned to one of two groups for a 12-week intervention. Groups received either 1) a physical activity tracker (PAT) alone, or 2) a physical activity tracker and three sessions of MI (PAT+MI). Physical activity was assessed pre and post-intervention using accelerometers. Average steps per day were compared within and between groups pre- and post-intervention using paired and independent sample t-tests. Participants were then split into two groups based on whether they increased their mean daily step count from baseline. These post-hoc groups were then compared on demographic and baseline physical activity characteristics.

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PURPOSE: This study examined 3D motion during drop jump landing between early and late stages of rehabilitation in young athletes following anterior cruciate ligament reconstruction (ACLR). METHODS: 21 athletes (14 female; age range 10.7-17.7 years) with unilateral ACLR underwent motion testing 3-6 months and again 6-10 months post-operatively. 3D motion was analyzed during the landing phase of a 41 cm vertical drop jump, and differences were compared between visits and operative
and contralateral limbs using paired t-tests. RESULTS: At the first visit, operative limbs exhibited less knee flexion (94 vs. 98°, p<0.002) and ankle dorsiflexion (28 vs. 30°, p<0.002), lower vertical ground reaction force (eGRF) (1.5 vs. 2.1 body weights, p<0.005), lower knee and ankle sagittal moments (knee 0.71 vs. 0.97 Nm/kg, p<0.002; ankle 0.70 vs. 0.86 Nm/kg, p=0.001) and power absorption (knee 0.83 vs. 1.4 Nm/kg, p<0.0001; ankle 0.56 vs. 0.77 Nm/kg, p=0.03) compared with the contralateral side. Between visits, hip and knee flexion increased on the operative (hip 10.4°, p=0.005) and contralateral (hip 10.4°, p=0.007; knee 7.6°, p=0.01) sides, as well as hip flexion moments and power absorption (p<0.01). Power absorption at the knee increased on the operative side only (0.18 Nm/kg, p=0.01), with a trend of increased vGRF (p=0.08), but remained lower than the contralateral side. No significant changes between visits were observed at the ankle, and only minor differences were observed in the frontal and transverse planes. CONCLUSION: During early rehabilitation pediatric and adolescent patients with ACLR exhibit flexion and loading of the knee and ankle on their operative limb, possibly representing an avoidance mechanism. Motion and loading at the knee increase over time but remain reduced relative to the contralateral side 6-10 months post-operatively. Increased hip flexion motion, moments, and power absorption may indicate improvements in proximal control as rehabilitation progresses, which may aid in compensation for persistent deficiencies at the knee. Motion analysis appears to provide valuable insight into resolution of this avoidance mechanism and improvements in proximal control which may be used as a valuable marker for readiness to return to play after ACLR.

Drop vertical jump (DVJ) performance is often used to aid in the decision to return to sport after anterior cruciate ligament reconstruction (ACLR). In healthy subjects, the 2nd landing from a DVJ does not differ in velocity between the limbs. Deficits in sagittal plane angle and moments at the knee and hip are commonly observed in individuals with ACLR, which may lead to decreased joint loading and an increased risk of reinjury. The purpose of this study was to compare sagittal plane mechanics between the ACLR limb and a control group during the 2nd landing of a DVJ. METHODS: Twenty-two subjects (10 F, age 20.6 ± 5.6 y, H 1.74 ± 0.1 m, M 71.4 ± 12.5 kg) 6 months post ACLR and 12 controls (5 F; age 21 ± 3 y; H 1.7 ± 0.1 m, M 65 ± 12 kg) performed a DVJ. Three-dimensional motion analysis was conducted while subjects performed a DVJ by stepping off a 30.5 cm box, landing on two feet (1st landing), immediately transitioning into a maximal vertical jump, and landing on two feet a second time (2nd landing). Visual 3D was used to analyze sagittal plane hip and knee mechanics at initial contact. Independent sample t-tests were used to compare groups. RESULTS: The ACLR limb had significantly greater knee and hip flexion angles than the control group (Knee:31 ± 9.4 vs.22 ± 5.1°, p<0.004; Hip: 27.2 ± 12.9 vs 17.2 ± 14.5°, p=0.04). Additionally, the ACLR limb demonstrated less knee extensor moment, but greater hip extensor moment compared to the control group (Knee: -0.22 ± 0.21 vs 0.03 ± 0.21 Nm/kg·m, p=0.002; Hip: -0.32 ± 0.2 vs -0.13 ± 0.24 Nm/kg·m, p<0.01). CONCLUSIONS: The combination of greater knee flexion angles with a reduced knee extensor moment suggests the ACLR limb is unable to control the increased sagittal plane demands of the 2nd landing. Additionally, increased hip extensor moment in the ACLR group indicates an altered landing strategy to transfer load absorption from the knee to the hip musculature. Future work should explore the relationship between altered landing strategies to hip and knee muscle strength to identify possible interventions to restore knee neuromuscular control after an ACLR.
Hop testing after an Anterior Cruciate Ligament reconstruction (ACLR) is a common functional test to determine return to play status. Due to the difficulty in capturing knee and hip mechanics over a large area where hopping is little known is differences in kinematics that may persist. Advancements in inertial sensor technology allow for assessment of hop and knee mechanics outside of the laboratory setting and could provide significant insights into how these functional tests are performed.

**Purpose**

To investigate hop and knee mechanics in ACLR patients and healthy controls in the sagittal and frontal plane during hop tests, using inertial magnetic measurement units (IMMU).

**Methods**

5 ACLR patients (2 male, 3 female, 20.4 ± 2.1 yrs, 164.2 ± 10.7 cm, 69.1 ± 23.5 kg) one year after reconstruction, and 10 healthy controls (7 male, 3 female, 21.8 ± 2.0 yrs, 178.3 ± 10.2 cm, 73.5 ± 14.3 kg) performed a single leg hop and a triple hop for distance with the reconstructed or dominant leg while wearing a suit equipped with 8 IMMUs at the feet, tibia, upper legs, sacrum and sternum. Sagittal and frontal plane hop and knee angles (flexion, abduction) at initial contact (IC) were calculated. Independent Mann-Whitney U-tests were used to statistically compare the data.

**Results**

Significant differences (p<0.05) in knee and hip flexion and knee abduction were observed at IC for the single leg hop and triple hop between groups (table 1).

**Conclusions**

Subjects who have had an ACLR employ landing strategy of less hip and knee flexion and abduction when performing a single leg and triple hop as compared to the mechanics of healthy control subjects. This results in a stiffer landing strategy that may predispose them to secondary injuries if not fully addressed.

**Supported by a grant from the Dutch Fulfright Centre.**
point. Identifying people who suffer from the sarcopenia using physical fitness/ function measures earlier could play a key role in the early prevention of sarcopenia among the older adults.

**PURPOSE:** To develop a risk index to predict older adults’ sarcopenia using a set of physical fitness and function measures.

**METHODS:** We administered a set of physical fitness and function tests to 1320 volunteered old Chinese adults (75.03±6.83 yr.; height: 159.16±8.28 cm; mass: 63.30±11.55 kg; male: 28.9%), including vital capacity, hand grip, back muscle strength measured by pull sensor, 30 seconds Chair Stand (30CS), standing toes, seated body flexion, hands back hook, standing on one foot with eyes closed, reaction time, Timed Up and Go (TUG) and 6-M Gait Speed (GS). Their muscle mass of body was measured using Magnetic Resonance Imaging. The Appendicular Skeletal Muscle Index (ASMI) was calculated by the muscle mass of limbs and prevalence rates of the sarcopenia were computed. Using the logistic regression analysis and ROC curve methods, a risk index to predict older adults’ sarcopenia was then derived using the physical fitness and function measures.

**RESULTS:** According to the ASMI reference values recommended by the Asian Working group of sarcopenia (AWGS), a provisional cut-off value was: ≥0.70 was defined as normal, 0.69–0.61 as predysfunctional and <0.60 as dysfunctional. The accuracy of the prediction was derived by this study and the accuracy of the prediction was computed. In addition, we considered the individual measure of sarcopenia such as ASMI, hand grip and GS, and 30CS was used as a single measure for different sarcopenia.

**Corresponding author:** Chunmei Cao

**Study was supported by Independent scientific research plan of Ministry of Education (20121088023)**

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**June 1 1:15 PM - 1:30 PM**

**Heat Treatment Regulates Autophagy in C2C12 Myotubes**

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(No relationships reported)

Autophagy is a cellular process that allows for recycling of intracellular macromolecules and organelles. This process has been shown to be regulated by nutrient availability, with an upregulation in nutrient depleted conditions and a downregulation during nutrient excess. Prolonged heat stress has been shown to dysregulate autophagic signaling in skeletal muscle, leading to deleterious consequences. In contrast, exposure to short durations of heat (heat treatment) appears to have no effect on autophagy.

**PURPOSE:** To investigate the effects of an acute bout of heat treatment on autophagic signaling in skeletal muscle cells. **METHODS:** C2C12 myoblasts were grown and differentiated into myotubes. Following differentiation, cells were maintained at 37°C (thermal neutral, TN) or heated at 40°C (heat treatment; HT) for 1 or 2 h. Heated cells were harvested immediately (post-heating, recovery), or 24 h recovery. **RESULTS:** Heat lysis was induced by cardiotoxin (CTX) injection into the tibialis anterior (TA) muscle of a hind limb of each mouse. The opposite limb was injected with saline to serve as a within-animal sham control. At 2, 7 and 14 days post-exercise muscle function of both the CTX- and saline-injected TA muscles was assessed using an in situ contraction preparation. After the neurological testing, the TA muscles were excised, weighed, cut by cross section and mounted on glass slides for histological studies. Muscle mass samples were stained using hematoxylin and eosin to identify central nucleated fibers and quantify cross sectional area. Samples were also stained immunohistochromically for embryonic myosin heavy chain (myoHC) to identify the number of nuclei.

**CONCLUSIONS:** When compared to baseline, the bout of downhill running reduced twitch force one day post-exercise, indicative of low-frequency fatigue. However, it did not significantly depress tetanic force or alter the amount of TNF-α, MCP-1 or carboxylated proteins present in the muscle. Besides L7M1 muscle lacking LMP7 and MECL-1, no other differences in proteasome content were observed at baseline. In contrast, following the exercise, WT muscle tended to upregulate the catalytic subunits of the immunoproteasome while L7M1 muscle instead upregulated the catalytic subunits of the standard proteasome. Together, these results suggest that downhill running does not significantly alter heat stress production or induce a large inflammatory response in mouse soleus muscle. Yet, it appears the stress of downhill running activates the production of specific subunits of the proteasome, which are influenced by LMP7 and MECL-1.

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

**The Chemokine Cxcl10 is Not Needed For Normal Skeletal Muscle Regeneration Following a Toxin-induced Injury**

Michael R. Deyhle, 84602, Coray Peerce, Marissa Robison, Jacob W. Parrarley, Jacob R. Sorensen, Paul Hafen, Robert D. Hydall. Brigham Young University, Provo, UT.

(No relationships reported)

**METHODS:** To test this, we measured functional and histological markers of muscle regeneration in mice out to 14 days post muscle injury (DI). In wild type (WT) mice and Cxcl10 knockout (KO) mice (n = 13 and 12, respectively). The muscle injury was induced by cardiotoxin (CTX) injection into the tibialis anterior (TA) muscle of a hind limb of each mouse. The opposite limb was injected with saline to serve as a within-animal sham control. At 2, 7 and 14 DPI muscle function of both the CTX- and saline-injected TA muscles was assessed using an in situ contraction preparation. After the neurological testing, the TA muscles were excised, weighed, frozen, cut by cross section and mounted on glass slides for histological studies. Muscle mass samples were stained using hematoxylin and eosin to identify central nucleated fibers and quantify cross sectional area. Samples were also stained immunohistochromically for embryonic myosin heavy chain (myoHC) to identify the number of nuclei.

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June 1 2:00 PM - 2:15 PM
Blockade Of Mtor And Erk1/2 Resulted In Attenuated Protein Synthesis Rates In Differentiated C2c12 Myoblasts.
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Fractional protein synthesis rates have long been used as an indicator of acute alterations in the anabolic state of various tissues. Through the use of a number of stable and isotopic tracer methodologies, the measurement of fractional synthesis rates (FSR) in vivo has become a staple of skeletal muscle physiology. Through the application of a deuterium oxide tracer, this project sought to measure pharmacological perturbations in fractional synthesis rates in culture in differentiated C2C12 murine myotubes. PURPOSE: To assess myofibrillar protein synthesis in differentiated C2C12 murine myotubes following pharmacological inhibition of rapamycin-sensitive (mTOR) or -insensitive (ERK1/2) pathways. Furthermore, how signal transduction through these pathways impact FSR as compared to previous in vivo studies of pharmacological inhibition studies in skeletal muscle. METHODS: C2C12 murine myoblasts were cultured in collagen coated 6 well culture dishes, and grown to 60-70% confluency using a high glucose DMEM growth media (GM). Cultures were transitioned to a differentiation media (DM) upon reaching target confluency. DM was changed daily for 4 days to allow for complete differentiation to myotubes. Cultures were randomly assigned treatment conditions of cell control (CC), rapamycin inhibition (RAPA), ERK1/2 inhibition (ERK), and electrical stimulation (ESTIM). Cultures underwent treatment conditions for 24 hours with a 4% deuterium oxide GM supplement. Analysis was carried out using a gas chromatography mass spectrometer. RESULTS: Fractional rates of protein synthesis were significantly lower in the RAPA (p=0.028) and ERK (p=0.029) groups as compared to CC, with no differences between RAPA and ERK groups (p>0.05). Although statistics were not applied to the ESTIM group due to small sample size, electrical pulse stimulation shows promise for the stimulation of FSR in cultured myotubes. CONCLUSION: Diminished FSR in both RAPA and ERK groups are consistent with previous findings from in vivo rodent studies. These results may indicate comparable alterations in skeletal muscle anabolic signaling in cell culture as well as in vivo rodent models. Further investigations into anabolic signaling mechanisms related to the control of protein synthesis are needed.

June 1 2:15 PM - 2:30 PM
6 Weeks Of Nrf2-activator And Protein Supplementation Improves Myofibrillar Proteostasis In Men.
Robert V. Musci, Adam R. Konopka, Jaime L. Laurin, Christopher A. Wolf, Justin J. Reid, Laurie M. Biela, Fredrick F. Peelor, III, Christopher L. Melby, Karyn L. Hamilton, FACS, Benjamin F. Miller, FACS, Colorado State University, Fort Collins, CO. (Sponsor: Karyn Hamilton, FACS)
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(No relationships reported)

The age-related loss of muscle mass and function are key contributors to the decline in healthyspan. Maintenance of protein homeostasis (proteostasis) is critical to maintain muscle quality and function during advancing age. We have previously shown that interventions that slow aging increase the ratio of skeletal muscle protein to DNA synthesis, which we believe are indicative of improved proteostatic mechanisms. Oxidative stress and inflammation blunt the anabolic response to protein feeding, thus supplementation with a nuclear factor, erythroid 2 like 2 (Nrf2) activator could restore the anabolic response to protein feeding in older adults. PURPOSE: To test the hypothesis that supplementing with a Nrf2 activator alongside protein feeding would increase muscle subcellular protein synthesis in skeletal muscle of older adults. METHODS: In a 6-week double-blind study, older adults (n=46, 60-77 years old) were randomized to protein supplementation with placebo (CON) or one of the Nrf2 activators conjugated linoleic acid (CLA) or Protandim (PTD). We used deuterium-labeled water to measure DNA synthesis and protein synthesis in myofibrillar, mitochondrial, and cytosolic enriched fractions of skeletal muscle. RESULTS: PTD maintained myofibrillar protein synthesis while mitochondrial and cytoplasmic protein synthesis decreased (p<0.05). There was no change in DNA synthesis with PTD or CLA supplementation compared to CON. PTD tended to increase the myofibrillar protein:DNA synthesis ratio compared to CON (PTD 5.55 ± 1.364 vs CON 4.691 ± 0.749; p<0.07). Increased myofibrillar protein:DNA synthesis after PTD was more apparent in men than women. CONCLUSIONS: We report that protein supplementation with a Nrf2 activator tended to increase myofibrillar protein:DNA synthesis ratio which was more profound in men versus women. Given that protein:DNA synthesis is a measure of proteostasis, our results demonstrate that protein supplementation with a Nrf2 activator to diminish oxidative stress and inflammation improves proteostasis in older adult men. Additional studies are warranted to determine if maintaining myofibrillar proteostasis with PTD or more potent Nrf2 activators may help maintain muscle mass and function with age in both men and women. Supported by the National Dairy Council.

June 1 2:20 PM - 2:35 PM
The Effects Of Compression Treatment On Ribosome Biogenesis, Hypertrophy And Inflammation In Subjects Performing Resistance Exercise
(No relationships reported)

PURPOSE: We sought to determine the effects of external pneumatic compression (EPC) when used concurrently with resistance training on skeletal muscle measures related to ribosome biogenesis, hypertrophy and inflammation. METHODS: (a) 20 resistance-trained males (aged 21±2 years) were randomized to balanced sham and EPC intervention groups. The protocol consisted of 3 consecutive days of heavy, voluminous back squat exercise followed by EPC/sham treatment on Day 2-4 and 3 consecutive days of recovery (Days5-7) with EPC/sham only on Days5-6. Vastus lateralis muscle was biopsied on Day 1 (PRE), 1-hour post-EPC/sham treatment on Day2 (POST1) and 24-hour post-EPC/sham treatment on Day7 (POST2). RESULTS: Of all of the assayed ribosome biogenesis mRNAs and RNAs, only c-myc increased significantly in both groups from PRE to POST1 (p<0.001). No significant main effect of time nor group*time interaction was observed for mechano-growth factor or myostatin mRNAs, although there was an increase in IGF-1 protein levels in both groups (p<0.05). A significant main effect of time was observed for IL-6, IL-10, IL-1β, and MCP-1 mRNA levels (p<0.001 for all). CONCLUSIONS: These data suggest that EPC does not modulate select markers of ribosome biogenesis or muscle-specific growth factor expression compared to sham treatment during a one-week voluminous resistance training paradigm.

June 1 2:45 PM - 3:00 PM
Inducible Overexpression of p21Cip1 in Myotubes Promotes Increases in Protein Synthesis and Myotube Hypertrophy
C. Brooks Mobley1, Tyler Kirby2, Christopher Ballmann1, John Quindry, FACS,3 John J. McCarthy4, Michael D. Roberts4, Auburn University, Auburn, AL. 3Cornell University, Ithaca, NY. 4Samford University, Birmingham, AL. 1University of Montana, Missoula, MT. 2University of Kentucky, Lexington, KY. 3Auburn University, Auburn, University, AL.
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(No relationships reported)

PURPOSE: p21Cip1 is classically defined as a cyclin-dependent kinase inhibitor that promotes satellite cell differentiation within the skeletal muscle. However, sparse literature has demonstrated that mechanical loading can elicit robust (~30-50+%) increases in skeletal muscle p21Cip1 mRNA expression patterns up to 6 hours post-exercise; this being an event which precedes satellite cell activity. Herein we tested whether the inducible over-expression of p21Cip1 promotes alterations in muscle protein synthesis (MPS) and hypertrophy in post-differentiated myotubes. METHODS: Briefly, the p21Cip1 gene was cloned into the pINDUCER vector, which is turned on by doxycycline treatment, and a stable C2C12 p21Cip1-inducible (p21-IND) cell line was established. Empty vector C2C12 clones (EV) served as the control condition. Following 7 days of differentiation, the p21-IND and EV lines were treated for 4 days with doxycycline. RESULTS: An 86% overexpression of p21Cip1 mRNA was confirmed in p21-IND versus EV myotubes with RT-PCR (p < 0.05). p21-IND myotubes exhibited 2.5-fold greater MPS rates (p < 0.05) and a 2.2-fold greater increase in myotube size (p < 0.05) compared to EV myotubes. Select differentiation markers (i.e. Myod mRNA and myogenin mRNA) did not differ between cell lines. Interestingly, pre-475 rRNA trended to increase in p21-IND myotubes compared to EV myotubes (1.6-fold, p = 0.09). CONCLUSIONS: This data suggest that p21Cip1 may act in post-mitotic skeletal muscle fibers to increase transcriptional capacity and/or efficiency, thereby promoting skeletal muscle hypertrophy.

Abstracts were prepared by the authors and printed as submitted.
D-14 | Clinical Case Slide - Elbow

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 401

1776 | Chair: Jason L. Zaremski, FACSM. University of Florida, Gainesville, FL. (No relationships reported)

1777 | Discussant: Sean Engel. University of Minnesota, Minneapolis, MN. (No relationships reported)

1778 | Discussant: Poonam P. Thaker, FACSM. Presence Resurrection Medical Center, Chicago, IL. (No relationships reported)

1779 | June 1 1:00 PM - 1:20 PM
Elbow Pain in an Adolescent Baseball Pitcher
Malory Shasteen, Kyle Cassas, FACSM. Greenville Health System/Steadman Hawkins Clinic of the Carolinas, Greenville, SC. (Sponsor: Kyle Cassas MD, FACSM)
Email: malory.shasteen@gmail.com (No relationships reported)

1780 | June 1 1:20 PM - 1:40 PM
Elbow Injury - Baseball
Terin Sylstra, Timothy McKenna. Mayo Clinic, Rochester, MN. (Sponsor: Dr. Karen Newcomer, FACSM)
Email: sylstra.terin@mayo.edu (No relationships reported)

1781 | June 1 1:40 PM - 2:00 PM
Elbow Pain-Young Baseball Pitcher
Luis A. Sanchez1, Juan C. Galloza2, William Micheo, FACSM. 1University of Puerto Rico, Medical Sciences Campus, San Juan, PR. 2University of Texas Health Science Center at Houston (UTH), Houston, TX. (Sponsor: William Micheo, FACSM)
Email: luisalberto721@gmail.com (No relationships reported)

1782 | June 1 2:00 PM - 3:00 PM
Elbow Pain Young Baseball Pitcher
Jason L. Zaremski, FACSM. University of Colorado, Denver, Colorado
Email: luisalberto721@gmail.com (Sponsor: William Micheo, FACSM)

HISTORY: 15 year-old right-hand dominant male baseball pitcher presents with 3 weeks of right posterior elbow pain. The pain started after a weekend of extended pitching. He describes the pain with ball release, extension type movements, and hitting. He denies numbness, tingling, swelling, erythema, medial elbow pain, or shoulder pain. There are no prior injuries and his father states that his son’s throwing mechanics are normal.

PHYSICAL EXAMINATION: Right elbow with mild tenderness on the olecranon and triceps insertion. No tenderness over the medial epicondylo, ulnar collateral ligament, flexor pronator mass, radiocapitellar joint, or lateral aspect of his elbow. Full ROM with mild pain on passive extension of the elbow. No significant pain with valgus stress. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: Olecranon stress fracture, avulsion fracture, posterior olecranon impingement, olecranon bursitis.

TEST AND RESULTS: 3V XR of right elbow - delayed closure of the olecranon physis with widening and chronic changes when compared to the uninvolved side. No osteochondral injury or other growth plate abnormality. MRI of the right elbow - inflammation and edema near the olecranon growth plate.

FINAL WORKING DIAGNOSIS: Olecranon stress fracture TREATMENT AND OUTCOMES:
- Completely shut down from a throwing perspective and referred to physical therapy.
- Physical therapy focused on stretching to increase shoulder mobility as well as scapular and rotator cuff strengthening in an effort to decrease the amount of stress on the elbow. - Referral to an orthopedic surgeon to discuss operative (screw fixation) vs non-operative treatment. - The choice was made to pursue a trial of non-operative treatment. - At 6 weeks follow up, he had minimal pain. At 3 months, he was pain free with a normal exam. Repeat radiographs at 3 months showed a marked amount of healing around the olecranon physis. Repeat MRI showed very mild persistent olecranon apophysitis. - Released to slowly progress back to play.
- Significance: Olecranon stress fracture is a separation of the olecranon secondary ossification center. If left untreated, it can result in an incompletely fused olecranon apophysis. Some orthopedic surgeons recommend internal fixation with a screw for throwing athletes in order to allow early return to sport.

HISTORY: A 13-year-old male baseball player presented with intermittent lateral and posterior right elbow pain that became constant over the last month of travel baseball. The pain worsened in the cocking stage of throwing, and he reported decreased elbow extension. There was no numbness, tingling or weakness in his right upper extremity. Pain was a 4/10 at rest and worse with activity.

PHYSICAL EXAMINATION: Slight right elbow effusion with tenderness over the olecranon and lateral and medial epicondyles. Range of motion was decreased to 15 degrees short of full extension. Range of motion did not elicit snapping of the triceps or ulnar nerve. There was pain with valgus stress of the right elbow but no instability. Strength of the upper extremity was normal with no pain elicited during strength testing. Tinel’s at the cubital tunnel was negative.

DIFFERENTIAL DIAGNOSIS:
1. Osteochondritis Dissecans (OCD) of the capitellum
2. Panner’s Disease
3. Lateral/medial epicondylitis
4. Lateral/medial epicondyle apophysitis/avulsion fracture
5. Triceps tendinitis
6. Ulnar collateral ligament sprain
7. Olecranon stress fracture/loose body

TEST AND RESULTS:
- Right elbow radiographs:
  - Small right elbow effusion
  - Small right elbow MRI:
    - Focal bone marrow signal changes in the anterior capitellum
    - Large joint effusion
    - Focal tiny subchondral fluid signal abnormality in mid capitellum
- No visualized loose bodies
- Suggestive of Panner disease or early OCD of the elbow

Repeat right elbow MRI for increased pain after three weeks:
- New 9 mm oval cartilaginous defect from the central capitellum, displaced in the medial joint recess posteriorly
- No definite bony component
- Underlying capitellar edema

FINAL WORKING DIAGNOSIS:
- OCD of the capitellum

TREATMENT AND OUTCOMES:
1. Right elbow arthroscopy with OCD drilling microfracture and loose body removal
2. Adjustable hinge elbow brace locked at 60-90 degrees of flexion for 2 weeks
3. Brace was loosened to 40-120 degrees after 2 weeks
4. Doing well at 5 week postoperative follow up. The brace was removed, and activities were restricted to no throwing activities for an additional 6 weeks. Then he was allowed slow return to throwing.
5. At 5 weeks follow up, he was doing well with no pain or symptoms. He was cleared for sports but instructed to refrain from pitching.

DIFFERENTIAL DIAGNOSIS:
1. Ulnar Collateral Ligament Sprain
2. Valgus extension overload (Veo) syndrome
3. Olecranon fracture
4. Medial Epicondylitis
5. Common flexor tendon strain
6. Triceps tendinopathy

TEST AND RESULTS:
- AP & Lat x-rays: Linear lucent defect at the olecranon process.
- MRI: Olecranon non-union with associated edematous changes at the level of the growth plate.

FINAL WORKING DIAGNOSIS:
- Non Union of Olecranon Stress Fracture (Right)

TREATMENT AND OUTCOMES:
1. Conservative treatment
   a. Kinetic Chain Evaluation i. Weakness of core and pelvic girdle muscles
   ii. Quadriceps Asymmetry: Isokinetic Tests: Right 29% weaker than Left
   iii. Scapular dyskinesis
   iv. GIRD (Glenohumeral Internal Rotation Deficit)
   b. Physical therapy i. Physical modalities
   ii. Strengthening and strengthening program for right shoulder, elbow and other components of the kinetic chain (core/hip/legs)

iii. Avoid elbow extension exercises until symptoms free
c. Outcome
i. 6 weeks: No symptoms on palpation.
ii. 8 weeks: Continued without symptoms. Start throwing program.
iv. 16 weeks: No symptoms throwing. Completed throwing program. Persisted with core and right lower extremity weakness. Focused on strength deficits to correct kinetic chain.
v. 20 weeks: Return to sports practice and progress full participation if asymptomatic.

TREATMENT AND OUTCOMES: Patient was treated with dry needling with STEM in the sports medicine clinic. He was placed on rest and treated with modalities by ATC. He continued to have pain. He was offered PRP and placed in arm sling for a duration of 2 weeks. Repeat evaluation at 2 weeks post PRP showed 80% reduction in pain and he was started on home exercises. Week 4 follow up visit, he was started on low weight with high repetition exercises. Week 5 follow up visit revealed that the patient was able to tolerate light weights and was 95% better. He was released to full weight room and started on RTP throwing protocol. He completed throwing protocol without issue and has been returned to full play.

HISTORY: 17-year-old female presents complaining of left elbow pain ongoing for 4 years. She has a history of a diagnosed subluxing ulnar nerve on the left. She complains of difficulty playing sports such as softball and doing push-ups. She would like to enlist in the Armed Services and is concerned about the symptoms limiting her from doing so. She mainly complains of symptoms when the nerve is subluxing during flexion of the elbow, including discomfort over the cubital tunnel with numbness and tingling in her 4th and 5th digits. She denies symptoms when the nerve is not subluxing. She is right hand dominant and has never had treatment for this, including physical therapy. She believes the symptoms of subluxation started when she suffered a direct fall to the ground landing on the elbow years ago. No fractures were diagnosed at that time.

PHYSICAL EXAM: Examination of the left upper extremity reveals intact skin without discoloration, atrophy or swelling. Mild tenderness to palpation in the cubital tunnel. Sensation to light touch is intact. AROM with flexion is to 140 degrees. Strength is 5/5 with arm flexion. Tinel’s sign is positive at the elbow. There is palpable subluxation of the ulnar nerve over the medial epicondyle when brought into flexion from extension. A second snap is also appreciated when the elbow is brought into further flexion.


TESTS AND RESULTS:
- EMG shows no cubital tunnel compression at baseline.
- Dynamic ultrasound evaluation reveals an ulnar nerve in cross section located in the normal position within the cubital tunnel during extension. With the elbow slowly flexed past 90 degrees, a palpable snapping of the ulnar nerve was noted on exam and seen dynamically with ultrasound crossing over the medial epicondyle. As the elbow was brought into further flexion, a second snap was appreciated by palpation and on dynamic ultrasound evaluation as the muscle belly of the triceps was noted snapping over the medial epicondyle.

FINAL WORKING DIAGNOSIS: Subluxing Ulnar Nerve

TREATMENT AND OUTCOMES: 1. Conservative measures including physical therapy and bracing with no relief. 2. Surgical Treatment: Anterior transposition of the ulnar nerve with triceps subluxation of the ulnar nerve over the medial epicondyle when brought into flexion. 3:00 PM

Discussion: Michael Fredericson, FACSM. Stanford University, Stanford, CA.

(No relationships reported)
1788 June 1 1:00 PM - 1:20 PM
Uncommon Cause Of Footpain After Trauma In A Collegiate Rugby Union Player
Pierre L. Viviers, FACS, Wayne Derman, Jeande H. Viljoen.
Stellenbosch University, Stellenbosch, South Africa.
Email: plviviers@sun.ac.za

HISTORY: A 22 year old male rugby union loose head prop received a ball prior to a contact situation. He was tackled from the front with his left foot firmly planted on the surface. He immediately experienced foot pain, however not severe enough to cause him to stop. Whilst he could not identify the exact location of the pain he indicated that it was under the foot on the medial aspect.He completed the match in pain and discomfort. Scrummage intensified the pain during loading of the affected foot. He applied RICE after the match. The next morning he experienced severe pain in the medial arch and described difficulty flexing his big toe. Weight bearing during the gait cycle, especially toe-off caused extreme pain. Previous history included two concussions and a right-sided turf toe. He also suffered from lower back pain during pre-season seminamn training as well as during scrumming sessions. He described effective relief from his lower back pain following ingestion of NSAID’s and physiotherapeutic management.

PHYSICAL EXAMINATION: Healthy rugby player, unable to bear weight on his left foot. No obvious bruising or any deformity of the left foot. Severe medial arch tenderness of the affected foot to palpation (plantar fascia, sesamoids). No bony tenderness over the whole forefoot or medial arch. Neurovascularly intact. Severe pain during active plantar flexion, as well as pain with passive stretching (dorsiflexion) of the big toe.

DIFFERENTIAL DIAGNOSIS: • Sprain 1st MTP joint (Turf toe) • Collateral ligamentous injury 1st MTP joint • Flexor hallicus longus strain 
rupture • Plantar fascia - acute tear • Subluxation/Dislocation 1st MTP joint • Sesamoid fractures (acute) • 1st Metatarsal avulsion fracture • Metatarsal fracture • Phalangeal fracture • Sesamoiditis • "Undiagnosed" soft tissue injury

TESTS/RESULTS: X-rays: reported partial tears of the left medial and lateral heads of flexor hallicus brevis. "Undiagnosed" soft tissue injury

TREATMENT/OUTCOMES: 1.Short leg cast x 4 weeks

1790 June 1 1:40 PM - 2:00 PM
Chronic Planter Fasciitis: From Disability To Running!
Lindsay Troilo, Irene Davis, FACS, Sprauling Outpatient Center Cambridge, Cambridge, MA.

HISTORY: 27 yr. old male with BIL knee and plantar foot pain R>L. Knee pain developed while running in college. Foot orthotics resulted in no change in symptoms. Thus he stopped running and stopped wearing them. Pt. moved to London 5 yrs ago and increased his daily walking. He also began wearing a flat, less supportive shoe. As a result, he developed heel pain that radiated to the arch and gradually progressed to a burning sensation. He returned to the United States and underwent steroid injections, orthotics, tarsal tunnel release and 4 months of PT without relief. At the time of our assessment, foot pain was 6/10 after 3 minutes of standing/walking. He was unable to take public transportation or care for his young daughter due to this pain. PHYSICAL EXAMINATION: Pain in posterior tibialis muscle and tendon, plantar fascia origin, and 1st MTP joint R>L. Posterior tibialis, peroneals, and toe flexors were weak and painful on contraction. A (+) patella compression BIL and (+) Ober’s R noted. Weakness noted in hip EXT. and ABD BIL. Pt presented with contralateral hip drop L>R, hip ADD and IR, and midfoot pronation BIL during a brief running assessment. He was a rearfoot striker with mildly elevated vertical load rates. These loadrates were markedly reduced when he ran on his forehead. His knee pain was also reduced when he ran on his forehead. WORKING DIAGNOSIS: 1. BIL planter fasciitis due to foot weakness and overuse, with associated posterior tibialis and flexor hallicus longus tendinosis. 2. BIL patellofemoral pain due to increased Hip ADD and IR associated with hip weakness. TREATMENT: Goal1: Pain-free standing and walking Progressive foot core program performed barefoot Soft tissue and joint mobilization to foot/ankle Fibit to monitor walking step progressions Wear out of orthotics and into minimal shoes to promote foot strength Gait retraining to promote activation of foot intrinsic muscles during walking Goal 2: Pain-free running Progressive and dynamic hip strengthening Gait retraining to promote activation of hip musculature to improve hip mechanics OUTCOME: After 32 visits over 11 mos. pt was walking 1-2 hrs with 0/10 pain in his feet. Pt. worked on home program of hip strengthening for 8 mos. He then returned for 8 sessions of gait retraining to improve hip mechanics. Pt. discharged running 25 min. pain-free in knees and feet.

1791 June 1 2:00 PM - 2:20 PM
Ankle Injury - Football
Philip Hoffman, Igor Danelisen, Jonathan Vanadore, Andrew Martin. Campbell University, Lillington, NC. (Sponsor: Patrick Leary, FACSM)
Email: mbdrphill@gmail.com

HISTORY: A 17 year old high school football player, free-safety position, blocked a kick by the opposing team, landing on his left foot and falling in obvious distress. Examination on the field revealed injury to the left lower extremity, with his foot being stuck in approximately 75 degrees inversion and the distal tibia protruding anteriorly from ankle joint.

PE: Examination revealed intact neurovascular structures and no break in the skin. There was a step off of his lateral malleolus concerning for fracture. 1 attempt was made at relocation of the ankle joint but was not successful on the field.

Differential Dislocation of left ankle Fracture distal left fibula

Test and results
AP,X-ray confirmed lateral displacement of ankle and distal fibular fracture

Lateral x-ray showed posterior dislocation of ankle and distal fibular fracture.

Final diagnosis
Closed ankle dislocation with displaced distal fibular fracture

Treatment and outcomes
ER relocation of ankle

Surgical fixation and plating of distal fibular fracture

Aircast boot and non-weight bearing for 6 weeks; anticipated date he may start weight-bearing activity is 11/5/16.
HISTORY: A 44-year-old female presented with 3 weeks of left posteromedial ankle and foot pain and swelling only occurring with running. It did not bother her while walking and she experienced no injury or trauma.

PHYSICAL EXAMINATION: Normal walking gait with full range-of-motion. Significant tenderness over tarsal tunnel approximating posterior tibial tendon and mild tenderness over the medial retrocalcaneal area. Drawer test, Cotton test, Squeeze test, Talar tilt test, and Thompson test all negative. Too-Many-Toes and Peck-a-Boo heel signs negative, and Rise on Toe exhibited normal heel varus. Dorsalateral compression negative. Strength testing was 5/5 globally with increased pain on resisted inversion. Tinel’s sign negative over the tibial nerve. Distal pulses intact.

DIFFERENTIAL DIAGNOSIS:
1. Posterior tibialis or insertion Achilles tendinopathy
2. Stress fracture
3. Cartilage or osteochondral injury
4. Accessory soleus muscle
5. Soft tissue neoplasm

TEST AND RESULTS: Radiographs negative for fracture or acute bony injury. Patient was prescribed relative rest and activity modification, and was given a home exercise program and referred for physical therapy. MRI of the foot and ankle performed when symptoms failed to improve after 6 weeks of PT. MRI showed a prominent accessory soleus muscle with minimal edema. The tendinous attachment inserted medially at the margins of the posterior calcaneus. The accessory soleus muscle abutted the posterior margins of the tarsal tunnel.

FINAL DIAGNOSIS: Accessory soleus muscle

TREATMENT AND OUTCOMES:
1. Symptoms improved 80% with continued focus on eccentric rehabilitation of ankle flexors and evertors.
2. Patient able to gradually return to light exercise.

D-16 Clinical Case Slide - Hip and Pelvis I

Chair: John C. Hill, FACSM. University of Colorado, Denver, CO.

Discussant: Siobhan M. Statuta. University of Virginia, Charlottesville, VA.

Discussant: Scott A. Paluska, FACSM. Christie Clinic Sports Medicine, Champaign, IL.

June 1 1:00 PM - 1:40 PM Pelvis And Hip Injury - Soccer

In-Kyu Choi, 90015. Kaiser Permanente Fontana Medical Center, Fontana, CA. (Sponsor: Aaron Rubin, FACSM)

Email: inkyu0925@gmail.com

HISTORY:
A 18 year old male soccer player presented with a 2 week history of gradually worsening left sided groin pain without any radiation or radicular symptoms. Pain was initially only with activity such as spriting and kicking, but now with just walking. Patient is a right leg dominant attacking mid-fielder and reports having similar symptoms about 2 years ago while in Germany. He had negative work up for hernia and the symptoms eventually resolved with rest at the time. He denies any recent history of trauma or change in activity level. No history of urinary or testicular symptoms.

PHYSICAL EXAMINATION: Full range of motion of the left hip. Pain with resisted hip adduction but no pain with resisted flexion, extension and abduction. Tenderness to palpation over the pubis symphysis and medial inguinal region. No testicular/inguinal lumps and negative cough test for hernia. Positive FADIR and FABER. No leg length discrepancy. Neurovasculary intact.

DIFFERENTIAL DIAGNOSIS:
1. Hip adductor strain
2. Osteitis Pubis
3. Femoroacetabular impingement
4. Labral tear
5. Inguinal hernia

TEST AND RESULTS: 1. XR Pelvis, AP and lateral - reported normal, but possible CAM lesion and possible degenerative changes at the pubis symphasis. 2. MRI Pelvis - Osteitis Pubis. Stress reaction at the bilateral inferior pubic rami. Possible labral tear. 3. MR Arthrogram of the left hip (obtained 3 weeks after initial MRI) - No evidence of labral tear. Stress reaction at the right inferior pubic ramus resolved, improved on the left. CAM lesion

FINAL WORKING DIAGNOSIS: Stress reaction of the inferior pubic ramii 2. Osteitis Pubis 3. Femoroacetabular impingement

TREATMENT AND OUTCOMES:
1. Discussed repeat injection vs debulking operation vs trial of botulimum toxin injection to the QF
2. Referred to PT for hip stretching and pelvic stabilization exercises

June 1 1:40 PM - 2:00 PM Back And Buttocks Pain In An Adolescent Athlete

Andrew Getzin, FACSM. Cayuga Medical Center, Ithaca, NY.

Email: agezin@cayugamed.org

(History:
"I hurt my glit in football, then on and off in basketball, as of one week it seems like much different injury." LS is a 14-year-old male with right-sided 9/10 lower back and gluteal pain for six months. There was no specific injury. He was able to complete football (linebacker, QB, tight end) and basketball seasons with mild pain and has now

Abstracts were prepared by the authors and printed as submitted.
progressed into the start of baseball season. Eight days prior, his pain changed to be first thing in the AM, stabbing pain over his glute and ischial tuberosity - made worse with sudden movement, swinging, throwing, squatting, and lateral bending. Pain was better with not moving but did not disturb his sleep. No relief with stretching nor ibuprofen.

Physical Exam:
- Athletic looking adolescent male mildly uncomfortable
- Chest: normal respiratory effort
- Skin: no visible rashes or lesions
- Normal gait

Back: right glut pain on flexion with finger tips to the floor, FROM on extension without pain, -Slump test bilaterally, +R SLR with severe glut pain, -L SLR, dermatomes and Myotomes WNL

Right Hip: mild tenderness over ischial tuberosity, FROM, -FADIR’s +FABER’s -Ober’s, 5/5 strength with mild pain on resisted hip extension

DDTs
1. LS strain
2. Axial discogenic pain
3. Spondyloysis
4. Slipped Capital Femoral Epiphysis
5. High hamstring teninopathy
6. Proximal adductor teninopathy
7. Piriformis syndrome
8. Juvenile Spondylarthropathy
9. Pelvic stress fracture

Tests and Results
- X-ray LS spine: WNL
- MR LS spine: WNL
- MRI LS spine: WNL
- ESR: 8
- CRP: <0.5
- RF: <15
- HLA-B27: positive
- ANA: positive

Final Dx: Juvenile Spondylarthropathy
Outcome: He initial did well with Humira injections. Due to exacerbation and chronicity, further imaging was performed.

MRI arthrogram
- revealed late abnormalities of LCPD
- flattened of superior weight bearing surface of femoral head with a shortened femoral neck, cova magna deformity,
- globular thickening of the acetabular labrum
- chondral thinning along the acetabular margin anterosuperiorly

FINAL/WORKING DIAGNOSIS:
- Legg-Calve Perthes Disease with Acetabular Dysplasia

TREATMENT AND OUTCOMES:
- Athlete began conservative treatment with rest, soft tissue therapy, and stretching but right hip bulge exacerbated. An MRI arthrogram was ordered and revealed late abnormalities of LCPD. Athlete was further treated conservatively with NSAID’s, activity modifications, and light resistive exercises. With ceased sport activity providing incomplete relief of symptoms, through a consultation with a physician, the athlete agreed to undergo a combined right hip surgical dislocation with acetabular rim trim, acetabular labral repair, femoral head and neck junction osteoplasty, relative neck lengthening, trochanteric advancement, and right hip periacetabular osteotomy. Since surgery, athlete has undergone five months of rehabilitation. Athlete is progressing well but her return to full participation has not been determined.

1800  June 1 2:20 PM - 2:40 PM
Pelvic Floor Injury - Gymnastics
Luis J. Soliz, Sheila Dugan, FACSM. Rush University Medical Center, Chicago, IL. (Sponsor: Sheila Dugan, MD, FACSM)

Email: luisj.soliz@gmail.com

(No relationships reported)

HISTORY: A 16-year-old female gymnast sustained a gymnastic injury resulting in left hip and pelvic pain. She was on the uneven bars and had to straddle in the air and then catch the bar coming from the abducted hip position to an adducted hip position. She felt the outside of her bilateral hips "pop". She rested for 6 weeks and underwent physical therapy. She returned to competition and reinjured the same area 2 weeks later. She underwent additional physical therapy and again returned to gymnastics but subsequently noticed many activities within her sport now caused "stABBING" pain. When landing from a trick she reported a shock up her left leg into her pubic bone. She was referred to a physiatrist for consideration of pelvic floor involvement given limited improvement in her symptoms with previous treatments and therapies.

PHYSICAL EXAMINATION: Bilateral active and passive ROM at the hip was WNL. There was tenderness to palpation (TTP) of the piriformis, glutes, ITB and trochanteric bursa on the left. Special tests including Scour’s, FABER’s, Ober’s and Elly’s were negative. There was TTP of the adductors bilaterally. Pelvic floor examination revealed normal labia with external inspection with intact sensation. Palpation revealed no pain in the introitus or urogenital diaphragm. Obturator internus was tender to touch and with resisted motion L>R. Abdominal exam revealed TTP of the psoas bilaterally L>R, pubic symphysis, and at the attachment of the rectus abdominis on the pubic bone bilaterally L>R.

DIFFERENTIAL DIAGNOSIS:
1. High Tone Pelvic Floor Muscle Dysfunction
2. Abdominal Wall Strain
3. Osteitis Pubis

TEST AND RESULTS:
- MRI Abdomin Pelvis
- osteitis pubis, questionable pubic symphysis abnormality, and possible sports hernia

FINAL WORKING DIAGNOSIS:
- High-Tone Pelvic Floor Muscle Dysfunction

1801  June 1 2:40 PM - 3:00 PM
Anterior Hip Pain Following A Trampoline Injury
Ashley L. Yelinek, Suzanne Hecht, FACSM, Brad Nelson. University of Minnesota, Minneapolis, MN. (Sponsor: Suzanne Hecht, FACSM)

Email: ashley.yelinek@gmail.com

(No relationships reported)

History: A 13 year old female presented to sports medicine clinic with substantial left anterior hip pain 2 weeks after jumping on a trampoline where she landed awkwardly and heard a loud “pop.” She was in immediate pain and unable to bear weight. She was seen at a local emergency department immediately after the incident where she...
had x-rays that were negative for fracture. She was admitted overnight for pain control. Orthopaedics was consulted and she was diagnosed with a muscle strain. She was discharged the next day with crutches to use as tolerated. When she presented to clinic she continued to have severe pain. She had spent the last 2 weeks non weight bearing with crutches with minimal improvement. She described her pain as sharp, constant, anterior, and worse with movement especially flexing her hip.

Physical Examination: She was guarded to any movement but in no acute distress. She was tender to palpation over her left ASIS and iliac spine. She had limited range of motion secondary to pain. Pain was elicited with muscle testing for hip flexion and hip abduction. She had a normal motor, vascular, sensory exam distally.

Differential Diagnosis:
1. Rectus femoris strain/ rupture
2. Sartorius strain/ rupture
3. Hip apophyseal avulsion fracture
4. Acetabular fracture

Test and Results:
X-rays. AP Pelvis and frog-leg lateral views of her left hip showed near complete skeletal maturation, no fracture or osseous abnormality. Pelvic MRI. MRI revealed a fluid signal along the left anterior superior iliac crest, consistent with sartorius tendon avulsion. No evidence of displaced bone.

Final Diagnosis: Complete sartorius avulsion off ASIS without bony involvement

Treatment and Outcomes:
- She was referred to Orthopaedic surgery and seen 5 weeks after her initial injury. Her pain was improving and she had been able to weight bear without her crutches for short distances.
- She was treated non operatively and instructed to weight bear as tolerated.
- Formal physical therapy was prescribed for range of motion, core and pelviformal strengthening, as well as neuromuscular re-education with a follow up visit scheduled in eight weeks.

D-31 Highlighted Symposium - Too Hot to Handle: Protective Clothing, Thermoregulation and Performance

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 406

1826 Co-Chair: Caroline J. Smith. Appalachian State University, Boone, NC.
(No relationships reported)

1827 Co-Chair: Robert W. Kenefick, FACSM. U.S. Army Research Institute of Environmental Medicine, Natick, MA.
(No relationships reported)

1828 June 1 3:25 PM - 3:55 PM
Keynote - How Much Personal Protection is too Much? Conflicts Between Optimal Performance and Protective Obligations
(No relationships reported)

1829 June 1 3:55 PM - 4:10 PM
Variability in Human Responses when working in Chemical protective Impermeable Suits
Emiel A. DenHartog. North Carolina State University, Raleigh, NC.
(No relationships reported)

Purpose: A major concern for responders to hazardous materials (HazMat) incidents is the heat strain that is caused by impermeable (NFPAP1991) suits. In a research project, funded by the US Department of Defense, the thermal strain experienced when wearing these suits was studied. One area of interest was determining whether individual or anthropometric factors of age and body mass index could be predictors for individual physiological responses to allow more accurate predictions of work time in HazMat suits. Methods: 40 subjects between the ages of 25 and 50 participated in a protocol approved by the local ethical committee. Six different fully encapsulated impermeable HazMat suits were evaluated in three climates: moderate (24°C, 50% RH, 20°C WBGT), warm-wet (32°C, 66% RH, 30°C WBGT), and hot-dry (45°C, 20% RH, 37°C WBGT, 200 W/m2 radiant load) and at three walking speeds: 2.5 km/hr, 4 km/hr, and 5.5 km/hr. The medium speed, 4 km/hr, was tested in all three climates and the other two walking speeds were only tested in the moderate climate. Prior to the test a submaximal exercise test in normal clothing was performed to determine a relationship between heart rate and oxygen consumption (Pre-Test). Results: In total 163 exposures were measured. Tolerance time ranged from as low as 20 minutes in the hot-dry condition to 60 minutes (the maximum) in the moderate climate, especially common at the lowest walking speed. An important aspect of the dataset was the large variability between the subjects. Although the average responses seemed predictable, the variability in the high strain conditions ranged from 20 minutes up to 60 minutes. Individual characteristics showed very limited power in predicting individual tolerance times; only age versus final heart rate and the pre-test versus tolerance time showed a significant correlation with tolerance time (p<0.05). Conclusions: Individual variability was much larger than expected, partly due to the inhomogeneous groups used in these experiments. Furthermore, rather than maximum core temperature reaching maximum heart rate was the most important reason for terminating the work. The data show the importance of individual monitoring for these high thermal and physiological strain exposure in the work place.

1830 June 1 4:10 PM - 4:25 PM
Human Wetness Perception: From Skin To Clothing
Margherita Raccuglia, Simon Hodder, George Havenith, FACSM. Laugborough University, Loughborough, United Kingdom.
(No relationships reported)

During exercise the increased sweat production causes moisture build-up at the skin-clothing interface. The resultant perception of wetness (WP) triggers the onset of thermal and sensorial discomfort, which can cause reductions in performance and productivity. In absence of skin hygro-receptors, WP occurs through the central integration of thermal and tactile stimulations. When in contact with clothing, especially personal protective ones, a large portion of skin interacts with textile materials, the latter’s factors modulating WP. PURPOSE: To identify those textile parameters that trigger cutaneous thermal and tactile inputs underpinning WP. METHODS: A number of textile samples with different thickness, fiber type, and surface texture, were tested in STATIC (upper back) and DYNAMIC (inner forearm) contact with the skin. In both conditions fabric WP was observed at HIGH and LOW fabric-to-skin pressure. WP and stickiness sensation (tactile cue) were measured using ordinal perceptual scales and local skin temperature (thermal cue) by thermocouples. RESULTS: In STATIC, WP was positively related to fabric thickness (r² = 0.87). In fact, higher thickness resulted in greater fabric water content (r² = 0.98), the latter related to a diminished local skin temperature (r² = 0.78). In DYNAMIC, higher WP was associated with greater stickiness sensation (r² = 0.68), occurring from differences in fabric surface texture; additionally, fabric thickness did not correlate with WP directly, however when combined with stickiness sensation it provided a strong predictive power (r² = 0.86). In both STATIC and DYNAMIC, greater WP responses (p < 0.05) were observed in HIGH compared with LOW pressure condition; furthermore when matching for thickness, fiber type (cotton, polyester, polyester Coolmax) did not affect WP (p > 0.05). CONCLUSION: Fabric thickness and surface texture properties trigger thermal and tactile inputs, respectively, underpinning skin WP in static and dynamic clothing applications. Additionally, fabric weight and clothing fit could cause changes in fabric-to-skin pressure, which represents another tactile sensory modality contributing to skin WP. Hence; when wearing protective clothing, discomfort could be attenuated by accounting for these clothing and textile factors which modulates WP.

1831 June 1 4:25 PM - 4:55 PM
Keynote - What Kind of Protection is Needed for the Firefighters’ Tasks and How Does it Influence the Performance?
Ronald Heus. Institute for Safety (IFV), 2718 RP Zoetermeer, Netherlands.
(No relationships reported)

June 1 4:55 PM - 5:15 PM
Overall Discussion

Abstracts were prepared by the authors and printed as submitted.
Cognitive functions, especially executive functions, develop across the lifespan into early adulthood. Physical activity has been shown to improve cognitive functions, yet the influence of youth sport, specifically, on cognitive function in later life is unknown. PURPOSE: To determine the association between latent class trajectories of organized sport participation and cognitive functions in young adulthood. METHODS: Organized sport latent class trajectories were previously developed separately for women and men for the Western Australian Pregnancy Cohort (Raine) Study from reported sports participation at ages 5, 8, 10, 14, and 17. At age 22, participants completed three subtests of the computerized Cogstate battery: card-detection (a test of speed of processing), card identification (a test of vigilance and visual attention) and one back (a test of attention and working memory). Performance on these cognitive tasks (reaction times as log_{10} transformed seconds) was compared using sex-specific MANCOVAs adjusted for the probability of trajectory class membership. Further adjustments were made for highest education level completed and self-reported cognitive function, sex, and age. RESULTS: There were significant multivariate effects in cognitive performance between sport trajectories for both women (p=0.046) and men (p=0.004). For women, there were differences in performance on the one back test (F=3.6, df=2, p=0.014) between the 3 sport trajectories. Women in the non-participator trajectory had slower reaction times, and thus poorer performance, compared to women who consistently participated or dropped-out of sports. For men (n=356), there were differences in performance for both the one back test (F=3.6, F=7.1, df=2, p<0.001) and card detection tasks (F=3.2, df=2, p=0.038). Men who dropped out of sport had slower reaction times on both tests compared to those who were in the consistent participant trajectory. These associations remained when adjusted for education and current physical activity. CONCLUSIONS: Improved cognitive performance was associated with a trajectory of consistently participating sports compared to never participating or dropping out of sport for women and dropping out of sport for men.

Physical activity (PA) is associated with academic achievement in school-aged children. There appears to be a threshold intensity with more intense PA having a stronger association with higher academic achievement. It is not known whether this intensity threshold is present in young children (preschool and kindergarten) since limited research has examined the association between PA and school readiness, a proxy for academic achievement, in this age group. PURPOSE: To determine whether an association exists between PA intensity and academic achievement in young children. METHODS: Participants were 28 children (5.3±1.3y) enrolled in preschool and kindergarten programs at a university laboratory school. PA was assessed using an ActiGraph GT3x+ accelerometer worn on the right hip for seven days. Data were analyzed using the Pate cut points to calculate minutes of daily PA in each intensity (light, moderate, and vigorous). School readiness was assessed using the Expressive (BE) and Receptive (BR) Bracken Basic Concept Scales. BE requires verbal responses on items related to colors, numbers, letters, shapes, and sizes/comparisons. The BR includes non-verbal responses (e.g., pointing) to the same items. Spearman correlations were used to examine the associations between PA intensities and the two Bracken subtests. RESULTS: Children accumulated 309.5±72.1 min of daily total PA. Significant correlations were identified between moderate PA and BR (r=0.39; p<0.005) and between vigorous PA and both BE (r=-0.51; p=0.01) and BR (r=0.47; p<0.05). Correlations were not significant between light PA and both Bracken subtests (BE: r=-0.29; p=0.13; BR: r=0.33; p=0.08) and between moderate PA and BE (r=0.21; p=0.28). CONCLUSIONS: Results suggest the existence of an intensity threshold influencing the PA and school readiness association such that only moderate or vigorous levels were associated with higher levels of readiness. The promotion of PA of varying intensities in early childhood programs may be beneficial for school readiness.

Recent studies have shown the positive influence of physical activity on brain function in children. However, there is a lack of studies focusing on the qualitative aspects in type of exercise. Soccer requires sophisticated levels of thinking. Players are asked to decide quickly and accurately using optimum skill during the game. Because of this, it is implied that soccer stimulates cognitive functions. PURPOSE: The purpose of this study was to examine executive functions, especially, planning, cognitive flexibility, and fluency in generating visual patterns, between a group of non-physically active children and the group of young soccer players. The test results of the levels of performance of the group of young soccer players were compared between the two groups to reveal important findings in executive functions in soccer. METHODS: The participants were 171 children, aged 10-12 years. They were divided into 2 groups. The group of young soccer players (GS) comprised of 63 children in a soccer team and the group of non-physically active (GN) candidates comprised of 108 sedentary children. Following that the group of young soccer players was divided into 2 groups according to level of performance. Group 1 (G1) was comprised of 29 soccer players from the highest level of national youth soccer league. Group 2 (G2) was comprised of 34 soccer players from the third national division in the same location. The test used was Design Fluency Test, which measures planning, cognitive flexibility, and fluency in generating visual patterns, above and beyond contributions from motor speed. The results were compared between GS and GN, and G1 and G2. RESULTS: The group of young soccer player performed much better in the executive tests than the group of non-physically active (GS: mean-score: 8.0; SD: 3.31; GN: mean-score: 10.02; SD: 3.37; t=3.793, df169, p<0.05) and BR (r=0.47; p<0.01). The soccer players in the G1 had significantly better results than soccer players in the G2. (G1: mean-score: 11.21, SD: 3.45; G2: mean-score: 9.0, SD: 2.94; t=2.694, df61, p=0.01). CONCLUSION: This study suggests that playing soccer influences the executive functions, especially, planning and cognitive flexibility for children and suggests that even the slightest improvement in executive functioning might be important for soccer performance in young soccer players.
Prospective Associations Of Cardiorespiratory Fitness, Motor Performance, and Adiposity With Cognition In Children

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Reported Relationships: E.A. Haapala: Consulting Fee; Fazer Group.

Cardiorespiratory fitness and motor performance have been associated directly and adiposity has been associated inversely with cognition among children in cross-sectional studies. However, little is known about their longitudinal relationships to cognition in children. PURPOSE: To investigate the associations of cardiorespiratory fitness, motor performance, and body fat percentage among children aged 6-8 years and changes in these parameters during 2-year follow-up with cognition at the age of 8-10 years. METHODS: A total of 391 children (195 boys, 196 girls) participated in the study. Cardiorespiratory fitness (CRF) was assessed using a maximal treadmill test on a bicycle ergometer and was defined as peak workload per lean body mass. Motor performance score was computed from the z-scores of 50-meter shuttle run test time, errors in the static balance test, and results of the Box and block test. Body fat percentage was measured using dual-energy X-ray absorptiometry. Cognition was measured using Raven's Coloured Progressive Matrices (RCPM). The data were analyzed separately for boys and girls by linear regression analyses and ANCOVA with repeated measures adjusted for age. RESULTS: In boys, motor performance was directly associated with RCPM score (β=0.237, 95% CI=0.083 to 0.392, p=0.003) at baseline and better motor performance at baseline was related to a higher RCPM score at 2-year follow-up (β=0.180, 95% CI=0.052 to 0.308, p=0.002), but this association weakened after adjustment for baseline RCPM score (p=0.569). Changes in CRF, motor performance, or body fat percentage were not associated with RCPM score at 2-year follow-up in boys. In boys in the highest third (mean difference=2.545, 95% CI for difference=0.705 to 4.386, p=0.003) and in the middle third (mean difference=1.813, 95% CI for difference=0.068 to 3.558, p=0.039) of motor performance at baseline had higher Raven CMP scores across 2 years compared to boys in the lowest third. CRF, motor performance, body fat percentage, or their changes were not associated with RCPM score among girls. CONCLUSIONS: Poor motor performance at baseline was associated with poorer cognition trough 2-year follow-up period in boys. No associations of CRF, motor performance, or body fat percentage with cognition were found in girls.
education, body mass index and total brain volume. The statistical threshold was calculated with AlphaSim and further Hayasaki adjusted to account for the non-isotropic smoothness of structural images.

**RESULTS:** Cardiorespiratory fitness was related to greater gray matter volumes ($P<0.001, k=58$) in 9 out of all regions with $\beta$ ranging from 0.493 to 0.584; specifically in frontal regions (i.e premotor cortex and medial primary motor cortex), superior parietal cortex, subcortical regions (i.e. hippocampus and caudate), temporal regions (i.e. middle and inferior temporal gyrus and parahippocampal gyrus) and the frontal cortex. Speed-agility was associated with greater gray matter volumes ($P<0.001, k=54$) in 2 regions (i.e. the inferior frontal gyrus and the superior temporal gyrus) with $\beta$ ranging from 0.564 to 0.611. Muscular fitness was not independently associated with greater gray matter volume in any brain regions. No brain regions showed statistically significant negative associations between components of physical fitness and gray matter volume.

**CONCLUSIONS:** Cardiorespiratory fitness and speed-agility, but not muscular fitness, might independently be associated with greater volume of numerous cortical and subcortical brain structures. Importantly, those associated brain structures are different for each fitness component. These findings suggest that the development of cardiorespiratory fitness and speed-agility might positively affect development of distinctive brain regions and contribute to counteract the harmful effect of overweight and obesity on brain structure during childhood.

**D-42** Thematic Poster - Biomechanical Effects of Fatigue

**Thursday, June 1, 2017, 3:15 PM - 5:15 PM**

**Room: 403**

**1889** Chair: Rod Harter, FACSM. Texas State University, San Marcos, TX.

**1890** Board #1 June 1 3:15 PM - 5:15 PM The Effect Of Compression Tights On Muscle Vibration And Fatigue From A High-intensity Run

Margaret E. Raabe, 43212, Michael P. McNally, Ajit M.W. Chaudhari, FACSM. The Ohio State University, Columbus, OH.

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(No relationships reported)

**BACKGROUND:** It has been hypothesized that compression garments may enhance performance by reducing muscle vibrations during running and jumping. Muscles naturally contract to dampen vibration, which could lead to accelerated fatigue. Therefore, wearing compression garments may result in reduced muscular fatigue.

**PURPOSE:** To investigate the effect of compression tights on muscle vibration and fatigue from a high-intensity run.

**METHODS:** Twenty healthy experienced male runners ran overground at estimated 80% VO2 max speed. Vibration data was collected using an optical motion capture system. The peak amplitude of muscle vibrations (axial direction) were calculated during the first 150ms after foot strike for the quadriceps, hamstrings, gastrocnemius, and tibialis anterior muscles. A high-intensity run was then performed on a treadmill at the same speed for 30 minutes or until voluntary exhaustion. Participants performed 3 countermovement jumps (CMJ) and isometric strength measurements of the 4 leg muscle groups before and after the run. This protocol was repeated on three separate days, one with running shorts (S) and the others with low (L) or high (H) compression tights (10-15 mmHg; 20-25 mmHg). The order of conditions was randomly assigned.

**RESULTS:** Compression tights significantly reduced muscle vibration during running but had no effect on muscle fatigue as measured by change in jump height, jump landing loading rate, or strength following a 30-minute high-intensity run. Supported by a research grant from Nike, Inc.

**1891** Board #2 June 1 3:15 PM - 5:15 PM The Influence of Fatigue on Vertical Free Moment and Vertical Moments around the COM in Female Runners With a History of Stress Fractures

William J. McDermott, Kristen L. Popp, Camden S. Marshall, James Walker, The Orthopedic Specialty Hospital, Murray, UT. Harvard Medical School, Boston, MA.

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(No relationships reported)

The free moment (FM) is a torque around a vertical axis that is the result of the friction between the foot and ground. The FM has been shown to be greater in runners with a history of stress fractures (SF) and is associated with changes in step width, length, pronation, and knee kinematics, arm swing, and fatigue. Since the FM acts in conjunction with moments due to horizontal ground reaction forces (GRFs) to determine whole body axial acceleration, a history of SF may be associated with a difference in controlling axial rotation.

**PURPOSE:** Evaluate the influence of progressive fatigue on FM and vertical moments around the body COM in female runners with and without a history of SF.

**METHODS:** 9 Females with a history of SF and 11 healthy females ran on an instrumented treadmill at their estimated 5k pace until voluntary exhaustion. 3D kinematics for 13 segments identified whole body COM. The product of the horizontal GRFs and the difference between COP and the projected COM determined the axial moment from medio-lateral force (MML), antero-posterior force (MAP) and their sum (MGFRnet). Peak internal (PKINT) and external (PKEXT) values at peak braking (PKBRK) of the moments were evaluated between groups and time with a RMANOVA. RESULTS: In most cases, MML was dominated by MMAP in the first half of stance and by MMAP in the latter half and FM directly opposed MMAP. No group by time interactions were found. PKINT-MMAP (.184 ±.07 to .223 ±.09 Nm/kg, p=0005) and PKINT-MFM (.163 ±.08 to .203 ±.12 Nm/kg, p=0007) increased over time in the SF group. Group differences indicated greater PKEXT-MFM in the SF group (.113 ±.03 vs. .092 ±.02 Nm/kg, p=014) along with lower internal PKBRK-FM (.015 ±.12 to .110 ±.10 Nm/kg, p=015). CONCLUSIONS: Runners with a history of SF respond to fatigue similarly as healthy runners. Differences in PKBRK-FM and PKEXT-MFM suggest whole body axial rotation is controlled differently when there is a history of SF. The opposing relationship between FM and MMAP suggests that FM acts to modify the influence of MMAP on the COM during the first half of stance. The increase in PKINT-FM and PKINT-MMAP with fatigue indicates changes in the requirements to control whole body axial rotation during stance in both groups.

**1892** Board #3 June 1 3:15 PM - 5:15 PM The Effect of Fatigue on Tibial Acceleration During an Incremental Run

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(No relationships reported)

Background: Tibial acceleration is one of the most important mechanical factors associated with high risk of injuries, such as tibial stress fracture and other related musculoskeletal pathologies. Increased tibial acceleration is linked to increased bone-to-bone stress and may exceed the repair and remodeling process of the bone structure over time. Running through fatigue also exacerbates this phenomenon. Purpose: To investigate the effects of a high-intensity fatigue running on tibial acceleration while running at various speeds to identify a change in speed-acceleration relationship.

**Methods:** Five male college students (age = 20.8±1yr; weight =76.7±4kg; height = 181.2±6cm) visited the Creighton University Biomechanics laboratory on two occasions. During the first visit, subjects underwent an incremental test of 3-min stages to determine their lactate threshold speed (LTS) by collecting blood samples (LTS=7.6±1implh). During the second visit, subjects were asked to complete an incremental run of seven 30-second stages at speeds that ranged from 20% below to 40% above the LTS. Subsequently, they performed a 5k run at their LTS followed by another incremental run. A wireless accelerometer that was placed at each subject’s dominant tibial plateau recorded acceleration before and after the 5k run.

**Results:** A two way repeated ANOVA (2 stages x 7 speeds) showed that there was a main effect of speed and a main effect of fatigue (p<0.05). Post hoc analysis revealed that tibial acceleration was significantly greater at speeds larger than 10% above LTS.

**Conclusion:** Current findings showed that tibial acceleration – a previously identified risk factor for impact-related injuries – is affected by fatigue and speed. Therefore, it is of paramount importance that recreational runners that run through fatigue should not run at speeds much faster than their LTS to avoid increasing their risk of injury due to reduced tolerance for impact.
Effect of Fatigue on Landing Biomechanics in Soccer Players with an Anterior Cruciate Ligament Reconstruction
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(No relationships reported)

Fatigue has been shown to influence landing biomechanics in individuals with an anterior cruciate ligament reconstruction (ACL-R). However, no study has evaluated the effect of fatigue on landing biomechanics during a soccer-specific landing task in soccer players with an ACL-R.

PURPOSE: To evaluate the effect of fatigue on landing biomechanics during an unplanned landing task in soccer players following ACL-R compared with healthy non-injured soccer players.

METHODS: Eighteen soccer players with an ACL-R (age, 26.11 ± 3.95 years; height, 1.70 ± 0.09 m; weight, 66.13 ± 9.64 kg, BMI, 23.52 ± 2.69 kg/m²; time since surgery, 5 ± 3.30 years) and 18 healthy non-injured soccer players (age, 25.83 ± 3.51 years; height, 1.66 ± 0.05 m; weight, 66.88 ± 10.37 kg, BMI, 24.09 ± 3.73 kg/m²) participated in the study. Subjects were assessed during an unplanned landing task before and after completing a Wingate fatiguing protocol. The landing task included jumping forward to head a soccer ball and landing on the force plates. An accumulation of 4 minutes of lactate was indicative of fatigue. The outcome measures were peak flexion angles and extension moments of the hip, knee and ankle joints, peak pressure and electromyography activity of gluteus maximus, quadriceps, hamstrings and gastrocnemius muscles. A 2 × 2 (fatigue × group) was performed for each outcome measure.

RESULTS: There were no significant fatigue × group interactions for any of the outcome measures. There were significant main effects of fatigue (as compared to NFL, p = 0.007). Starting in the middle of the trial, peak knee abduction angle (R + J: 18.6 ± 8.8° vs. 21.4 ± 7.5°; R: 18.4 ± 8.6° vs. 21.4 ± 7.6°) and decreased knee flexion angle (2.7±5.2° and 4.0±6.3°) at initial contact (IC). An increased trunk maximum flexion angle (15.5±7.6° and 10.0±5.2°) and knee flexion displacement (58.7±12.8° and 55.6±13.6°) also occurred. Additionally, FL also resulted in an increase in vertical GRF peak magnitude (1.47±0.24 N·kg⁻¹ and 1.75±0.26 N·kg⁻¹). CONCLUSION: At IC, both an extended knee position and greater knee abduction angle have been associated with an increase in ACL injury risk and loading. However, a decrease in peak vertical GRF and increased trunk flexion angle and knee flexion displacement are factors that decrease ACL injury risk and loading and may be adaptation strategies to protect the knee when fatigued.

Effect of Fatigue on Lower Extremity Biomechanics during Repeated Vertical Jumps in College-Aged Females
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(No relationships reported)

Anterior cruciate ligament (ACL) injuries are common in females, and most non-contact ACL injuries occur during landing or cutting movements. Also, fatigue has been linked to an increased risk of injury. Accordingly, significantly more injuries occur during the latter portions of game performance, according to several epidemiological studies. However, a scarce amount of research exists regarding the effects of neuromuscular fatigue on landing biomechanics. We surmised that FL would cause abnormal lower extremity biomechanics.

PURPOSE: To determine if a 60-second continuous bout of jumping affects lower extremity landing biomechanics in females. METHODS: Recreational female athletes (n=10: 63.91±6.5kg, 170.53±3.1cm) participated in this study. Participants performed an established fatigue protocol: double leg vertical jumps every three seconds for 60 seconds. Participants were required to touch a suspended horizontal bar during each jump, with the bar height set by having participants hang from the bar and adjusting it until the height from the midpoint of the lateral malleolus to the ground was 0.4 m. The first three consecutive jumps from the first and last 10 seconds were chosen for data analysis. Reflective marker coordinates were reconstructed from locations captured by 7 cameras (240 Hz). Dominant-side lower extremity angular joint kinematics and ground reaction forces (GRF: 1200 Hz) were compared between the non-fatigue landings (NFL) and fatigue landings (FL) using paired t-tests (p<0.05).

RESULTS: FL, compared to NFL, resulted in increased knee abduction angle (1.6±3.9° and 0.6±2.8°) and decreased knee flexion angle (2.7±5.2° and 4.0±6.3°) at initial contact (IC). An increased trunk maximum flexion angle (15.5±7.6° and 10.0±5.2°) and knee flexion displacement (58.7±12.8° and 55.6±13.6°) also occurred. Additionally, FL also resulted in a reduction in vertical GRF peak magnitude (1.47±0.24 N·kg⁻¹ and 1.75±0.26 N·kg⁻¹). CONCLUSION: At IC, both an extended knee position and greater knee abduction angle have been associated with an increase in ACL injury risk and loading. However, a decrease in peak vertical GRF and increased trunk flexion angle and knee flexion displacement are factors that decrease ACL injury risk and loading and may be adaptation strategies to protect the knee when fatigued.
Training that results in optimal performance.

influence the amount of dynamic knee valgus and increase the risk of ACL injury.

: Hip abductor weakness and acute fatigue are thought to negatively

eccentric hip abductor peak torque at 120°/s, closed chain leg press peak force at

were obtained pre- and post-fatigue at Week 0 and Week 4, and included concentric/

32 physically-active women (age, 21.0 ± 1.4 yrs; height, 1.63 ± 0.06 m; mass, 61.3 ±

Supported by NSFC grant (81302131).

PURPOSE: Hip abductor weakness and acute fatigue are thought to negatively influence the amount of dynamic knee valgus and increase the risk of ACL injury. The Landing Error Scoring System (LESS) is a validated, low-tech drop landing field test commonly used to screen athletes en masse for ACL injury risk. We compared the effects of two 4-week lower extremity neuromuscular training (NMT) programs on acute hip abductor muscular fatigue and LESS scores in women. METHODS: 32 physically-active women (age, 21.0 ± 1.4 yrs; height, 1.63 ± 0.06 m; mass, 61.3 ± 8.6 kg) were randomly assigned to one of two 4-week NMT programs, traditional (n = 17) or Plyometric (n = 15), and performed their respective NMT exercises 4 days per week for 4 weeks. We induced fatigue with a standing hip abduction protocol that employed an isokinetic dynamometer (Thomas et al., 2010). Key outcome measures were obtained pre- and post-fatigue at Week 0 and Week 4, and included concentric/ eccentric hip abductor peak torque at 120°/s, closed chain leg press peak force at 60°/s, and the 17-point LESS test score. RESULTS: Compliance with both NMT programs was excellent, with 27 of 32 participants (84%) recording perfect attendance. Concentric hip abduction peak torque increased 27.9% in the Plyometric group and 19.9% in the Traditional group after 4 weeks (p < 0.001), but there were no significant between group differences (p > 0.05). Our 3-way mixed ANOVA—Group x Time x Fatigue Condition x Time x Fatigue Condition—revealed significant differences on the LESS test for Group (p < 0.05), and Time and Fatigue Condition (p < 0.001). At entry into the study, mean post-fatigue LESS scores were 9.06 ± 1.49 for the Plyometric group and 6.89 ± 1.69 for the Traditional group (p = 0.05). The Plyometric NMT protocol improved LESS scores at Week 4 in both the pre-fatigue (16.7%) and post-fatigue drop landings (11.6%), while participation in the Traditional NMT program improved LESS test scores at Week 4 by 9.0% pre-fatigue and 7.9% post-fatigue when compared to Week 0 (p < 0.05). CONCLUSION: Both of the 4-week lower extremity NMT programs were successful in improving hip abductor and leg press strength. More importantly, the Plyometric protocol produced significantly greater improvements in LESS test scores than the Traditional program, possibly further reducing ACL injury risk in this population.

Thematic Poster - Measurement and Modeling

Performance modeling has been used in numerous sports to predict performance based on the interaction of the positive (i.e. fitness) and the negative (i.e. fatigue) effects of training that results in optimal performance. PURPOSE: i) To use accelerometer to quantify daily training load of on-ice sessions among collegiate ice hockey players, ii) to use this training load as inputs for an impulse-response performance model & iii) to compare model parameters to on-ice performance metrics. METHODS: 7 NCAA Div. III hockey players (22.0 ± 0.6 yr; 185.4 ± 3.7 cm; 87.9 ± 6.6 kg) consented to procedures approved by the Adrian College Human Subjects Committee whereby triaxial accelerometry (Zephyr, MD) was collected during each practice and game of the 2014/15 season. Accelerations (g’s) were used to generate a Training Stress Scores (TSS). TSS was entered into two performance modeling algorithms: a Training Stress Balance (TSB) resulting from Chronic Training Loads (CTL) (i.e. “fitness”), & daily Acute Training Loads (ATL) (i.e. “fatigue”). Data were divided into quartiles, & quartile Top 10 anaerobic (5-60 sec) & aerobic (20, 45 min) efforts were analyzed. MANOVA & Regressions were performed using SPSS 21.0 (IBM, NY). RESULTS: Compared to quartile 1 (Q1), TSS was significantly lower during Q2 (3.2 ± 0.7 v. 65.0 ± 3.2; p<0.05). TSS was significantly higher during Q3, Q4 (3.9 ± 2.0, 3.0 ± 1.6 v. 65.0 ± 2.4; p<0.001); CTL was significantly higher during Q3 & Q4 (32.5 ± 0.2, 33.5 ± 0.7 v. 29.9 ± 0.6; p<0.001); whereas ATL was significantly lower during Q4 (34.7 ± 0.95 v. 44.8 ± 0.67; p<0.001). Anaerobic acceleration outputs were non-significantly higher. Strong relationships were observed between 30 and 60 sec accelerations and TSS (r=0.63, 0.68, respectively), while not as strong with TSB (r=0.33, 0.35, respectively). Aerobic efforts were generally weaker in relation to model parameters. CONCLUSION: Training load was reduced in 2nd half of the season, as a result ATL declined in 2nd half of season, while CTL remained relatively high. Predicted increased CTL matched a nonsignificant increase in long- duration (aerobic) on-ice metrics. Although TSB increased significantly, short-duration (anaerobic) metrics decreased.

Thematic Poster - Measurement and Modeling

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Physical fitness is a powerful marker of health in children and adolescents, and there is no reason to believe that fitness is less important in younger children, i.e., preschoolers. Our group has recently published a systematic review and methodological studies on fitness in preschoolers and has proposed the PREFIT (Assessing levels FITNESS in PreSchooLers) battery for preschoolers aged 3-5 years, providing information about its feasibility, reliability and practical recommendations. References, manual of operations, videos about the tests, etc. are freely available at http://profith.ugr.es. Currently, there are no fitness reference standards available to interpret fitness levels in preschoolers.

PREFIT: To provide fitness reference standards for preschool children. METHODS: A total of 3179 preschoolers aged 3-5 years from 10 cities were randomly sampled in Spain and participated in the PREFIT project. Cardiorespiratory fitness, muscular strength, speed-agility and balance were assessed using the PREFIT 20m shuttle run (an adapted version of the original test proposed by Leventis in 1989), handgrip strength and standing long jump. A total of 30 one-leg stances, & 5 one-leg balance tests, respectively. We applied the Generalized Additive Model for Location, Scale and Shape method to obtain reference standards based on percentile curves. RESULTS: Reference standards for each fitness component by sex and age each 0.25 year are provided. Boys performed better than girls in cardiorespiratory fitness, muscular strength and speed-agility in all age groups and over the different percentiles (all Ps<0.01). However, girls performed slightly better than boys in balance (P<0.001). Older children had better performance in all fitness tests than their younger counterparts (P<0.001). CONCLUSION: Our study provides age- and sex-specific fitness reference standards in preschool children. This work complement the reference standards already published in children and adolescents. These findings can help professionals to identify preschool children with very low fitness level and also as screening element of poor cardometabolic health levels in order to implement new public health strategies from very early ages.

Supported by RYC-2011-09011, BES-2014-068829.
7-a-side football is a game played by football players with cerebral palsy (CP). The Dutch 7-a-side team prepared for the Paralympic Games at Rio 2016 at our national training centre. We monitored the physical performance monthly using a submaximal Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo). However, the Yo-Yo test has been developed specifically to measure physical performance in team sports for able-bodied athletes [1] with determined reliability and sensitivity [2]. PURPOSE: Therefore, to use the Yo-Yo test as a monitoring tool appropriately, the aim of this study was to determine its reliability and sensitivity in CP athletes. METHODS: A subgroup (n=13) of the Dutch 7-a-side team participated in this data-collection. The Yo-Yo tests were executed as previously described [2]. Two submaximal tests (up to step 14.8) were carried out 2 days apart, aiming to elicit a heart rate (HR) of 86-93% of the HR achieved during a maximal Yo-Yo test (HRmax), as this range has proven to show the least variability in submaximal tests [3]. RESULTS: The day-to-day variation, calculated as the TEM, and the SWC were found to be 2.6 and 1.6 m/min, respectively, while the CV was 5.1%. A significant correlation between submax 1 and 2 was observed (r=0.93, P < 0.05). Different heart rate recovery’s (HRR) (calculated as the average of 15s) were calculated and it was found that HRr at 75s showed the highest correlation with the distance completed during the maximal Yo-Yo (r=0.59, P < 0.05). In addition, this test can discriminate between different classifications (athletes are classed according to the magnitude of the disability; cl: 5-6: 91.1%, cl: 7: 93.4% and cl: 8: 88.2% HRmax). CONCLUSIONS: Submax Yo-Yo test performed with CP football players showed a high reproducibility and strong sensitivity. Therefore, submaximal Yo-Yo tests can be used to monitor physical performance in CP football players.
Strenuous exercise like marathon or triathlon leads to disturbances of several biomarkers, not at least markers of skeletal and heart muscle damage. Different predictors of biomarker changes, e.g., sex, age, and training experience have been discussed in the literature with contradictory results. To our best knowledge, maximal oxygen consumption (VO₂ max) has not been investigated in this setting. PURPOSE: To evaluate predictors of biomarker changes in an Ironman triathlon. METHODS: In 39 non-elite athletes (10 female, 29 male; age 41.1 ± 9.7, range 24-70 years) who had performed a 20 m shuttle run test to predict VO₂ max, biomarkers (cardiac troponin T (cTnT; reference < 14 ng/L), creatine kinase (CK; ref. < 1.9 µkat/L), myoglobin (MG; ref. <72 µg/L), and N-terminal prohormone of brain natriuretic peptide (NT-proBNP; ref. < 300 ng/L)) were measured by standard laboratory methods 7 days before, directly after, and day 1, and 6 after the race. RESULTS: VO₂ max was on average 49.9 ± 6.4 mL/kg/minute (range 36.5-63.9). Three biomarkers measured directly after the race were predicted by VO₂ max: CK (53 ± 50 µkat/L; R = -0.44; p = 0.005), MG (2137 ± 2614 µg/L; R = -0.31; p = 0.056) and NT-proBNP (772 ± 2614 ng/L; R = -0.35; p = 0.027). cTnT (75 ± 89) was not significantly predicted by VO₂ max but cTnT leakage was, in contrast to the other biomarkers, higher with higher VO₂ max (R = 0.10; p = 0.65) and return to normal appeared to be faster with higher VO₂ max. CONCLUSION: Earlier research into predictors of biomarker changes after strenuous exercise has found contradictory results concerning age, sex and training experience. In the present Kalmar IronWoMan study VO₂ max was found to be a good predictor of biomarker changes with higher VO₂ max values being correlated to lower values for CK, NT-proBNP and MG.

Validity And Reliability Of A Low-cost System To Measure Oxygen Uptake During Submaximal Exercise

Christen J. Mendonca, Jillian L. Hawkins, Sinclair A. Smith. Drexel University, Philadelphia, PA. (Sponsor: Dr. Stella Volpe, FACSM)

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(NO relationships reported)

Measuring oxygen uptake (VO₂) is the gold standard method for assessing cardiorespiratory fitness. Metabolic systems that assess VO₂ require a significant financial investment. A low-cost VO₂ system would increase the availability to measure cardiorespiratory fitness. PURPOSE: To assess the validity and reliability of a low-cost VO₂ system consisting of a Vernier O₂ sensor, CO₂ sensor, spirometer, and a modified 2L BioChamber 2000 versus the Vmax Encore metabolic system (Care Fusion). METHODS: One healthy adult (55 years, 70.5kg) completed a submaximal graded exercise test on a cycle ergometer that began at a 50-Watt workload and increased by 25 Watts every 3 minutes to a maximum of 175 Watts. The participant’s expired air was captured simultaneously by the low-cost VO₂ system and Vmax system. Both instruments measured flow rate (L/min), O₂ (%), CO₂ (%), and were used to calculate ventilation (VE) and relative VO₂. For the low-cost VO₂ system, VO₂ was calculated as the difference between the inspired and expired O₂ fraction multiplied by VE (L/min). VE was corrected to Standard Temperature and Pressure, Dry. An independent t-test was used to test validity and an Intraclass Correlation Coefficient (ICC 3,2) was used to test reliability between the low-cost VO₂ system and Vmax system. Significance was set at p < 0.05. A Bland-Altman plot was used to illustrate the individual difference scores between the low-cost VO₂ system and Vmax system. RESULTS: There was no significant difference between the low-cost VO₂ system (μ = 21.1 ± 10.3 ml/kg/min) and Vmax system (μ = 19.6 ± 9.5 ml/kg/min) p = 0.388, 95% CI [-0.72, 1.85]. The low-cost VO₂ system demonstrated excellent reliability across 71 measures with an average measures ICC=0.886, 95% CI [0.941,0.994] p<0.01. Conclusion: Findings support that a low-cost system provides valid and reliable measures of VO₂ at rest and submaximal exercise conditions compared to the Vmax system. This project was not funded.

Thematic Poster - Move More, Sit Less, What’s Best?

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 304

Alpa V. Patel. American Cancer Society, Atlanta, GA.

(NO relationships reported)

Age-related progressive increases in sedentary behavior (SB) and decreases in physical activity (PA) have been independently linked to deficits in functional capacity in older adults. The independent relationship of PA and SB on functionality and the lack of evidence for PA interventions to alter SB have led to an interest in joint interventions to displace SB with a PA. PURPOSE: To examine the relationship of substituting 30 minutes of SB with light (LPA) and moderate-to-vigorous physical activity (MVPA) on functional performance in community dwelling older adults. METHODS: A hip-worn accelerometer (Actigraph GT3X+) was worn for seven consecutive days to collect human movement. Freedon cut-points and Choi algorithm for wear-time were used to determine SB, LPA, and MVPA. Functional measures included 400m walk test (400W; m/sec), usual gait speed (UGS; m/sec), and 5-time sit-to-stand (STS; sec). Isotemporal substitution modeling was used to predict the relationship of substituting 30 minutes spent in SB, LPA, and MVPA while adjusting for age and gender. RESULTS: Ninety-one older adults (60% female) aged 50-90 years with an average ACC wear time of 13.99 ± 0.13 hr/day spent approximately 63% of waking hours in SB. LPA was a significant predictor of 400W [0–0.032 m/sec (95% CI: 0.006, 0.056)] and MVPA for 400W [0.204 m/sec (0.110, 0.297)], UGS [-0.618 sec (-0.178, -0.1059)], and STS [-2.726 sec (-3.714, -0.759)]. Directly substituting 30 minutes of SB time with LPA resulted in a significant improvement in 400W [0.027 m/sec (0.000, 0.053)]. MVPA significantly improved 400W [0.193 m/sec (0.099, 0.286)], UGS [0.575 sec (0.123, 1.020)], and STS [-2.176 sec (-3.734, -0.753)]. Aside from a strict 1:1 reallocation of SB to LPA or MVPA, significant improvements in all functional measures were observed with a combination of 5 minutes MVPA and 25 minutes LPA. CONCLUSIONS: While MVPA had the greatest impact when displacing SB, the practical implications of introducing a LPA to displace SB may be of particular importance among public health practitioners. Specifically, a goal of redirecting 5-10% of SB time (27-54 minutes/day) toward LPA, and not exclusively MVPA, may result in beneficial changes in functional health in older adults.

Physical Activity on Functional Performance in Older Adults

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(NO relationships reported)

The prevalence of metabolic syndrome (MetS) in young adults is on the rise. Excessive screen-based media use during adolescence may increase the risk of developing MetS in adulthood. PURPOSE: To examine screen time in adolescence and its longitudinal association with metabolic risk factors that are related to MetS in young adulthood. We hypothesized that the amount of screen time and its change through adolescence would be significantly associated with metabolic risk in young adulthood. METHODS: This study included 5098 participants (age 29±1.8 yrs) from wave I (baseline) through IV of the National Longitudinal Study of Adolescent Health. Using the wave IV data, a latent variable for clustered metabolic risk factors was constructed consisting of blood pressure, waist circumference, HbAlc, triglycerides, and high-density lipoprotein cholesterol. The self-reported weekly screen time hours during adolescence (wave I in 1994-95, wave II in 1996, and III in 2001-02) were calculated by summing the screen-based media time variables (i.e., watching TV, watching videos, and computer use) at each wave. The latent trajectory of screen time during adolescence was analyzed using latent growth modeling and the latent variable for the metabolic risk factors was treated as distal outcome of the growth model. RESULTS:
Mean screen times were 22.5 (±19.0) hrs/wk, 20.4 (±17.7) hrs/wk and 21.6 (±17.3) hrs/wk at wave I, II and III, respectively, indicating that the prevalence of excessive screen time was high. The structural model showed a good fit of the data (χ2=126.12; df=25; p<0.001;CFI=0.952; TLI=0.931; RMSEA=0.025; 90%CI [0.021, 0.029]; SRMR=0.025). The results suggest that individuals who reported a high level of screen time at baseline or increased their screen time during adolescence had an increased metabolic risk in young adulthood, respectively (β =0.305; p<0.001; β=0.191, p=0.002). The model fitted approximately 10% of the explained variance in the latent variable of the clustered metabolic risk factors. CONCLUSIONS: Our findings suggest that screen-based sedentary behavior during adolescence may predict increased risk for developing MetS in young adulthood. Longitudinal intervention research is warranted to investigate the causal pattern between sedentary behaviors and MetS.

**INTRODUCTION:** Physical activity and sedentary behavior are major risk factors for chronic disease. These behaviors may change at retirement due to shifts in daily routine, social networks, and access to resources, with implications for health in later life.

**PURPOSE:** To describe longitudinal trajectories in moderate to vigorous physical activity (MVPA) and TV watching among adults transitioning to retirement compared to continuing to work.

**METHODS:** Participants in the MESA (N=6,814) were recruited from six United States communities, had no history of cardiovascular disease, and were aged 45-84 years. Participants were included if they were not retired at baseline and were followed through age 89 years. The study was powered to detect differences in physical activity and sedentary behavior at retirement, occupational physical activity, self-rated health, and study site. Models were adjusted for age, gender, race/ethnicity, education, income, time since retirement, occupational physical activity, self-rated health, and study site.

**RESULTS:** Of 4,212 MESA participants not retired at baseline, 57% were female, 51% had a college degree, and 40% were non-Hispanic white. A total of 955 (23%) retired during follow-up (median follow-up time: 8.0 years). Retirees engaged in less MVPA (median 3583 vs. 4005 MET-minutes/week) and more TV watching (median 900 vs. 750 minutes/week) compared to workers. Over time, average MVPA decreased (-44 MET-min/week per year, 95% confidence interval (CI): -67, -22) and average TV watching increased (18 minutes/week per year, 95% CI: 15, 21). Retirement was associated with a slower rate of decline in MVPA (a decrease influences colorectal cancer risk: MET-minutes/week per year, 95% CI: 19, 197) and faster rate of increase in TV watching (10 minutes/week per year decrease, 95% CI: -1, 22).

**CONCLUSION:** Retirement was associated with unfavorable decreased MVPA and increased TV watching compared to continuing to work. Exploring domain specific changes in physical activity (e.g., exercise, care giving) and identifying determinants of physical activity and sedentary behavior change at retirement may inform physical activity promotion efforts targeted at the growing population of American retirees. Supported by the NIH/NHLBI and Royster Society of Fellows.

**Sedentary behavior such as sitting is becoming increasingly prevalent in the modern society, and it is distinctly different from physical inactivity. Colorectal cancer (CRC) is one of the most common cancers, and physical activity consistently reduces the risk for CRC. It is still unclear whether increased sitting time increases colorectal cancer risk.**

**PURPOSE:** In a prospective longitudinal design, we examined sitting time and physical activity in relation to colorectal cancer risk. The HUNT-study, Norway.

**METHODS:** Participants in the Northern Norway Health Study (HUNT2, 1995-97). Individuals from Northern Norway, aged 40-79 years, were included if they were not retired at baseline and were followed through age 89 years. The study was powered to detect differences in colorectal cancer incidence. The study was conducted in two phases: baseline (1995-97) and follow-up (1997-2007). The main exposure of interest was sitting time. Analyses were based on participants with complete information on sitting time and colorectal cancer incidence at follow-up. The primary outcome was colorectal cancer incidence among participants with complete information on sitting time and colorectal cancer incidence at follow-up.

**RESULTS:** In total, there was included 626,761 person-years and 709 incident CRC cases during the 16-year (average) follow-up. Men who reported moderate or low PA had a 32% and 34% higher risk for CRC respectively, compared to those who were in the high active category. In analyses of the joint association of sitting time and physical activity, it was found that men who reported low physical activity combined with sitting more than 8 hours per day had a 60% increased risk (95% CI 1.11, 1.27) and those sitting less than 8 hours per day had a 44% increased risk (95% CI 1.06, 1.96) compared to those who were highly active. CONCLUSIONS: Low physical activity is a risk factor for CRC in men. Vigorous physical activity is independently protective against CRC cancer in men, but this was not found in women.

**Evidence suggests that time spent in sedentary behaviors is associated with a greater risk of adverse cardiometabolic outcomes. However, existing research has focused on broad measures of sedentary time or television viewing, and less is known about the association between other types of sedentary activities and cardiometabolic risk.**

**PURPOSE:** To investigate the cross-sectional associations of six distinct sedentary activities with cardiometabolic risk factors, and compare replacing one type of sedentary behavior with another in relation to cardiometabolic risk.

**METHODS:** Participants were 3,314 Black and White adults, aged 42-59 years, from the Coronary Artery Risk Development in Young Adults (CARDIA) study who reported average sitting time at baseline or increased their screen time during adolescence had an increased cardiometabolic risk score. Isotemporal substitution models were then used to estimate the “substitution effect” of replacing sedentary time from one activity for an equal amount of sedentary time from another activity. All models adjusted for age, sex, race, education, smoking status, alcohol consumption, fast food frequency, sugar-sweetened beverage consumption, physical activity and MetS. Time spent in each of the sedentary activities, with the exception of car time, was independently and positively associated with the cardiometabolic risk score (p<0.04). When all sedentary activities were entered simultaneously in the model, television viewing was the only variable that remained significantly associated with the cardiometabolic risk score (p<0.001). Replacing television time with time spent in any other sedentary activity was associated with a 0.06 to 0.09 standard deviation lower cardiometabolic risk score (all p<0.007). Conclusion: Television viewing has a more adverse association with cardiometabolic risk factors than other types of sedentary behaviors.

**Low back pain (LBP) is a major public health problem. Preliminary data suggest that LBP increases throughout the workday for sedentary, desk-bound employees.**

**PURPOSE:** The Stand Back randomized trial evaluated whether an intervention targeting reduced sitting time could decrease pain in desk workers with chronic LBP. **METHODS:** The study recruited individuals with chronic LBP. Oswestry Disability Index (ODI) > 10%, and desk jobs (sitting ≥20 hr/wk). Participants in the intervention received behavioral counselling with an initial in-person visit followed by monthly telephone calls. They also received a sit-stand desk attachment with a goal to stand for 2 hr each day and an activity-promoting device set to vibrate after 30 min of inactivity. Goals were individually tailored and progressed during monthly contacts.
based on participant response. LBP was measured using the ODI. Sitting time (work and all day) was assessed by self-report. Outcomes were compared across intervention groups using paired t tests and linear mixed models. RESULTS: In completers (n = 25 of n = 27 enrolled), baseline mean (SD) age was 49 (11) years, 76% were female, and ODI was 23.9 (2.1) %. Sitting time at baseline was 6.9 (1.1) hr during work and 10.2 (1.6) hr all day. At 3 months, sitting time significantly decreased in intervention (n = 13) vs. control (n = 12) both during work [-2.0 (1.3) vs. -0.5 (1.2) hr, p = 0.007] and all day [-2.5 (1.7) vs. -1.1 (1.6) hr, p = 0.045]. Across months 1-3, the average decrease in ODI from baseline was significantly greater in intervention vs. control (difference between groups of -7.9 %, of p = 0.007) (Figure). At 3 months, the change in ODI was -10.6 (8.7) % in intervention vs. -1.0 (10.4) % in control (p = 0.020). CONCLUSION: An intervention targeting sedentary behavior in desk-bound employees with chronic LBP was effective in reducing sitting time and low back pain/disability. Studies are needed to examine longer term effects of sedentary behavior interventions in chronic LBP.

Excessive sitting time is ubiquitous in Westernized societies and is associated with deleterious health outcomes. Few studies have examined whether the manner in which sedentary time is accrued (in short or long bouts) carries clinical relevance that is separate from or jointly related to total sedentary time. PURPOSE: The purpose of this study was to examine the individual and joint associations of total sedentary time and prolonged, uninterrupted sedentary bouts with glycemic biomarkers in Hispanic/Latino adults. METHODS: We studied 12,083 adult participants from the population-based Hispanic Community Health Study/Study of Latinos. Homeostatic model assessment of insulin resistance (HOMA-IR) was measured from a fasting blood sample and 2-hour glucose was measured following an oral glucose challenge. Sedentary time was measured via hip-mounted accelerometer. Prolonged, uninterrupted sedentari ness was expressed as mean sedentary bout length. Participants were classified into four categories: low total sedentary time (quartiles 1-3 of total sedentary time) and low sedentary bout duration (quartiles 1-3 of mean sedentary bout duration), low total sedentary time and high sedentary bout duration (quartile 4), high total sedentary time (quartile 4) and low sedentary bout duration, or high total sedentary time and high sedentary bout duration. RESULTS: Adjusted for confounders and moderate-vigorous physical activity, participants in the upper quartile for both sedentary characteristics (e.g. high total sedentary time and high sedentary bout duration) had the highest levels of HOMA-IR (4.76 [95% CI: 3.94, 5.59] vs 4.09 [95% CI: 4.10, 4.89] for low/low group; p = 0.001) and 2-hour glucose (138.9 mg/dl [95% CI: 123.0, 154.8] vs 134.2 mg/dl [95% CI: 118.3, 150.1] for low/low group; p = 0.002). High total sedentary time or high sedentary bout duration alone were not associated with differences in any of the glycemic biomarkers CONCLUSIONS: High total sedentary time and high sedentary bout duration were deleteriously associated with glycemic biomarkers together (e.g. high total sedentary time and high sedentary bout duration) but not individually. These findings support the concept that reducing and regularly breaking up sedentary time may be an important adjunct to existing physical activity guidelines.

**D-45** Thematic Poster - Neuromechanics of Ankle Instability

**Thursday, June 1, 2017, 3:15 PM - 5:15 PM**

Room: 404

**Chair: Robin Queen, FACSM. Virginia Tech, Blacksburg, VA.**

**(No relationships reported)**

Lateral ankle sprains are common sport-related injuries which often lead to chronic ankle instability (CAI). CAI has been shown to impair neuromuscular control as well as dynamic stability of the ankle joint. PURPOSE: To examine if CAI subjects demonstrate different ankle neuromechanical patterns during walking when compared to controls. METHODS: 100 CAI patients (22.5 yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.5±2.6 ankle sprains) and 100 controls (22±3 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports, no previous sprains) participated. Subjects performed five walking trials over a force plate while ankle joint angles, moments and muscle activation were collected during the stance phase (0-25%: initial stance, 25-50%: loading response, 50-75%: midstance, and 75-100%:...
terminal stance). Functional analyses (p < 0.05) were used to compare the entire gait cycle between groups. Functions of each group as well as 95% confidence interval (CI) were plotted to determine significant differences. **RESULTS:** Figure 1. The CAI group increased plantarflexion, likely a result of greater plantarflexion moments and gastrocnemius activation. Decreased eversion was also observed, accompanied by decreased inversion moments tied to decreased peroneus longus activation. **CONCLUSION:** Relative to the leg, CAI subjects demonstrated a potentially high-risk gait pattern by positioning the foot in a less closed-back position and a more inverted position. CAI subjects appear to alter lower extremity biomechanics in a way that could increase injury risk during walking.

Lateral ankle sprains are common orthopedic injuries that often result in chronic ankle instability (CAI). CAI is characterized by many residual symptoms, including pain, episodes of giving way, recurrent injury, impaired postural control and gait, decrease in strength, structural laxity, and decreased physical activity. Impairments in postural control have been identified using both static balance tests like the single leg test on Biodex Stability System and dynamic balance tests, like the star excursion balance test. However, it is not known if there are differences in postural control between individuals with and without a history of ankle sprain when tested without feedback. **PURPOSE:** To examine postural control and stability characteristics of persons with and without CAI during the Athlete Single Leg Stability Test on the Biodex Balance System (BBS). METHODS: 18 persons with CAI, 15 Copers, and 18 healthy controls (mean age: 22 years for all the groups) completed 20 trials for each leg without center of pressure feedback at each of the following BBS levels: Static, Levels 12, 8, and 4. Each level corresponds to the degree of tilt of the platform surface with a lower number corresponding to lesser stability or more tilt. A 3x4 ANOVA was run with the dependent variables: overall stability index (OSI) and sway area. OSI is the mean distance of the center of pressure from the center of the platform. **RESULTS:** Significant level main effect was observed for both OSI and sway area (both P < 0.001). At Level 12, OSI (1.2) and sway area (1.1 cm²) were significantly less compared to other levels (all P < 0.001). At Level 8, OSI (1.8) and sway area (2 cm²) were significantly less compared to Static and Level 4 (both P <0.002). Static OSI (2.3) and sway area (4.9 cm²) values were similar to those at Level 4 (OSI: 2.6; sway area: 10.9 cm²). No significant group main effect or interaction was observed for either of the variables. **CONCLUSION:** The Athlete Single Leg Stability Test on BBS without feedback is not sensitive in detecting differences among those with and without CAI. Further testing should examine if standing with eyes closed on the static level on BBS provides a more sensitive way to challenge proprioceptive input in this population. Use of OSI as a dependent variable should be used with caution.
With aging decreasing function of peripheral proprioceptors may affect proprioceptive acuity and contribute to increased falls risk. The development of proprioceptive acuity across the lifespan has not been extensively examined. **Purpose:** To investigate the trend of age-related changes in active ankle proprioceptive acuity. **Method:** The right ankles of 80 right-handed healthy and active participants across four age groups were assessed - children (aged 6-8), adolescent (aged 13-15), adults (aged 18-25), and the elderly (aged 65-82). Ankle proprioception was assessed using active movement extent discrimination assessment (AMEDA). **Results:** There was a significant difference between the four groups (F_{3, 76} = 13.071, p < 0.001). Significant differences in the mean area under the curve (AUC) accuracy score of the active movement extent discrimination ability were observed between children (0.666 ± 0.08) and the other three groups: adolescent (0.748 ± 0.046; P < 0.01), adult (0.787 ± 0.047; P < 0.01), and the elderly (0.740 ± 0.07; P < 0.05), adolescent and adult (P < 0.05), and adult and the elderly (P < 0.05). No difference was found between adolescent and the elderly (p > 0.05). The AUC score of the elderly was worse than that of the adult (p < 0.01), while better than that of the children (p < 0.05). **Conclusion:** We inferred that the development trend of proprioceptive acuity in normally active participants progressed from being least sensitive during childhood to the highest level in young adulthood in parallel with the development of physiologic and physical function (i.e. peripheral proprioceptors and CNS development), and decreased for the elderly over 65 to a level close to that of the adolescent. Future research is needed to determine how much of the decline in proprioceptive function is due to degeneration in the CNS or peripheral nervous systems, or due to failure to maintain adequate exposure to environmental stimuli to reduce the overall proprioceptive function decline.

Ankle arthritis is most often post-traumatic and is associated with substantial disability and pain. A common intervention for severe ankle arthritis is joint replacement (arthroplasty). Previous research has suggested that balance as evidenced by center of pressure (CoP) excursions is not improved two years post-total ankle arthroplasty (arthroplasty). Previous research has suggested that balance as evidenced by center of pressure (CoP) excursion velocities may be a better measure of postural control. **Purpose:** To quantify recovery of balance as evidenced by CoP excursion velocities at 1 and 2 years post-surgery in the surgical (Sx) and non-surgical (NSx) limbs of TAA patients. **Methods:** Fifty-two individuals with unilateral ankle arthritis capable of unassisted ambulation performed three trials of quiet standing for a period of 10 seconds with their feet placed together. Bilateral ground reaction forces (GRFs) were recorded using two embedded force plates (1200 Hz, AMTI, Watertown, MA). This assessment was completed pre-operatively (PRE) and then 1 year (POST-1yr) and 2 years (POST-2yr) after TAA. Custom software (MatLab 2016, Mathworks, Natick, MA) was used to calculate CoP excursion velocities. Mean CoP excursion velocity (MEV) were calculated in the anteroposterior (AP) and mediolateral (ML) directions for the Sx and NSx. SPSS was used to conduct a pair of 2 x 3 (side by time) repeated measures ANOVAs with post-hoc t-tests to assess the effect of surgery and time on MEV. Significance was set at p < 0.05.

**RESULTS:** ML MEV was not different between limbs (Sx versus NSx) (p=0.75) or across time during recovery (p=0.54) but was there a side by time interaction (p=0.09). A significant side by time interaction was present for AP MEV (p=0.01; NSx PRE: 34.1±10.3; NSx POST-1yr: 41.5±16.0; Sx POST-2yr: 58.7±17.1; Sx PRE: 46.2±14.2; Sx POST-1yr: 42.4±12.4; Sx POST-2yr: 65.4±13.7). Post-hoc assessment of the interaction revealed that AP MEV values converged with time. **CONCLUSIONS:** These data suggest that AP MEV’s become more similar between the Sx and NSx with time potentially demonstrating improved symmetry. However, MEVs were not altered in either Sx or NSx. This may suggest that postural control mechanisms have not improved following TAA and that these individuals could benefit from focused balance training to decrease fall risk.
Effects of Concussion Recovery Phase on Symptom Provocation using Vestibular and Assessments.

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Ocular motor testing is quickly emerging as a valuable component of the diagnostic portion of a sport concussion assessment when combined with symptom scores. However, the usefulness of oculomotor testing in helping to track recovery following a sports related concussion and aid in return to play decisions remains unclear.

**Purpose:** To evaluate the usefulness of several readily available oculomotor and vestibular tests that require minimal to know equipment for assessing S/S from injury and tracking recovery from a sport related concussion.

**Materials and methods:** Participants were divided into three groups: healthy controls (n=58), acute concussion (n=21) and prolonged recovery (n=10). The acute concussion group suffered a concussion 29 days prior to initial assessment as evidenced by delayed recovery and the concussed group suffered a concussion ≥16 days prior to initial assessment. Repeated measures ANOVA was performed on the combined control group and the acute and recovery concussion groups. 2x2x6 MANOVA was performed. Post hoc tests were conducted using Bonferroni correction.

**Results:** Using the average of the last three visits of symptoms provoking force breathing tests, the recovery group had significantly greater scores for symptoms provoked using force breathing tests compared to the control group. This increased symptom provocation was evident even during the recovery phase of concussion. The recovery group showed significant improvements in symptoms provoked by force breathing tests compared to the acute concussion group. The acute and control groups did not differ in symptoms provoked by forced breathing tests.

**Conclusion:** The current study supports the usefulness of oculomotor and vestibular tests to track recovery from concussion and aid in return to play decisions.
Following a concussion, athletes are often prescribed physical and/or cognitive rest. The effectiveness of prescribed rest may depend on initial burden or presentation of signs and symptoms. More objective signs of concussion such as amnesia, disorientation/confusion, and loss of consciousness have been linked to poor outcomes and may reflect a greater burden of injury; whereas symptoms are more subjective and may be less reflective of injury burden.

**Purpose:** To determine if patients with signs of injury respond differently to prescribed rest following concussion compared to patients with a predominant symptom only.

**Methods:** We conducted a secondary analysis of a prospective randomized controlled trial (RCT) of 93 pediatric concussion patients aged 11–17 years. Patients completed the Immediate Post-concussion Assessment and Cognitive Testing (ImpACT), Post-concussion Symptom Scale (PCSS), and the Balance Error Scoring System (BESS) within 24 hours of injury and at 3 and 10 days post-injury. Patients were randomized to rest or usual care and completed activity and symptom diaries for 10 days after injury. A series of 2 (group: Symptomatic, 2+ Signs) x 2 (treatment: prescribed rest, usual care) ANOVAs were performed for each outcome measure. Univariate nonparametric tests (i.e., 22 with odds ratios, 95% CI) were used to examine the association between treatment and symptoms 1-9 days post-injury.

**Results:** Results revealed a significant group x treatment interaction for symptoms at 3 days post-injury (F=6.31, p=0.01, q2=0.7). Prescribed rest increased the likelihood of being symptomatic at days 1-6 and 8 (p<0.05) for the Symptom group. In contrast, rest was beneficial for patients in the 2+ Signs group on verbal memory performance (r=−2.29, p=0.029).

**Conclusions:** The effects of prescribed rest following concussion may be dependent on initial injury presentation. Compared to patients with objective signs of injury, patients with predominantly symptoms were more likely to remain symptomatic post-injury if prescribed rest, whereas patients with signs of injury benefited from rest following concussion. Individualized treatment planning post-concussion should start at the time of presentation and take into consideration initial presentation of concussion signs and symptoms.

Concussions in adolescents are a public health concern with the growing popularity of high school sports. State legislation mandates that athletes who are suspected of having a concussion be cleared by a clinician to return-to-play. More research is needed to identify populations at risk for protracted recovery. **Purpose:** The aim of this study was to identify clinical (e.g., concussion history, migraine history, learning disabilities, attention deficit hyperactivity disorder (ADHD)) and demographic factors (e.g., age, sex, race/ethnicity, health insurance status, mechanism of injury/sport, education) that predict concussion recovery times. **Methods:** In a retrospective cohort study of adolescents, 13 to 19 years old, evaluated for an acute concussion (<10 days from injury) at a university-based concussion clinic, recovery times were calculated from the date of concussive injury to the date of clearance to return-to-play and/or normal activities. The healthcare provider determined recovery based on physical examination, symptom reporting by the patient, parent, and/or athletic trainer, ImpACT computerized battery performance compared with norms and/or baseline scores (when available), and academic performance. A Cox proportional hazards model was used to identify predictors of concussion recovery times. **Results:** There were 227 charts that met inclusion criteria. There were no differences in distributions of age and sex. The sample (N=227) was primarily male (75%), and the median age was 15 years. Ethnic minorities (blacks and Hispanics) constituted 46% of the sample. The median time to recovery was 216.15 days in minority males. The median time to recovery was 149.9 days in males and 11 days in minority males. The median time to recovery was 26 days in females and 13 days in males. White females had the longest recovery time (median 27.5 days). Predictors of protracted recovery included ADHD (HR = 4.49, 95% CI = 2.72 - 7.41, p=0.002) and prior concussion (HR = 0.574, 95% CI = 0.397 - 0.828, p=0.003) in all sex and ethnic groups, while shorter recovery times were predicted by male minority status (HR = 2.12, 95% CI = 1.30 - 3.46, p<0.003). **Conclusions:** This study found significantly shorter recovery times in adolescent minority males compared to white females and identified ADHD and prior concussions as risk factors for protracted recovery.
Conclusion: As a result of this study, normative values for the PD test were established for the pediatric population. Test performance varied with age. Test performance did not vary based on hand, pre-surgically indicating hand dominance does not affect performance during this evaluation, Future studies should evaluate the effect of concussion on performance.

D-47 Free Communication/Slide - Free-Living Validation Studies
Thursday, June 1, 2017, 3:15 PM - 5:00 PM
Room: 103

1933 Chair: Andrea K. Chomisteck. Indiana University-Bloomington, Bloomington, IN.
(No relationships reported)

1934 June 1 3:15 PM - 3:30 PM
Free-living Total Energy Expenditure Assessed using Three Accelerometer Models Validated against Doubly-Labeled Water
William E. Kraus, FACSM1, Megan A. McCreory2, Manjushiri Bhagkar1, Edward P. Weiss3, Corby K. Martin1, James P. DeLany4, Susan B. Roberts1, Sai K. Das5, Susan B. Racette4.
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PURPOSE: Methods for estimating total energy expenditure (TEE) in free-living conditions are needed as alternatives to the expensive and technically demanding gold-standard doubly labeled water (DLW) technique. Accelerometers are one such option. We evaluated three widely-used accelerometers (ActiGraph, Actical, and RT3) using a standardized data analysis procedure to determine their ability to accurately estimate TEE using manufacturer-provided algorithms. Second, we determined if the inclusion of simple variables in the regression model improved the accelerometer TEE estimate.

METHODS: Healthy, nonsmoking, non-obese adults aged 25-60 y wore accelerometers during a 14-d DLW assessment of TEE. Data were collected at 3 sites (Pennington Biomedical Research Center (PBRC; n=47), Tufts University (n=38), and Washington University School of Medicine (WUSM; n=38)) as part of a study on caloric restriction and aging (the CALERIE Study). Accelerometer manufacturers’ algorithms were used to convert minute-by-minute counts to energy expenditure per minute, from which TEE (kcal/d) was derived. Only days in which accelerometers were worn for ≥720 min were included in the analysis; at least one valid day was required.

RESULTS: The three evaluated accelerometers provided estimates of TEE differing significantly from TEE measured by DLW (-690 to 220 kcal/d; pooled SE 44 kcal/d; p<0.0001). Regression equations generated from accelerometer-assessed TEE accounted for 46-74% of the variability in DLW-measured TEE (R²=0.51-0.74), and all differed significantly from the line of identity (p<0.0001). When body mass and/or sex were included in regression models, all predictions were improved and the SEE was reduced to 7-9% of DLW-measured TEE. Accelerometer-specific equations were derived for the prediction of free-living TEE which may prove useful and can be cross-validated in future studies.

CONCLUSIONS: Using manufacturers’ algorithms, the three accelerometers evaluated in this study estimated TEE with an error comparable to the within-subject between-day variability in DLW-measured TEE. Including simple variables such as age and body mass in the prediction equations improved the utility of the accelerometers for assessing free-living TEE.

Self-report remains an important measurement method for physical activity and sedentary behaviors because it provides the contextual information needed in targeted behavioral interventions.

PURPOSE: This study aimed to evaluate the validity and responsiveness to change of a workplace sedentary behavior questionnaire (SBQ) in assessing total sedentary behavior (1) at work and (2) outside of work during workdays, and during (3) non-workdays.

METHODS: Participants (N=359) were recruited from 16 worksites in the greater Minneapolis and Phoenix regions. Participants wore an activPAL3 accelerometer for 7 days at two timepoints (baseline and 12-week follow-up). They also completed a sedentary behavior questionnaire on the 7th day of each assessment timepoint. Time spent in each behavior from both measures was standardized to a 16-hour day on non-work days and 8-hours to both work hours and non-work hours on work days. The agreement between the two measures was assessed through single-measure with absolute definition ICC using a two-way random effects model. Bias estimates (mean difference [] and root of mean square error [RMSE ] were used to compare the activPAL values. Responsiveness to change following the intervention was assessed using the responsiveness statistic (RS).

RESULTS: There was poor agreement between the SBQ and activPAL (ICC from 0.06 - 0.29) across all time periods. On average, participants over-reported their time spent sitting (Mean [95% CI]= 39.9 [31.1, 48.7] min/day, RMSE= 112.5) and moving (12.9 [9.39, 16.5] min/day, RMSE= 44.3), but under-reported standing (-52.9 [-60.5, -45.2] min/day, RMSE= 105.5) at work. Moreover, sitting time during their non-work time was over-reported (51.7 [45.4, 65.7] min/day, RMSE= 218.8). Sitting on non-work days was underestimated (-87.2 [-111.6, -62.7] min/day, RMSE= 298.8). SHQ was similarly responsive to change compared to the activPAL except for sedentary time during non-work days (0.13 and 0.49 for SBQ and AP, respectively).

CONCLUSION: Despite the poor absolute agreement between the SBQ and activPAL, overall bias estimates and responsiveness during work days were acceptable. Further studies are needed to explore ways to improve accuracy in sedentary behavior reporting during non-working days.

S397

THURSDAY, JUNE 1, 2017

1935 June 1 3:30 PM - 3:45 PM
Workplace Sedentary Behavior Questionnaire: Validity and Responsiveness to Change
Meynard John L. Toledo1, Sarah Mullane1, Miranda Larouche1, Sarah Ryde1, Mark Pereira2, Matthew Buman, FACSM3, 1Arizona State University, Phoenix, AZ. 2 University of Minnesota, Minneapolis, MN. (Sponsor: Matthew P Buman, FACSM)
Email: mtoledo@asu.edu
(No relationships reported)

The Validity of Fitbit Charge in Free Living Conditions
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Email: Yang.Bai@med.uvm.edu
(No relationships reported)

PURPOSE: Research is accumulating regarding the accuracy of wrist-worn consumer activity monitors in controlled lab settings. However, there is a lack of evidence of validity under free living conditions. The study investigated the accuracy of Fitbit Charge (FBC) for estimating minutes of moderate and vigorous physical activity (MVPA) compared to research grade accelerometers. A secondary purpose was to evaluate the accuracy of steps.

METHODS: Ninety-four healthy men and women (mean age 41 ± 9 years) wore a FBC as part of a 12-week intervention. The participants were also asked to wear research grade accelerometers concurrently as the criterion physical activity measure during the last week of intervention. A minimal of 10 hours/day wear-time was applied to both methods. Estimated daily MVPA and steps taken from the FBC were compared to the criterion using indicators of Pearson correlation, mean absolute percent errors, mean percent errors, and equivalence testing. The activity classification agreement between the two methods was 0.92 with a low sensitivity of 30.1% but a high specificity of 96.7%.

Abstracts were prepared by the authors and printed as submitted.
Questionnaires assessing sitting time generally use a questioning technique that asks for absolute length of time (hours and minutes) spent sitting. However, recent studies evaluating workers' physical activity questionnaires (WPAQ) showed that asking for the percentage of time rather than the absolute length of time spent sitting improved the questionnaire's properties. Furthermore, the study showed that most participants preferred the percentage method rather than the absolute time method. Therefore, we developed a new WPAQ (JNIOSH-WPAQ) to investigate workers' sitting time using the percentage method. **Purpose:** To investigate test-retest reliability and criterion validity of sitting time assessed by the JNIOSH-WPAQ. **Methods:** Our study included 138 workers who completed the WPAQ and wore a thigh-worn inclinometer (activPAL) over time as a criterion measure. The WPAQ measures time spent sitting within four typical domains of a worker's life: (a) working time, (b) commuting time, (c) non-working time on a workday, and (d) non-workday. We calculated intraclass correlation coefficients (ICC) as a reliability value and Spearman's ρ as a validity value. Results: The WPAQ demonstrated favorable reliability for sitting time in all four domains. That is, the ICCs for working time, commuting time, non-working time on a workday and non-working day were 0.86, 0.93, 0.80 and 0.77, respectively. As for validity, the ρ values of the WPAQ sitting time varied by domain. The ρ value during commuting time (0.86) was "strong" (0.70-0.89), whereas the ρ value on a non-working day (0.41) was "low" (0.30-0.49). On the other hand, the ρ values during working time (0.61) and non-working in a workday were "moderate" (0.50-0.69). **Conclusions:** The study showed that the JNIOSH-WPAQ has acceptable measurement properties for investigating workers' sitting time, which makes this questionnaire a reasonable resource for future epidemiological survey. Supported by funding from the National Institute of Occupational Safety and Health, Japan (N-F25-08).

**PURPOSE:** Questionnaires typically used in epidemiologic studies to assess habitual physical activity (PA) and sedentary time (ST) are imprecise and do not assess the full spectrum of daily activities. This has limited our understanding of how these behaviors affect health. Thus, we tested two more precise and comprehensive measures, an accelerometer and an internet-based 24-hour recall (ACT24), as well as a questionnaire (Q). **METHODS:** Adults (50-70 y) enrolled in a 12-month study that included 3 criterion measures: PA energy expenditure (PAEE) measured by doubly labeled water (DLW), and two 7-d activPAL measures of active and sedentary time (A-ST). They also completed a 20-item past year Q about PA and ST (twice), an ACT24 recall of PA and ST every 2 months, and were asked to answer a乔尔 equation (ActiGraph) on the waist for 7-d AG equations (Freedom, Sasco, Cronut 2-regression, Lyden machine learning [Soj3x]) were used to estimate PAEE. A/ST was quantified via Cronut, Soj3x and two cut-points (100 vertical axis [100VA]; 200 vector magnitude [200VM]). Accuracy was evaluated as % difference from the mean of the criterion values, while correlations between the true criterion and each test instrument were also calculated. **RESULTS:** Among those with DLW or activiPAL measures, mean age and BMI was 63.7 y and 23.8 kg/m². Mean criterion values were: DLW PAEE (747 kcal/d, n=689) and activiPAL A/ST (6.0/9.8 hrs/d, n=932). Accuracy in assessing PAEE was similar for the Q and ACT24 (-6%), while 100VA was most accurate for A/ST (1%/2%). Strength of the correlations for PAEE and A/ST were relatively consistent within each measure, but correlations were lower for Q (<0.28-0.41), higher for ACT24 (r=0.63-0.73) and highest for AG Soj3x (r=0.72-0.77). Correlations for the other AG measures (r=0.61-0.75) were similar to ACT24. Results did not vary greatly by sex, but all correlations for Q and ACT24 were lower for obese participants. **CONCLUSION:** ACT24 and AG measures of PA and ST were more accurate and had higher correlations than Q, suggesting that use of these more comprehensive measures in future epidemiologic studies could yield new etiologic discoveries, possibly leading to new intervention opportunities.

**PURPOSE:** Investigated which self-reported PA questionnaires (Community Healthy Activities Model Program for Seniors (CHAMPS) or American Association of Retired Persons (AARP) questionnaires), objective PA measures (ActiGraph), dietary questionnaires (Automated Self-Administered 24-hour (ASA24) dietary recall or Dietary History Questionnaire II (DHQ-II)), and anthropometric measurement outcomes best predicted total energy expenditure (TEE) measured by doubly-labeled water (DLW). **METHODS:** A secondary data analysis was performed from data collected over a 12-month period from The Interactive Diet and Activity Tracking in AARP (IDATA) study. **RESULTS:** Of the 681 participants with a mean age of 63.1 (range 50-74) 95% were Caucasian and almost half (49.5%) were male. Approximately one-fourth (26.6%) had a healthy body mass index while 42.0% were overweight and 31.4% obese. Mean TEE measured by DLW was 2,506 kcal (range 1,453 to 4,615 kcal). Stepwise linear regression was used to examine the possible significant outcomes that predicted TEE by DLW. Results indicated three outcome predictors of TEE. The overall model was significant, F(3, 211) = 49.468, p < .001. Specifically, resting energy expenditure (REE) estimated from the MiFit-St. Joer equation (mean 1,496 kcal) (Beta = -433, p < .001), steps measured by ActiGraph accelerometers (mean 12,530 steps) (Beta = -290, p < .001), and total dietary fiber measured from DHQ-II (mean 22.9 g/day) (Beta = .182, p < .001) significantly predicted TEE from DLW. **CONCLUSIONS:** These results indicate that the older adults with the highest TEE and who take more steps throughout the day expend more calories. Total dietary fiber may be a surrogate for adequate nutrient intake and healthy lifestyle behaviors thus contributing to the prediction of energy expenditure. In conclusion, estimating TEE from the MiFit-St. Joer equation, steps measured by ActiGraph, and fiber intake from DHQ-II are the most advantageous tools to determine TEE in older adults.

**PURPOSE:** Activity trackers (ATs) are valuable tools to monitor physical activity (PA) behavior and energy expenditure (EE). Despite the broad appeal of such devices for consumers and researchers, there is limited evidence of how well ATs detect change in PA behaviors in free-living settings. **METHODS:** Participants were directly observed on three separate days for 2-hours each day in free-living behavior and criterion steps in free-living settings. **RESULTS:** Participants were a commonly used criterion step counting (CSC) device, and popular hip- and wrist-worn consumer ATs. Criterion EE was assessed using a validated direct observation (DO) method. The CMS and DO were then used to classify pairs of sessions for each participant based on whether steps and EE changed by +>/-5%, 15%, and 25% or not. The ATs were then used to perform the same classification. Percent agreement between the two methods where then calculated.
RESULTS:

Percent agreement: criterion steps compared to estimated steps

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<td>CSC step change</td>
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<td>AT hip (N agreement)</td>
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Percent agreement: criterion energy expenditure compared to estimated energy expenditure

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<td>AT hip (N agreement)</td>
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<td>AT wrist (N agreement)</td>
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CONCLUSIONS: These preliminary results provide evidence that ATs are sensitive in detecting change in steps and EE. For step estimates, the AT was superior in the detection of change compared to the hip AT. The implications are that consumers, clinicians, and researchers may employ hip- and- wrist worn ATs as an objective tool to track changes in steps and EE in free-living settings. In particular, the AT wrist is highly sensitive to changes in steps and is a tool that can be used for individual and group interventions designed to increase locomotion behavior.

Funded by: NIH: 1F31HL129802-01

D-48 Clinical Case Slide - Cardiovascular II
Thursday, June 1, 2017, 3:15 PM - 4:55 PM Room: 401

1941 Chair: Benjamin D. Levine, FACSM. Texas Health Presbyterian Hospital Dallas, Dallas, TX. (No relationships reported)

1942 Discussant: Sameer Dixit. Johns Hopkins University, Baltimore, MD. (No relationships reported)

1943 Discussant: Jerrad P. Zimmerman. Carle Clinic, Urbana, IL. (No relationships reported)

1944 June 1 3:15 PM - 3:35 PM
Football Athlete with Chest Pain and Dysphagia
Adam Fletcher, Jeremy Kent, Walter Hoyt, John MacKnight, FACSM. University of Virginia, Charlottesville, VA. (Sponsor: John MacKnight, MD, FACSM) (No relationships reported)

HISTORY: 22 year old collegiate football player was seen in clinic for several years of intermittent dysphagia with associated chest pain. Symptoms had occurred 3-4 times annually, but athlete had noted increasing frequency over the past several weeks with occasional associated heartburn. He was initially treated with oral omeprazole 40 mg daily for presumed gastroesophageal reflux disorder. Two weeks later, following an intense practice, he developed severe, burning, substernal chest pain and diaphoresis which prompted emergency department evaluation for possible cardiac etiology. PHYSICAL EXAMINATION: Vitals: HR 56, BP 147/90, RR 18 General: Uncomfortable, writhing on exam table Neck: Supple. No lymphadenopathy. CV: Regular rate and rhythm with no murmurs, gallops, or rubs. Lumbar: No lower extremity edema. Pulmonary: No respiratory distress. Lungs are clear to auscultation bilaterally. Abdominal: Soft, non-tender, non-distended. DIFFERENTIAL DIAGNOSIS GERD Esophageal stricture Esophageal spasm Acute coronary syndrome Myocarditis/Pericarditis Coronary or aortic dissection TESTS AND RESULTS: CBC: 4.8-13.2. WBC: 5.5. BMP, CBC, Troponin-0.09, 0.24, 3.63 (peak) CRP 0.2. ESR 9 Creatinine 1.8 CK (peak) 836 ECG: interpreted as having diffuse ST elevation Subsequent ECG: precordial J point elevation without concave ST elevations Echocardiogram: left ventricular ejection fraction of 45-50% Cardiac MRI: Small areas of focal mid-wall, late gadolinium enhancement (LGE) consistent with myocarditis Echocardiogram: left ventricular ejection fraction of 45-50% Cardiac MRI: Small areas of focal mid-wall, late gadolinium enhancement (LGE) consistent with myocarditis //Regenstrief Medical, Park Ridge, IL. Email: kaleigh.sulhs@gmail.com (No relationships reported)

HISTORY: A 19 year-old female collegiate division 1 soccer player was seen in athletic training room for follow up on 1 month history of rib pain and cough with blood tinged sputum. One week prior to training room visit, she was evaluated at a primary care clinic and diagnosed with pneumonia. She was placed on Azithromycin for 5 days which improved symptoms. The athlete was followed weekly in training room and although she tolerated a slow progression back to running, she again developed intermittent hemoptysis in the evenings after running. Pertinent family history included a grandmother who was recently diagnosed with a pulmonary embolism and found to have prothrombin gene mutation. PHYSICAL EXAMINATION: Well appearing, no cervical or supra-clavicular lymphadenopathy. CV: regular rate and rhythm, with no murmurs, gallops, or rubs. Lumbar: clear to auscultation bilaterally, without wheezes or crackles. Non-tender to palpation over costo-sternal junction. Extremities well perfused. DIFFERENTIAL DIAGNOSIS: 1. Post infectious airway irritation 2. Arterial Venous Malformation 3. Pulmonary Embolism TESTS AND RESULTS: CBC: 4.8-13.2. WBC: 5.5. BMP, CBC, Troponin-0.09, 0.24, 3.63 (peak) CRP 0.2. ESR 9 Creatinine 1.8 CK (peak) 836 ECG: interpreted as having diffuse ST elevation Subsequent ECG: precordial J point elevation without concave ST elevations Echocardiogram: left ventricular ejection fraction of 45-50% Cardiac MRI: Small areas of focal mid-wall, late gadolinium enhancement (LGE) consistent with myocarditis Echocardiogram: left ventricular ejection fraction of 45-50% Cardiac MRI: Small areas of focal mid-wall, late gadolinium enhancement (LGE) consistent with myocarditis //Regenstrief Medical, Park Ridge, IL. Email: kaleigh.sulhs@gmail.com (No relationships reported)

HISTORY: A 48-year-old female competitive marathon runner with no significant past medical history developed right sided neck pain while running a race. The patient completed the race at her typical pace, finishing top five in her age group. After the race, the right side neck pain persisted. Around thirty minutes post-race she began to have sudden onset dizziness, causing her to fall to the ground. While on the ground, she soon developed severe vertigo, nausea, and emesis. EMS was immediately called and she was transported to the hospital. During transport the patient had loss of consciousness. PHYSICAL EXAMINATION: Examination in the emergency room found the patient to be hemodynamically stable. She was noted to be lethargic but arousable, unable to stand due to vertigo, and had continued nausea and emesis. The rest of her physical exam was benign. DIFFERENTIAL DIAGNOSIS: Cardiac arrest Carotid artery dissection Exercise associated hyponatremia Exercise associated hypotension Hemorrhagic stroke Hypoglycemia Ischemic stroke Vertebral artery dissection TESTS AND RESULTS: BMP, CBC, Troponin, UDS, EKG, and CT Head without contrast were all normal. CT angiography of the neck: Right vertebral artery dissection and right vertebral artery dissection //Regenstrief Medical, Park Ridge, IL. Email: kaleigh.sulhs@gmail.com (No relationships reported)

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Abstracts were prepared by the authors and printed as submitted.
The patient was admitted to inpatient stroke rehabilitation and discharged to home after 5 days at an independent level. The patient continued to suffer from vertigo for which she was started on Clonazepam 0.5mg three times daily as needed which controlled her symptoms. She is enrolled in vestibular outpatient physical therapy. The patient is determined and plans to run the 2017 Boston marathon which she has already qualified for.

1947 June 1 4:15 PM - 4:35 PM
Dyspnea on Exertion - Former Marathon Runner
Rubria Marinires-Price, Andrew R. Tomlinson, Tony G. Babbs, FACSM, Benjamin D. Levine, FACSM. Institute for Exercise and Environmental Medicine, Dallas, TX. (Sponsor: Tony G. Babbs, FACSM) Email: rubriamarines-price@texashealth.org

HISTORY:
A 67-year-old former marathon runner with a history of venous thromboembolism was referred for cardiopulmonary exercise testing (CPET) for dyspnea on exertion (DOE), drop in fitness, and pre-surgical evaluation for pulmonary thromboendarterectomy (PTE). He was diagnosed with chronic thromboembolic (CTE) disease 3 months prior to referral. His V/Q scan showed multiple perfusion defects. Normal spirometry, lung volumes, and diffusion capacity. Right heart catheterization (RHC): RA 5 mm Hg; PA 37/15 mm Hg; PCWP 8 mm Hg; PA saturation 67%; TDCO 4.2 L/min.

PHYSICAL EXAMINATION:
Height: 175 cm; weight: 71 kg; Caucasian male, normal respiratory rate, no evidence of breathlessness at rest.

DIFFERENTIAL DIAGNOSIS:
1. Respiratory and/or cardiovascular limitation of breathlessness at rest.
2. Height: 175 cm; weight: 71 kg; Caucasian male, normal respiratory rate, no evidence of breathlessness at rest.
3. Deconditioning
4. Aging

TEST AND RESULTS:

<table>
<thead>
<tr>
<th>CPET Results</th>
<th>Variable</th>
<th>Workload (W)</th>
<th>Rest</th>
<th>SS 1</th>
<th>SS 2</th>
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<tr>
<td>VO2 (L/min)</td>
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<td>HR</td>
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<td>O2 Uptake (%)</td>
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<tr>
<td>VCO2 (L/min)</td>
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<tr>
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<td>21</td>
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<tr>
<td>Lactate (mmol/L)</td>
<td>2.1</td>
<td>2.9</td>
<td>4.6</td>
<td>9.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interpretation:
Functional Class I; fair-to-average fitness by AHA criteria
Severe ventilatory inefficiency
Increased ventilatory demand and breathlessness
Blunted cardiac output due to decreased SV reserve

FINAL WORKING DIAGNOSIS:
CTE disease
Evidence of ventilatory inefficiency
Impaired hemodynamics

TREATMENT AND OUTCOMES:
1. PTE surgery
2. Post-surgery cardiopulmonary rehabilitation
3. Repeated CPET 15 months after surgery due to persistent DOE and no fitness gains

1948 June 1 4:35 PM - 4:55 PM
Applying Cardiopulmonary Exercise Testing to the Evaluation of Left Ventricular Function for Patients Ventricular Assist Device Therapy
Jeffrey W. Christle1, Kegan J. Moneghetti1, Francois Haddad1, Dipanjan Banerje1, Jon Myers, FACSM1, Matthew T. Wheeler1, Stanford University, Stanford, CA. 1Palo Alto Veterans Administration Health Care System and Stanford University, Palo Alto, CA. (Sponsor: Jon Myers, FACSM)

EMAIL: christle@stanford.edu

HISTORY:
Patient with severe heart failure and presence of a left ventricular assist device (LVAD).

PHYSICAL EXAMINATION:
A patient with severe heart failure and LVAD (29 y, male, BMI 26 kg/m2, INR > 2.0) was examined on two separate occasions two weeks apart with CPX on a cycle ergometer (continuous ramp, 20 Watts per minute).

DIFFERENTIAL DIAGNOSIS:
1. Chest pain
2. Dyspnea on exertion
3. Fatigue
4. Syncope

TEST AND RESULTS:
The first CPX was performed with the LVAD on at its prescribed speed. The second test was performed at the lowest LVAD speed setting, at which point the LVAD was effectively not supportive. Both tests were performed to volitional exhaustion. The LVAD speeds for the first and second tests were 2400 rpm and 1800 rpm. Peak respiratory exchange ratios were 1.20 and 1.16, respectively. For the CPX with LVAD support, VO2 peak was 24.4 ml/kg/min and peak workload was 167 Watts For the CPX without LVAD support VO2 peak was 27.7 ml/kg/min and peak load was 190 Watts.

FINAL WORKING DIAGNOSIS:
Patient seems to have recovered a substantial amount of functionality, so that the LVAD may be unnecessary. Furthermore, the LVAD may be a hindrance to exercise performance and therefore adequate ventilator recovery.

TREATMENT AND OUTCOMES:
Patient is being considered for reevaluation for need of LVAD. Focus is on further recovery and improvement of quality of life.
Sensation: intact in left leg, minimally decreased over the right medial malleolus, significantly decreased over the right lateral malleolus, and absent along dorsum of right foot.

Reflexes: 2+ and symmetric in bilateral patella and Achilles, toes downgoing, no clonus

Beighton scale: 9/9

DIFFERENTIAL
Peroneal neuropathy
Flexopathy
Radiculopathy
Peripheral neuropathy
Myelopathy
Cauda Equina Lesions
ALS
Multiple Sclerosis
Conversion Disorder

TESTS
XR lumbar spine normal
MRI of the right leg suggestive of common peroneal neuropathy; no focal mass seen compressing the nerve

EMG/NCS: evidence of right common peroneal neuropathy proximal to the fibular head

FINAL DIAGNOSIS
Peroneal neuropathy across the fibular head

TREATMENT AND OUTCOMES
She was started on a short course of a corticosteroid taper and physical therapy. At 1-month follow-up, the patient reported significant improvement with decreased numbness and is able to perform maneuvers with cheerleading. Strength has also improved to 3/5 in right ankle dorsiflexion, 4/5 in right ankle eversion. She continues with PT and close follow-up with ortho and primary care sports medicine.

1954
June 1 3:55 PM - 4:15 PM
A Fibular Hook

Kevin N. Blythe, Bronson E. Delasobera. MedStar Georgetown University Hospital, Washington, DC.

History 26 yo female with several months of exertional posterior left proximal calf pain after training for 1/2 marathon. The pain is isolated to the proximal posterolateral calf without radiation, described as a dull ache and heaviness of 4/10 intensity.

Symptoms occur after 10 minutes of running, and lasts for 2-3 hours after runs. She has some tingling on the sole of the foot but no weakness, swelling or paller. PT for calf strain provided no relief. Initially had negative evaluation by vascular surgery including ABIs, arteriogram and a dynamic MRI/A

Physical Exam
Left lower leg - no edema, lesions or deformity. Mild TTP of proximal calf, midline and lateral. No other TTP of lower leg, knee or L-spine. No knee effusion. Full ROM and strength at knee/ankle. Normal sensation over the L4-S1 distribution, 2+ distal pulses. Negative Homan’s, negative straight leg raise, negative McMurrray’s, negative Tinel’s, no cords palpated. Normal gait and heel-toe gait.

Differential Diagnosis
1) Chronic Exertional Compartment Syndrome
2) Lower Extremity DVT
3) Popliteus or Hamstring Insertional Tendinopathy
4) Lumber Radiculopathy
5) Peripheral Nerve Entrapment

Test Results
L Knee MRI - small fluid collection under MCL, otherwise negative
L-Spine MRI - negative

Compartment Pressures:
Anterior - Rest 8 mmHg, Post-exercise 24 mmHg
Lateral - Rest 15, Post 25
Superficial Posterior - Rest 25, Post 30
Deep Posterior - Rest 8, Post 15

Lower extremity venous duplex - negative

Lidocaine injection of medial hamstring insertion - no relief

EMG - all motor and sensory nerves tested were within normal limits
L Knee joint steroid injection - no relief
L Posterior calf US- abnormal morphology of fibula at soleus insertion abutting tibial nerve

MRI L tib/fib - bony tug lesion of proximal posterior fibula near insertion of the soleus without surrounding edema

X-ray tib/fib comparison films - confirmed L fibular bone lesion identified as osteochondroma

Working Diagnosis: Sessile osteochondroma involving the left fibular head/neck.

Treatment and Outcome
US guided lidocaine injection of soleus insertion provided 80% relief. The patient was referred for surgical evaluation. Based on the surgical risks of adjacent tibial artery/nerve injury, a repeat trial of PT, including gait re-training, was prescribed. Follow-up in 8 weeks for re-evaluation.

1955
June 1 4:15 PM - 4:35 PM
Lateral Leg Pain in an Avid Hiker After a Fall

Alyssa M. Neph, Kentaro Onishi, Suehun G. Ho. University of Pittsburgh Medical Center, Pittsburgh, PA.

History 62-year-old female with a history of hip OA and low back discomfort presents with left lateral leg pain that started after a fall onto her back 11 months ago. Pain is described as a constant throbbing in the left lateral calf, ankle, and dorsal foot. Pain worsens with ambulation and is relieved by rest. Noninvasive vascular studies ruled out claudication. Prior treatments included L5 L5 nerve root block, lumbar ESI, SI joint injection, chiropractic treatment, pain medications, and therapy with limited success. She presents to our sports medicine clinic for a diagnostic ultrasound of the left lateral leg region.

Physical Examination: Guarded gait favoring weight bearing on right lower extremity. Mild tenderness over the proximal tibiofibular joint. No focal area of tenderness noted at lateral knee joint line or distal iliotibial band. Range of motion about the knee and ankle were both full without pain and strength was intact. Alloodynia noted to light touch over left anterolateral leg, ankle, and dorsal foot. Straight leg raise and lumbar facet challenge were negative. Lumbar Spurling’s was positive on the left.

Differential Diagnosis: 1) Peripheral peroneal neuropathy 2) Common peroneal neuropathy 3) Lumbar radiculopathy

Test and Results
- MRI lumbar spine: Mild multilevel DIS with significant stenosis. - MRI left tibia-fibula: Subtle edema in the peroneal muscle area. Diffuse symmetric atrophy in both muscles. - EMG/NCV: Decreased amplitude in left superficial peroneal response (4 mV vs 12 mV on contralateral side) and mildly prolonged peak latency. No signs of lumbar radiculopathy. - Lateral leg/knee ultrasound: Swollen superficial peroneal nerve at the site of penetration through peroneus longus muscular fascia (0.08 cm proximally and 0.22 cm distally).

Final Working Diagnosis: Left superficial peroneal neuropathy

Treatment and Outcomes
1) Sonographically guided superficial peroneal nerve hydrodissection (HD) x 2 resulted in improvement in painless walking distance and decrease in pain scale by 50-60%. 2) Repeat elective EMG/NCV 2 months later demonstrated signs of re-inervation of the left superficial peroneal nerve evidenced by normalized and symmetric sensory response amplitude (8mV) and peak latency measures with polyphasic motor unit potentials seen in the fibularis longus.

Abstracts were prepared by the authors and printed as submitted.
History:
35 year old male on phentermine for weight loss, presented to sports clinic with complaint of right foot numbness that started 6 days prior. After a basketball game he noticed pain and swelling in his posterior-lateral calf. He went hiking the next day and the pain increased. The next day he developed numbness to the bottom of his foot. He saw a podiatrist on day 4 and was diagnosed with radiolucenty and given Medrol. He did not have foot drop or weakness but complained of heel numbness. At the time of his visit, his pain had mostly resolved, the numbness is what persisted and brought him in.

Physical Exam:
Mk:
Spine: No midline tenderness, FROM, 5/5 strength all lumbar dermatomes, decreased sensation to touch over heel and lateral foot
Negative neural slump test, straight leg raise, Patricks, Fortins, Gaenslens, 1+ patellar and achilles reflexes
Compartments soft, but right leg with swelling compared to left, no warmth, redness or cords, mild tenderness laterally

Differential Diagnosis:
- Lumbar Radiculopathy
- Peripheral nerve entrapment
- Compartment syndrome
- DVT
- Hematoma/mass
- Partial aircocnemius rupture

Tests & Results:
- L-spine x-ray: L3/L4 retrolisthesis.
- Son: no DVT
- MRI R leg: Grade 2 popliteus strain with edema/hematoma formation and compression of tibial nerve
  - Initial labs (1 week post injury): CK 856, Cr 1.3, UA 1+ protein, 1+ ketones. CBC, CMP, ESR, and CRP normal
  - Repeat labs (3 weeks post injury): normal CK, creatinine, UA
  - EMG with nerve conduction (3 weeks post injury): normal
  - Repeat MRI (6 weeks post injury): interval improvement yet persistent edema of the popliteus muscle
- Xrays tib/ fib/knee (6 weeks post injury): no evidence of heterotopic ossification

Treatment:
Tibial nerve compression due to popliteus muscle injury with concomitant mild rhabdo

Outcome and Further Follow-Up:
The patient’s symptoms improved with rest and physical therapy. There was a discussion about seeing a nerve surgeon, or doing a cortisone injection or nerve hydro-dissection, but the patient declined since he was improving. 6 weeks post injury he reported only mild numbness in his heel.

Return to Activity:
The patient was able to gradually return to cardio and was back to basketball at 3 months.

1956 Foot Numbness - Basketball: Doc, My Foot Is Numb!
Elizabeth Kaufman, MD, Bronson Elizabeth Delasobera, MD. Georgetown, Washington, DC.
Email: ekaufman25@gmail.com
(No relationships reported)

History:
28 year old Paralympic track and field athlete presented for physical therapy evaluation. The athlete’s history was positive for a congenital absence of the right fibula, resulting in a below the knee amputation at age two. However, at the time of the evaluation, he was asymptomatic, participated in daily training activities, and regularly competed in meets at the world-class level.

PHYSICAL EXAMINATION:
The athlete demonstrated the following postural traits: forward head; forward, internally rotated shoulders bilaterally; decreased thoracic and lumbar curves; and anterior pelvic tilt. He demonstrated decreased active and passive range of motion in many of the muscles in his lower extremities, as well as asymmetries measured between legs. While manual muscle testing was 5/5 throughout, he demonstrated a delayed recruitment of the gluteals/hamstring dominance bilaterally. The athlete was unremarkable in neurological and soft tissue assessment. He demonstrated “a poor” capacity to maintain lower extremity symmetry while squatting to moderate depth, as well as marked asymmetry in numerous measures of single leg athletic function.

DIFFERENTIAL DIAGNOSIS
1. Musculoskeletal imbalances

TEST AND RESULTS:
1. Abnormalities in lower quarter muscle length and function.
2. Asymmetrical performance in numerous tests of single leg athletic function.

FINAL WORKING DIAGNOSIS:
Chronic musculoskeletal imbalances due to congenital deformity and compounded by repetitive athletic activity.

TREATMENT AND OUTCOMES:
Many throwing athletes sustain musculoskeletal or nervous injuries due to repetitive microtrauma to these tissues. Paralympic throwers are at greater risk of such injuries, due partly to the chronic effects of asymmetrical biomechanical demands. The physical therapist evaluated this athlete, identifying musculoskeletal imbalances and prescribing therapeutic exercises to address these limitations. The throwing coach integrated these prescribed activities into the athlete’s annual training program so as to foster his power development in an injury-free manner. This case report highlights a cooperative relationship between sports medicine and coaching professionals that assisted a Paralympian in peaking for the 2016 Rio Games.

1957 A F44 Paralympic Track and Field Discus Thrower: A Case Report
Donald L. Hoover1, David M. Bellar2, Lawrence W. Judge3.
1Western Kentucky University, Bowling Green, KY. 2University of Louisiana at Lafayette, Lafayette, LA. 3Ball State University, Muncie, IN. (No sponsor relationships reported)

A 44 year old male presented to a Paralympic track and field athlete for treatment and physical therapy. The athlete demonstrated a delayed recruitment of the gluteals/hamstring dominance bilaterally. The athlete was unremarkable in neurological and soft tissue assessment. He demonstrated “a poor” capacity to maintain lower extremity symmetry while squatting to moderate depth, as well as marked asymmetry in numerous measures of single leg athletic function.

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A Collapse that Led to Shoulder Pain

Michael Seifert, Krystian Bigosinski. Maine Medical Center, Portland, ME. (Sponsor: Heather Gillespie, FACSJM)

HISTORY: A 55 year old female presents for right shoulder pain. She has a history of multiple sclerosis, recent falls complicated by a right 6th rib fracture and a right 4th phalanx fracture, a 35 pack year history of tobacco use, and an unknown fracture of her right shoulder sustained at age 16. Her current shoulder pain began four weeks prior to her visit while reaching behind her in the shower. She felt like her shoulder popped out of place. She has achy pain, worse when touching her shoulder or using her walker. It improves with lying down and with a sling. Acetaminophen and ibuprofen do not provide relief. Physical therapy as part of her multiple sclerosis treatment has not helped.

PHYSICAL EXAMINATION:
BP: 122/82, Pulse: 69, Respirations: 16, SpO2: 96%.
- Shoulder:
  - No gross abnormality, no step-offs along the clavicle.
  - Tender over the entire humeral head and anterior shoulder.
  - No swelling, warmth, or erythema.
  - ROM:
    - o Right flexion 85 degrees active, 95 degrees passive.
    - o Right abduction 90 degrees active, 100 degrees passive.
    - o Adduction, internal rotation, external rotation and extension were full and equal bilaterally.
    - 5/5 strength
  - Special tests: positive empty can, Hawkins’, O’Brien’s, and Speed’s test. Negative crossed arm adduction, AC compression, and sulcus sign. Unable to perform Neer’s test due to pain.

DIFFERENTIAL DIAGNOSIS:
Torn rotator cuff
Glenohumeral arthritis
Humeral head fracture as part of Osteogenesis Imperfecta
Avascular necrosis
AC joint arthritis
Shoulder dislocation/subluxation
Elder Abuse

TEST AND RESULTS:
Shoulder 3 view XR:
- Extensive posttraumatic deformity of proximal right humerus with marked irregularity of articular surface.
- Possible non-displaced superimposed acute or subacute fracture
- Slightly displaced posteroconteral right 4th and 5th rib fractures
Shoulder MRI:
- Marked abnormality of the right humeral head with contour deformity
- Progressive collapse of superior articular surface, with focal marrow edema. This may be posttraumatic or relate to avascular necrosis
- No rotator cuff tear.

FINAL WORKING DIAGNOSIS:
Avascular necrosis of the humeral head

TREATMENT AND OUTCOMES:
- Placed in arm sling for pain control
- Referred for surgical replacement of the humeral head
- Referred for workup for osteogenesis imperfecta, given multiple fractures

PHYSICAL EXAMINATION:
Examination revealed atrophy of the right infraspinatus when compared to the left. There was no tenderness to palpation along the scapula, periscapular muscles, clavicle, acromion, or rotator cuff insertion points of the proximal arm. Cervical and shoulder range of motion were full and non-painful. Empty can test elicited pain and slight weakness on the right compared to the left; resisted external rotation showed 4/5 strength on the right and 5/5 on the left; resisted internal rotation 5/5 bilaterally and without pain, and lift off limited on the right compared to the left. Spurling test negative. Remainder of bilateral upper limb strength was 5/5. Sensation intact throughout. Biceps, brachioradialis, and triceps reflexes symmetric. Radial pulses strong and symmetric.

DIFFERENTIAL DIAGNOSIS:
1. Infraspinatus tear
2. Suprascapular nerve impingement
3. Brachial neuritis
4. Cervical radiculopathy
5. Upper trunk brachial plexopathy

TEST AND RESULTS:
R upper extremity EMG:
Right infraspinatus with significant amount of abnormal spontaneous activity; normal motor unit action potential morphology and recruitment characteristics. All other muscles tested including the paraspinals were normal.

R shoulder ultrasound:
Hypoechic 1.6 cm structure without internal color doppler flow adjacent to the supraspinatus muscle.

FINAL WORKING DIAGNOSIS:
Suprascapular nerve impingement due to paralabral cyst.

TREATMENT AND OUTCOMES:
1. Surgical referral
2. Underwent surgical decompression of the suprascapular nerve
3. Pending follow-up at this time
4. This case highlights the utility of EMG to diagnose an uncommon nerve entrapment in the setting of a common shoulder pathology
June 1 4:35 PM - 4:55 PM

Sholder injury- Rugby, Progressive Shoulder Pain After Fall
Shane L. Larson1, Caitlin M. Colitti2, Lance LeClere2. 1Womack Army Medical Center, Fort Bragg, NC. 2US Naval Academy, Annapolis, MD. (Sponsor: Francis O’Connor, FACSM)

(No relationships reported)

HISTORY: A 28-year-old female US Naval Academy college freshman sustained a left wrist injury after fall on outstretched hand during an intercollegiate rugby match. She endorsed immediate onset pain, tingling, hypedensation in her hand in a median nerve distribution. Originally diagnosed with acute carpal tunnel syndrome and treated with a surgical release she presents to clinic with generalized, worsening left shoulder pain and weakness for 3 months.

PHYSICAL EXAMINATION: Examination at the time of presentation revealed no shoulder tenderness or swelling. Normal neurologic examination and capillary refill demonstrated. Strength and range of motion were also normal. Neck exam demonstrated no abnormalities and negative Spurlings test. The physical exam remained unchanged for two months before patient developed anterior shoulder hypoesthesia and ipsilateral palmar hypoesthesia in nondominant pattern.


TREATMENT AND OUTCOMES: Complete resolution of symptoms and progressive return to play protocol was initiated via transaxillary approach done 7 days after initial presentation. 4. Return to pitching with return of full velocity by 8 weeks post operatively with no residual symptoms or recurrence.

June 1 4:55 PM - 5:15 PM

Arm Pain - Baseball
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(No relationships reported)

HISTORY: A 20-year-old collegiate baseball left handed pitcher, developed left arm pain and swelling. His symptoms started after hunting with a shotgun, holding the gun funny and heavy. He had no chest pain or dyspnea. He continued to participate in activity recommendations for this population.

ACSM May 30 – June 3, 2017
Denver, Colorado
Exercise tolerance is instrumental to obtain the health benefits associated with physical training in older adults. During cycling an “excess” in oxygen cost (VO₂) relative to power output (PO) (i.e., VO₂/PO ratios above the lactate threshold (LT)) This loss of muscle efficiency, of which type I fibres fatigue and/or increased type II fibres recruitment are putative causes, impairs exercise tolerance. PURPOSE: We tested the hypothesis that strength training, by increasing maximal force and reducing the recruitment of high-threshold motor units at a given exercise intensity will reduce the “excess” VO₂. METHODS: 8 healthy older males (67±5yrs), performed 5 weeks of ST (3 sessions, one-hour sessions per week). Pre and Post training we measured muscle strength (IRM Squat and Deadlift) and performed an incremental cycling test to exhaustion to determine: i) peak power output (POpeak) and VO₂peak ii) the slopes of the VO₂/PO relationship below (S1) and above (S2) the LT (modeled using a double-linear fit). Parametric tests were compared with paired t-test. RESULTS: Following strength training, muscle strength and S1 increased (+24 ± 9 % Squat, + 30 ± 16 % Deadlift; +8 ± % POpeak p<0.05) while VO₂max did not change (+2 ± 5 % p<0.05). No “excess” VO₂ was present before (S1 =-10.4±1.2; S2 =-10.2±2.7 ml·min⁻¹·W⁻¹, p>0.86) or following strength training (S1 =9.3±3.5; S2 =10.2±2.7 ml·min⁻¹·W⁻¹, p>0.38). However, S1 significantly decreased (Δ=-1 ml·min⁻¹·W⁻¹, p<0.04) after training. CONCLUSIONS: The “excess” VO₂ typically displayed by young subjects was absent in our older adults. An age-related selective atrophy of type-II muscle fibres may explain the absence of a loss of efficiency in the heavy-intensity domain in older adults. Strength training significantly improved muscle strength by ~30% and was associated with a reduction of VO₂/PO relationship in the moderate-intensity domain (i.e. reduced S2). This finding entails an improved efficiency of type-I fibres contraction in the moderate-intensity domain following training. Although further studies are warranted to identify a direct cause-effect relationship, this finding support a role of strength training in improving aerobic exercise tolerance through an improvement of muscle efficiency in the moderate-intensity exercise domain.
RESULTS: There were significant differences in body weight (GE=−12% vs CG=−11%; p=0.001), BMI (GE=−1.6% vs CG=−1%; p=0.023) and WHI (GE=−1.6% vs CG=−1%; p=0.001). Distances in SJ, CMJ, CMJas height (jump height), flight time and Take off velocity and gait parameters (Centre of pressure, p=0, 033) were found between GE vs CG (IG vs CG ~ p<0.05 and 0.001, with positive changes for GE.

CONCLUSIONS: The results suggest that 32 weeks of training with explosive and impact movements in rowing pools improve the strength expression and reduces significant adaptations in gait parameters, but not enough to the body composition changes for GE

1994 Board #7
June 1 2:00 PM - 3:30 PM
Effects of Exercise Intervention on Falls Risk Score in Aging Adults with History of Falling
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Falls are the leading cause of death by injury and most common cause of nonfatal injuries among adults 65 years and older in the United States. Current evidence suggests that at least 1 in 3 persons 65 years and older will experience a fall each year. Modifiable risk factors such as muscle weakness, mobility, and balance have been identified. Therefore, it is important to identify interventions that can positively alter the risk factors and reduce the risk of falling.

PURPOSE: To determine the effects of an exercise intervention on falls risk in aging adults with a history of falling.

METHODS: Twenty-two aging adults (74.4±7.7 years; 162±10.0 m; 78.58±19.20 kg) with a falls history (Fallers) completed this study. An 8-week intervention program utilizing the LEBED method, a dance therapy program, was implemented for 1 hour, twice per week, and attendance was recorded at each session. A Faller was defined as a participant who had fallen within the year prior to the study. Falls risk scores (FRS) were calculated using the NeuRA FallScreen® Physiological Profile Assessment (PPA) at pre- and post-intervention. The components that make up the composite FRS include proprioception, leg strength, balance, reaction time, and vision. Pre- and post-intervention FRS were compared. A repeated measures mixed ANOVA for pre- and post-assessment data with attendance as a covariate was conducted (p<0.05).

RESULTS: The average attendance during the 8-week intervention was 73.6±15.4%. There was no statistical significant difference between pre- (1,391±0.91) and post-assessment (1,46±1.43; p<0.05) FRS.

CONCLUSIONS: This study compared pre- and post-assessment FRS in aging adults after an 8-week dance therapy intervention. Results indicate that the intervention was not effective in influencing the composite FRS in aging adults with a history of falls. However, investigation of the individual PPA components might show improvements in specific areas. Analysis of each PPA component may represent important improvement for falls risk. Further research should consider length of intervention, larger sample size, and frequency of sessions and respective attendance to design targeted intervention programs to decrease falls risk.

Research supported by grant from the Potomac Health Foundation

1995 Board #8
June 1 2:00 PM - 3:30 PM
Preliminary Analysis: Effects Of An Intervention Program In Aging Adults With History Of Falling
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Falls are the leading cause of death by injury and most common cause of nonfatal injuries among adults 65 years and older in the United States. The largest risk factor for falls is previous history of falling. Different types of falling prevention programs have been implemented; however, the effects of intervention programs on fallers remain poorly understood. PURPOSE: To determine the effects of an 8-week exercise intervention program in the Timed Up and Go (TUG) test in aging adults with a history of falling. METHODS: Twenty-seven aging adults (74±9.8 years; 1,61±1.01; 80.2±23.6kg), with a history of falling within the year prior to the study, participated in an 8-week exercise intervention program consisting of the LEBED method, a dance therapy program. The intervention program was implemented for 1 hour, twice per week, and lasted a total of 8 weeks. Participants completed the TUG test pre and post-intervention. A timed test, the TUG requires participants to start in a seated position, stand and walk 3 meters (m), turn around a cone, and return to the original seated position. The average time, in seconds, from three trials was used for analysis. A paired-samples t-test was used to compare participants’ pre- to post-intervention measures (p<0.05).

RESULTS: No statistically significant difference existed between TUG pre-intervention (9.45±3.71) and post-intervention (9.86±4.45; p<0.05) values. CONCLUSION: This study examined the effects of an 8-week exercise intervention program on a mobility measure for aging adults with a history of falls.

Falls risk score was used for analysis. A paired-samples t-test was used to compare participants’ pre- to post-intervention measures (p<0.05) was used for analysis. A paired-samples t-test was used to compare participants’ pre- to post-intervention measures (p<0.05).

1996 Board #9
June 1 2:00 PM - 3:30 PM
Effects of Resistance Training on Health Related Fitness In Elderly People
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(resolutions reported)

Resistance training (RT) has been shown to increase muscular strength and concurrently improve functional ability in elderly people (EP). However, there is relatively little research available regarding the impact of RT on health related fitness components in EP. PURPOSE: The aim of this study was to examine the impact of a 12-week RT intervention on body composition, flexibility, and cardio-vascular, respiratory and metabolic systems in EP. METHODS: 120 subjects were randomly assigned into three experimental (E1: 65-74, E2: 75-84 and E3: older than 84) groups. The following outcome measures were assessed prior to, and immediately following the intervention: muscle mass, body fat, sit and reach, side lying hip abduction ROM, blood pressure, maximum heart rate (HRmax), basal metabolic rate, total cholesterol, LDL-Cholesterol and HDL-Cholesterol, forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1). Participants trained tree times per week for 12 weeks, for a total of 36 sessions. Each session consisted of the following 8 exercises: squats, step-ups, calf raises, back extensions, single arm/leg back extensions, sit-ups, vertical leg lifts, biceps curls with a stick. Pre- and post-intervention data were compared using paired t-tests or Wilcoxon signed ranks test, with an alpha set at p<0.05. RESULTS: Following the 12-week intervention a significant increase was found for flexibility (2.26-6.87%), HRmax (2.11-2.47%), basal metabolic rate (1.1-1.51%), FVC (0.3-0.7%) and FEV1 (0.5-0.9%) for all experimental groups. LDL-Cholesterol decreased for all experimental groups (3.55-11.57%) and blood pressure only for E2 (3.58%) and E3 (4.62%). Body composition positively changed only for E3 (muscle mass for 1.43%, and body fat for -2.54%). CONCLUSIONS: The study indicates that participation in a 12-week RT program may lead to improvement in flexibility, enhanced functions of cardio-vascular and respiratory system as well as betterment in some of metabolic system functions. Our study shows that RT is a physical activity suitable and recommended for elderly individuals as it has potential to improve health related fitness, which could lead to a healthier, more functional and independent aging.

1997 Board #10
June 1 2:00 PM - 3:30 PM
Intervention Study On The Exercise Order Of Combined Aerobic & Resistance Training In The Elderly
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(resolutions reported)

PURPOSE: Combined aerobic and resistance training has been postulated as the most effective strategy to product both neuromuscular and cardiovascular adaptations in the elderly. However, few studies have examined the effects of intra-session exercise order on muscular strength and arterial stiffness in the elderly. This study investigated the effects of aerobic exercise before and after resistance training on body composition, muscle strength, and arterial stiffness in the elderly. METHODS: Thirty-one elderly subjects (70.5±3.5 years) were randomly assigned to one of three groups that performed aerobic exercise first (AR: 4 male, 6 female), performed resistance training first (RA: 4 male, 7 female), and did not perform any training (CON: 2 male, 8 female). The AR and RT groups performed aerobic exercise consisted of cycling at 60% heart rate reserve (HRHR) and resistance training consisted of 5 types of exercises (leg curl, leg press, chest press, seated row, shoulder press) at 70-80% one repetition maximum (IRM) twice a week for 10-week. Body composition was evaluated by height, weight, body fat percentage, lean body mass and waist circumference. Muscle strength was measured by IRM and arterial stiffness was evaluated by carotid-femoral pulse wave velocity (cfPWV). Pre- and post-intervention group comparisons were analyzed using a two-way ANOVA with repeated measures. 

RESULTS: A significant group by time interaction effect was observed in body percentage (F=6.87, P=0.004). Significant interaction effects were observed in IRM (leg press: F=19.394, P<0.001; leg curl: F=7.495, P=0.001; chest press: F=10.188, P<0.001; seated row: F=32.753, P=0.001; shoulder press: F=15.419, P=0.001). However, no significant differences between the AR and RA groups were observed. In contrast,
Advancing age is typically associated with decreases in aerobic capacity and strength and loss of muscle mass and bone density. Evidence-based community exercise programs that emphasize strength, flexibility, and balance have been shown to improve functionality and increase independence. Pre-and-post assessment is critical to measuring program success and individual improvement. Criteria developed by the European Working Group (EWGSOP) classify sarcopenia using measures of appendicular lean mass (ALM), gait speed (GS) and/or grip strength (GR). Conventional resistance training in older women with symptoms of sarcopenia has been investigated, but the impact of periodized resistance training (PRT) on sarcopenia status is unknown. PURPOSE: To determine if 10 weeks of PRT on sarcopenia classification (EWGSOP) and criteria (IWG) was associated with improved functionality and indicated improved health. METHODS: Inactive women (n = 25) aged 72 ± 4.6 years, who were sarcopenic or were symptomatic were recruited. Sarcopenia criteria (ALM, GS, GR) were measured using dual-energy x-ray absorptiometry, a dynanometer, and a 4-meter walk test. Participants were randomized to a PRT group (n=13) or an active control group (CON, n = 12) and met 3 days per week for 10 weeks. Baseline measures were repeated post-intervention. Sarcopenia status at baseline and post-intervention was determined using current criteria, and a McNemar’s test was used to determine changes in sarcopenia status from baseline to post intervention. Significance was set at p<0.05. RESULTS: Non-sarcopenic participants increased in PRT group from baseline (n=8; n=10) to post intervention (n=10; post intervention (n=12), with no change in FNHSIP criteria. CON showed increases in non-sarcopenic classification from baseline (n=8) to post intervention (n=10) by EWGSOP criteria; IwG criteria, baseline (n=10), post intervention (n=12), with no change in FNHSIP criteria. CON showed no significant group changes in distribution frequency on sarcopenia classification (EWGSOP: p = 0.392; EWG: p = 0.841; FNHSIP: p = 0.95). CONCLUSIONS: Results indicate that 10 weeks of PRT, while effective at maintaining levels of lean mass, does not elicit significant changes in sarcopenia classification variables to impact overall sarcopenia classification. However, these results are limited by sample size and demonstrate the need for future research to investigate these aims in larger samples with longer duration interventions.

Regular physical activity can reduce the risk of falls, hypertension, osteoporosis, stroke, and diabetes, yet only 27–34.3% of older adults meet recommended physical activity (PA) guidelines. Use of self-regulation (SR) techniques may increase compliance in a group-based behavior change PA intervention for older adults, yet it is unclear which SR strategies are effective in older adults to increase PA level and stay active. PURPOSE: The purpose of this study is to examine change in PA, and improvement in the use of SR techniques employed by individuals in a 10-week exercise and lifestyle behavioral change intervention. METHODS: 52 adults aged 65 and older completed a 10-week group exercise and lifestyle behavior change program called Physical Activity for Life for Seniors (PALS). Three days/ week over 40 minutes, participants completed ten exercises in a circuit, at 1 minute intervals. The 30-minute lifestyle behavior change class included SR problem solving techniques for staying active. PA was measured using the Self-Regulation for Exercise Scale (1=never to 5=very often), which examined SR techniques for self-monitoring, goal setting, social support, reinforcement, relapse prevention and time management. PA was measured using the CHAMPS questionnaire (caloric expenditure/week). Significant differences (p<0.05) in response to the intervention were identified using paired t-tests. RESULTS: In this population of older adults, significant improvements (p<0.05) were noted in SR techniques, (p<0.05). Significant improvements included SR goal setting: 1.55±.75 vs 3.02±.88; SR social support: 1.35±.55 vs 2.09±.67; SR reinforcement: 1.92±.7 vs 2.71±.67; SR relapse prevention: 1.45±.56 vs 2.17±.63; SR time management: 1.45±.58 vs 2.8±1.01 and total PA energy expenditure: 2143±2153 24 vs 4092.99±2653.78; moderate to vigorous energy PA expenditure: 742.84±1476.00 vs 2366.96±2123.94). CONCLUSIONS: These results suggest that including SR strategies in a 10-week group exercise and lifestyle behavior change intervention can lead to an increase in total PA, especially the moderate to vigorous PA in this population. Goal setting, self-monitoring and time management were used most frequently following the intervention.

The Self-efficacy (SE) for Walking Scale, developed by McAuley et al., (2000), targets an individual’s confidence (range 0-100) to walk briskly for a duration of time. PURPOSE: The purpose of this study was to analyze the psychometric properties of the SE for Walking Scale in community-dwelling older adults, a 6-item scale with increasing 10-minute intervals (0 to 60minutes).

METHODS: Participants (N=300, M=73.8±8.2yrs) were recruited from senior centers and completed the following: 1) SE for Walking Scale, 2) 6-minute walk test (Rikli & Jones, 1999), and 3) to self-report aerobic physical activity (PA). Data were analyzed in RStudio for internal consistency reliability and concurrent validity with walking performance and PA level.

RESULTS: The SE for Walking Scale was scored using the mean score of all items (M=58.4±34.4). There was high internal consistency reliability across all items (>96) and good correlations of each item with the overall mean score ranging from 0.81 to 0.94. Concurrent validity with walking performance (M=431±119yds), as measured by yards walked in 6 minutes, was moderate (PMCC=0.56); there was no correlation with current aerobic PA level (PMCC=0.15; M=220±284min/wk).

CONCLUSIONS: The SE for Walking Scale in community-dwelling older adults has evidence of reliability and moderate validity with walking performance. However, the non-correlation with current PA level may suggest other important constructs, such as intention, previous experiences with PA, or social support, influence relationships between self-efficacy, ability, and actual current physical activity behavior. These additional constructs may be important considerations in PA interventions in older adults.
PURPOSE: Previous studies showed that some older adults can carry out basic activities of daily living (BADL) independently, but with some difficulty generating daily problems in their community and their home. However, little is known about implement exercise programs in elderly population. The aim of this study was to investigate the effect of a physical exercise program on the level of independence in the elderly population.

METHODS: This study involved a total of 52 elderly participants between 62 and 89 years of age (71.2% female) who attended to Comprehensive Care Center Senior Adult from Ecuador. Participants were randomized into a control group (CG, n=36) and experimental group (EG, n=36), which performed a physical exercise program (3 months; 3 days per week/45 minutes per session). The assessment to determine the level of independence was carried out through validated BARTHEL test which evaluated BADL with the following ranges of scores: 0-20=total dependence, 21-60=severe dependence, 61-90=moderate dependence, 91-99=light dependence, 100=total independence. Data were recorded at baseline and 12, 18, and 24 weeks (10 weeks during the intervention and in the end of the intervention period). A descriptive analysis of frequencies and percentages in order to determine the change of the range of independence was used for qualitative variables. A factorial ANOVA of repeated measures was used to analyze the effects and interactions between the factors: study groups and measure moments on the Barthel test overall score. Post-intervention, experimental group showed an increase of 15.4% of participants with total independence, whereas control group only increased 3.8%.

RESULTS: Experimental group showed trend to increase Barthel overall score (MD=11.77±6.26; p=0.006) compared to the control group after intervention. Post-intervention, experimental group showed an increase of 15.4% of participants with total independence, whereas control group only increased 3.8%.

CONCLUSIONS: A 3-months physical exercise program could improve the levels of independence in the elderly population; however, it could be necessary long-term interventions.
Men’s Lacrosse players are susceptible to Sports Related Concussions (SRC’s) due to magnitude and frequency of head impacts during practices and games. Currently there is a paucity of data quantifying head impacts in men’s lacrosse. PURPOSE: The purpose of this study was to quantify the magnitude and frequency of head impacts in a NCAA Division III men’s lacrosse team over a six-week period (second half) of the regular season. METHODS: Twenty-three men’s lacrosse players were head impact monitors during five home games and fourteen practices. The head impact sensor was placed in a head band and positioned underneath the nuchal line in the back of the head. Analyses were completed for magnitude, frequency, player position, and location of head impacts comparing games vs. practice. RESULTS: A total of 269 head impacts were recorded, 133 impacts during games and 136 during practice. There was no significant difference (p=0.05) in peak linear acceleration between games and practices (37.18 ± 15.47g vs. 36.83 ± 14.4g), peak rotational acceleration (4.15 ± 2.29g vs. 3.96 ± 2.07g), and peak rotational velocity (16.44 ± 8.89g vs. 16.32 ± 8.59g). In games there were 5.78 ± 6.90 impacts per player, while in practice there were 5.91 ± 3.79 impacts per player, which resulted in no significant difference (p=0.05). For positions there was no significant difference (p=0.05) in peak linear acceleration across all positions. Location of impact resulted in no significant difference (p=0.05) for all six locations measured; crown, base, left, right, front, and back of the head. CONCLUSION: Magnitude and frequency of head impacts in NCAA Division III men’s lacrosse did not differ between practices and games during the second half of the regular season, nor were head impact position dependent. Further research is required to understand the potential implications of head impacts in men’s lacrosse.
ANCORA, controlling for average days since concussion. RESULTS: No group differences were observed for single leg squat center of pressure path (P=0.197) or speed (P=0.765). Dominant leg TTS was not significant. The previously concussed group demonstrated longer TTS than the control group during non-dominant leg single leg hop (P=0.024; mean diff: ±0.34 s; 95%CI: 0.04, 0.64).

CONCLUSIONS: Lingering dynamic balance control deficits after concussion may contribute to an increased risk of musculoskeletal injury. While single leg squat may not challenge balance control sufficiently, future study of the more dynamic single leg hop is needed to determine the potential diagnostic and prognostic value following concussion. Non-dominant limb static balance assessment is common following concussion. Slight balance impairments may be better identified when assessing the non-dominant leg due to preexisting limb neuromuscular control disparities, as was the case in our investigation.

2010 Board #23 June 1 3:30 PM - 5:00 PM
Risk Factor Metrics for Adolescent Female Soccer Injury and Concussive Events
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(Purposes: The vestibular, visual, and somatosensory (cervical proprioception) systems may have deficits without overt symptoms. One such study identified athletes with pre-season neck pain, decreased balance, and/or headache as 2.4 to 3.65 times more likely to suffer concussion. The purpose of this study was to evaluate multiple baseline metrics as identifiers of risk for musculoskeletal and/or concussive injury.

METHODS: 15 female high school varsity soccer athletes, mean age of 15 years (±1.2) and mean BMI of 20 (±2.4), were assessed using pre-season movement screens including King-Devick (K-D), balance error scoring system (BESS), lower quarter Y-balance test (LQ-YBT), and functional movement screen (FMS). Historical data was collected for neck pain, dizziness, and headache, and injuries were tracked during the competitive season.

RESULTS: K-D score was 47.06 (±5.66) seconds. BESS score was 10.39 (±4.18) seconds, right LQ-YBT composite was 94.4 (±5.5) and left was 94.5 (±5.0). FMS score was 15.11 (±2.04). No statistical significance was identified in this study directly linking pre-season metrics as indicators for musculoskeletal injury or concussion. Concussion had correlated trends with each of the following pre-season metrics: history of prior concussion, pre-season headache, and neck pain. Statistical significance was found for individuals with pre-season neck pain who later suffered a musculoskeletal and/or a concussive injury (Fischer’s Exact test = 0.040).

CONCLUSIONS: Pre-season metrics failed to identify athletes at risk of suffering a musculoskeletal injury or concussion. The data identified a possible link between pre-season neck pain and later injury or concussion and a correlative trend between pre-season metrics and musculoskeletal and/or concussion. Small sample size limited the power and generalizability of the study. The ability to identify those at risk of musculoskeletal injuries and/or concussion from simple pre-season metrics including prior history, current symptoms, and movements may be an important step in making youth athletic participation safer. Further studies with larger data sets using similar pre-season metrics may demonstrate utility for identifying individuals at risk for musculoskeletal and/or concussive injury.
Athletes completed a modified sideline concussion assessment tool (m-SCAT) including symptom checklist, Standardized Assessment of Concussion (SAC), modified Balance Error Scoring System (m-VEST), Generalized Anxiety Disorder scale (GAD-7), Patient Health Questionnaire (PHQ-9), and self-report history of concussion, LID, headaches/migraines, and depression/anxiety. Athletes also completed the Immediate Post-Concussion Assessment and Cognitive Test (ImPACT). Following baseline assessment, all athletes were tracked by athletic medical staff to determine if a prospective concussion occurred during the study period. Athletes diagnosed with concussions were followed by athletic medicine staff. We then compared baseline performance between concussed and non-concussed athletes.

Results:
One hundred forty six athletes were diagnosed with a concussion during the study period.

With the exception of concussion history, none of the baseline clinical measures or modifiers were clinically significant. Concussion history significantly predicted future concussion. 10.24% of athletes with no concussion history, 16.35% with one concussion, and 22.12% with ≥2 concussions were concussed prospectively (χ²(2) = 16.14, p < 0.001).

Conclusion:
With the exception of previous concussion history, there were no meaningful pre-injury predictors of subsequent concussion. Though it may be useful to obtain clinical assessments and modifiers at baseline in order to improve management, these assessments do not predict the likelihood of subsequent concussion.
Multivariate logistic regression was used to investigate associations between running practice during this 3-year follow-up period without any substantial period of interruption since 2010. The most common motivations to maintain running adherence and training characteristics.

CONCLUSION: Most of the recreational runners have maintained running practice during this 3-year follow-up period without any substantial period of interruption since 2010. The most common motivations to maintain running adherence were “to be healthier” and “for fun.” The most common reasons to stop running were musculoskeletal injuries and lack of time. Some training characteristics (training surface, running frequency, running distance and running training duration) may influence running adherence.

Purpose: Using the self-determination theory understanding of what constitutes need-supportive and controlling motivational styles and their implications, the aim of this study was twofold: 1) Identify different profiles of motivational strategies used by exercise professionals in gym contexts, 2) Examine associations between these motivational profiles and perceptions of job pressure, exercisers’ self-determined motivation, work-related need satisfaction/frustration, type of motivation, and burnout. METHODS: Participants were 366 exercise professionals (193 males; experience = 7.7±5.5 years). Questionnaires assessing the analysed variables were completed online. Using a Latent Profile Analysis (LPA) approach, reported need-supportive and controlling motivational strategies were used to estimate profiles solutions (one to four), with the means and variances of the indicators freely estimated in all classes. The relationship between profiles and outcomes was also analysed. RESULTS: The 3-profiles model was retained as the best solution (lower scores in AIC, CAIC, BIC, and ABIC, and greater scores in Entropy; BLRT = 322.954; p<.05), composed by: a need-supportive profile (n = 225; characterized by high scores in supportive strategies and low on controlling ones), a controlling profile (n = 42; characterized by high scores in controlling strategies and low on need-supportive ones), and a mixed profile (n = 99; characterized by high scores in both need-supportive and controlling strategies). The need-supportive profile displayed the most optimal pattern, with significantly higher scores in perceived exercisers’ and professionals self-determined motivation, work-related need satisfaction and professional efficacy, and lower scores in perceived job pressure, need frustration, emotional exhaustion, and depersonalization (p<.05). On the contrary, the controlling profile displayed the most maladaptive pattern of associations. CONCLUSION: Although much emphasis has been given to promote need-support, diminishing controlling practices, that can also co-occur, seems comparatively important. Professionals relying mostly on this type of strategies displayed more problems related to the quality of their own motivation and burn-out.

Purpose: About 61% of adults with type 2 diabetes are not meeting the current physical activity guidelines. This study examined the usefulness of the theory of planned behavior (TPB) for understanding physical activity intention and behavior in this population. METHODS: A link to an electronic survey that included a demographics questionnaire, a TPB questionnaire, and the Godin Leisure-Time Exercise Questionnaire (GLTEQ) was distributed through several social media outlets and hotlines during an 8-week period. The TPB questionnaire used 7-point Likert-type scales to measure attitude, subjective norm, perceived behavioral control (PBC), and intention. The GLTEQ assessed weekly frequency of moderate and vigorous physical activity. RESULTS: Although 48 adults consented to participate in the research, only 23 adults (M = 56.18, SD = 11.41; M age = 29.55, SD = 7.65; 56.5% male; 78.3% White) reported having type 2 diabetes and provided complete survey data. Two hierarchical regression analyses with forced entry within each block were used to examine the predictors of physical activity intention and behavior. The final model that included attitude, subjective norm, and PBC explained 60.0% of the variance in intention. However, high running frequency was associated with lower odds of dropping out of running (OR 0.41 95% CI 0.28 to 0.59). Running distance ≥20 km/week and running training duration were associated with lower odds of dropping out of running, respectively OR 2.04 95% CI 1.01 to 4.09 and OR 0.44 95% CI 0.22 to 0.88. CONCLUSIONS: Most of the recreational runners have maintained running practice during this 3-year follow-up period without any substantial period of interruption since 2010. The most common motivations to maintain running adherence were “to be healthier” and “for fun.” The most common reasons to stop running were musculoskeletal injuries and lack of time. Some training characteristics (training surface, running frequency, running distance and running training duration) may influence running adherence. 

Purpose: The maintenance of physical activity in the long term is challenging. Understanding the factors associated with physical activity adherence is important to prevent potential dropouts from physical activity. PURPOSE: The aims of this study were to investigate running adherence and its association with training characteristics in recreational runners. METHODS: This study was a 3-year follow-up analysis of a prospective cohort study. The 141 participants (108 men, 76.6%; 33 women 23.4%) who had participated in a previous cohort study were invited to participate. Online questionnaires collected information on running adherence, training characteristics, and health problems sustained during three years of follow-up (2010 to 2013). Multivariate logistic regression was used to investigate associations between running adherence and training characteristics. RESULTS: In total, 97.9% (n=138) of the participants maintained the running practice during the 3-year follow-up without any substantial disruption period. The most common motivation to keep running was “to be healthier” (63.3%, n=88). The most common reasons to drop out of running were musculoskeletal injuries (33.3%, n=22) and lack of time (30.3%, n=20). Running on rigid training surface and treadmill were associated with higher odds of dropping out of running, respectively OR 3.84, 95% CI 1.20 to 12.2 and OR 8.50, 95% CI 1.96 to 36.7. However, high running frequency was associated with lower odds of dropping out of running (OR 0.41 95% CI 0.28 to 0.59). Running distance ≥20 km/week and running training duration were associated with lower odds of dropping out of running, respectively OR 0.24 95% CI 0.10 to 0.59 and OR 0.44 95% CI 0.22 to 0.88. CONCLUSIONS: Most of the recreational runners who have maintained running practice during this 3-year follow-up period without any substantial period of interruption since 2010. The most common motivations to maintain running adherence were “to be healthier” and “for fun.” The most common reasons to stop running were ecological factors, social interactions, stressful events, hydration status, food intake, exercise self-efficacy - and allowed PPTs to log exercise behaviors. PPTs were instructed to complete each survey within 60-min of receipt. Feasibility of this approach (e.g., recruitment, study adherence, survey compliance) was assessed using descriptive statistics and frequency analyses. RESULTS: Between 6/13/16 and 9/24/16, recruitment efforts yielded 22 individuals interested, with 19 adults consenting to enrollment (22.58±3.11 years, 25% women, 67% non-Hispanic white) and completing the study. Of 1064 text message prompts, 82.98% of surveys were completed within the 60-minute time frame. On average, PPTs completed 3.26±0.41 valid surveys per day within 24±16-min of receipt (79% within 30-min). Average survey duration was 4.40±0.93 min (86% within 5 min). 18 individuals had at least one week where they completed 75% of all surveys sent and 12 individuals had at least one week where they completed 85% of all surveys sent. PPTs reported 4.9±2.71 exercise bouts per week (range = 1 to 11), with 187 surveys indicating at least one type of exercise (21.5%) and 12 surveys indicating two types of exercise (1.38%). CONCLUSIONS: Using a survey distribution platform designed for use in personal smartphones demonstrates initial feasibility in young adults. Two weeks of observation appears necessary to elicit at least 75% survey compliance in most participants.

Purpose: To assess physical activity (PA) adherence and training characteristics of recreational runners. METHODS: Eligible PPTs were enrolled in the study for 14 days. Each day, text messages, containing a link to the EMA survey, were distributed at 9:30am, 1:30pm, 5:30pm, and 9:30pm ($0.01 per text). The survey assessed hypothesized antecedents of exercise (e.g. affective states, social interactions, stressful events, hydration status, food intake, exercise self-efficacy) and allowed PPTs to log exercise behaviors. PPTs were instructed to complete each survey within 60-min of receipt. Feasibility of this approach (e.g., recruitment, study adherence, survey compliance) was assessed using descriptive statistics and frequency analyses. RESULTS: Between 6/13/16 and 9/24/16, recruitment efforts yielded 22 individuals interested, with 19 adults consenting to enrollment (22.58±3.11 years, 25% women, 67% non-Hispanic white) and completing the study. Of 1064 text message prompts, 82.98% of surveys were completed within the 60-minute time frame. On average, PPTs completed 3.26±0.41 valid surveys per day within 24±16-min of receipt (79% within 30-min). Average survey duration was 4.40±0.93 min (86% within 5 min). 18 individuals had at least one week where they completed 75% of all surveys sent and 12 individuals had at least one week where they completed 85% of all surveys sent. PPTs reported 4.9±2.71 exercise bouts per week (range = 1 to 11), with 187 surveys indicating at least one type (21.5%) and 12 surveys indicating two types of exercise (1.38%). CONCLUSIONS: Using a survey distribution platform designed for use in personal smartphones demonstrates initial feasibility in young adults. Two weeks of observation appears necessary to elicit at least 75% survey compliance in most participants.
The stages and processes of change of the Transtheoretical Model have been used to design programs that facilitate exercise adherence. The stages that explain when people change refer to pre-contemplation (PC = inactive without any intention to change), contemplation (C = inactive with intention to change), preparation (P = active but not fulfilling the recommendations of the American College of Sports Medicine [ACSM]), action (A = has complied with the recommendations of the ACSM but for less than six months) and maintenance (M = has complied with the recommendations ACSM for more than six months). The processes that explain how this change occurs are divided into cognitive processes (CP), implying thoughts, attitudes and awareness, and behavioral processes (BP), which involve actions. This model suggests that the effectiveness of the change depends on doing the right things (processes) at the right moment (stage).

**PURPOSE:** To analyze which processes are the most used in the stages to fulfill ACSM recommendations for regular exercise.

**METHODS:** A total of 533 participants (48% female and 51.8% male) aged 11 to 76 (M = 33.22 ± 15.27) took part in the study. The Spanish version of the stages of change questionnaire (SCQ) and the processes of change questionnaire for physical activity (PCQ) were used to collect the data. The internal consistency of the subscales CP (α = .90) and BP (α = .92) were satisfactory. Results of One-Way ANOVA revealed significant differences in CP (F(4,525) = 27.707, p < .001) and BP (F(4,525) = 45.580, p < .001) at different stages. Tukey HSD post hoc test indicated that participants in C, P, and A stages used cognitive processes more than those in PC. In addition, those in M employed the most in M.

**RESULTS:** The internal consistency of the different BP ranged from .66 to .80. The internal consistency of the different CP ranged from .86 to .90.

**CONCLUSION:** The use of CP and BP are essential in order to advance from lower stages up to M. However, the use of CP was higher in C, whereas BP was employed the most in M.

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**ABSTRACT**

The stages and process of change are two key constructs in modifying risk behaviors according to Transtheoretical Model. The stages involve pre-contemplation (PC = inactive without any intention to change), contemplation (C = inactive with intention to change), preparation (P = active but not fulfilling the recommendations of the American College of Sports Medicine [ACSM]), action (A = has complied with the recommendations of the ACSM but for less than six months) and maintenance (M = has complied with the recommendations ACSM for more than six months). Meanwhile, the behavioral processes (BP) involve Substituting Alternatives (SA), Enlisting Social Support (ESS), Rewarding Yourself (RY), Committing Yourself (CY), Reminding Yourself (RY). **PURPOSE:** To analyze what behavioral processes are most commonly used in the different stages to fulfill the recommendations of healthy exercise of the ACSM. **METHODS:** A total of 533 subjects (48% female and 51.8% male; 33.22 ± 15.27; range = 11-76). A translation into Spanish spoken in Mexico of the stages of change questionnaire and questions related to behavioral processes belonging to the questionnaire process of change for physical activity were used. **RESULTS:** The internal consistency of the different BP ranged from .66 to .80. The results of One-Way ANOVA revealed significant differences in IK, BAR, CACO, CB and IHO in different stages (F(4,525) = 13.973 - 44.570, p < .001). The post hoc Tukey test indicated that, in general, the use of SA (PC>C=P>A-M), ESS (PC>C<P=A-M), RY (PC>C=P>A-M), CY (PC>C=A=P-M) and RY (PC>C=P>A-M) increase through stages. **CONCLUSION:** The CY process show more relevance to generate the intention to change the sedentary lifestyle, however, RY, SA y CY processes contributed more for healthy exercise for more than six months.

**Keywords:** Transtheoretical Model, Exercise, Mexico

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**An Integrative Perspective of Validating a Simplified Chinese Version Behavioral Regulation in Exercise Questionnaire-2**

**Purpose:** The Behavioral Regulation in Exercise Questionnaire (BREQ-2) is an instrument designed to assess individuals’ motivation in physical activity (PA) participation. The BREQ-2 aims to measure individuals’ motivation in PA participation. The simplified Chinese version of the BREQ-2 (C-BREQ-2) has been frequently used in PA motivation studies, the validation test of the Chinese version of the BREQ-2 (C-BREQ-2) has rarely been conducted. The study aims to examine psychometric property, measurement invariance, latent mean difference, as well as convergent and discriminant validity tests of the scale were met. Additionally, the revised scale is invariant at both configural, full metric, and full scalar levels across genders. The internal consistency of the different BP ranged from .66 to .80. The internal consistency of the different CP ranged from .86 to .90.

**Results:** The internal consistency of the subscales CP (α = .90) and BP (α = .92) were satisfactory. Results of One-Way ANOVA revealed significant differences in CP (F(4,525) = 27.707, p < .001) and BP (F(4,525) = 45.580, p < .001) at different stages. Tukey HSD post hoc test indicated that participants in C, P, and A stages used cognitive processes more than those in PC. In addition, those in M employed the most in M.

**Conclusions:** The use of CP and BP are essential in order to advance from lower stages up to M. However, the use of CP was higher in C, whereas BP was employed the most in M.
Pokémon Go, an augmented reality smartphone game has been credited for improving physical activity and wellness. **Purpose:** To examine changes in physical activity habits and mental and physical wellness as a result of playing Pokémon Go. **Methods:** Surveys were administered to seventeen regular Pokémon Go users, ages 18–65 years old. The survey was designed to compare time, type and frequency of physical activity (PA) as well as physical, mental and lifestyle factors prior to and following playing Pokémon Go. Paired-sample t-test compared the difference in the number of PA sessions/week before and after Pokémon. IBM SPSS Statistics version 24 were used for statistical analyses. **Results:** For all participants surveyed, 30% of their time playing Pokémon Go is spent in a seated position (car, golf cart, other) and 70% is spent in a mode of PA (walk, bike, rollerblade). 24% of participants solely play utilizing a form of PA, while nearly half of the participants said that ≥75% of play is spent walking. Half of the participants categorized their intensity while playing as light, while the other half play with moderate intensity. Paired-sample t-test compared the difference in the number of PA sessions/week before and after Pokémon, which was 0.44±1.72 (P=0.306). 41% have engaged in more PA as a result of playing, while the difference in minutes of PA/week before and after Pokémon is only 0.147±14 min. Since beginning Pokémon, participants have moved an average of 104 km and report decreased stress and less anxiety from playing. Conclusion: The majority of participants who play Pokémon Go do so while walking at various intensity levels. The popular exergame can lead to an increase in physical activity frequency, however the duration of exercise does not seem to be affected. Improved wellness was also noted with reports of decreased stress and anxiety as a result of playing. Overall, Pokémon Go can have a positive influence on both physical and mental wellness.
Young Children assessed preschoolers’ PPC. The Bruninks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) subtests for balance, running speed and agility (locomotor), upper-limb coordination (ball skills) and strength assessed children’s actual FMS. Spearman’s rho correlations were used to assess the relationships between PPC and each BOT-2 subtest. Hierarchical linear regression analyses were conducted for each of the four BOT-2 subtests to investigate the amount of variance in FMS explained by PPC (overall model controlled for age, sex, ethnicity, and BMI z-score).

**RESULTS:** Spearman’s rho correlations showed significant correlations between PPC and FMS when data were examined separately by sex and/or ethnicity. There were significant positive correlations between PPC and ball skills for males (r = 0.20, p < 0.05) and non-Hispanic preschoolers (r = 0.18, p < 0.05). There was a significant negative correlation between PPC and balance in Hispanic females (r = 0.31, p < 0.05).

Regression analyses showed PPC was significantly related to locomotor scores (β = 1.4, r = 2.19, p < 0.05) with the overall model explaining 16% of the variance in locomotor scores, F(5, 216) = 8.43, p < 0.05. Further, PPC was significantly related to strength scores (β = 1.97, r = 0.71, p < 0.05) with the overall model accounting for 20% of the variance in strength scores, F(5, 216) = 10.48, p < 0.05.

**Conclusions:** The correlation between PPC and FMS in preschoolers varies by sex and ethnicity in LEAP study participants. Moreover, PPC is significantly related to locomotor and strength skills. Promoting FMS development in preschoolers could potentially influence their movement competence or confidence, thus enhancing their physical literacy and ultimately physical activity engagement.

**Supplement S415**

2029 | Board #42 | June 1 2:00 PM - 3:30 PM | At-risk Preschoolers’ Perceived Physical Competence and Observed Fundamental Movement Skills
---|---|---|---
Jimikaye B. Courtney1, Susan L. Johnson2, Kaigang Li1, Laura L. Bellows1 | | |
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**Purpose:** Children’s perceived physical competence (PPC) may be related to their fundamental movement skills (FMS). Baseline data from the Colorado LEAP study were explored to examine the relationship between at-risk preschoolers’ PPC and observed FMS.

**Methods:** The LEAP study was conducted in 4 preschools serving preschoolers (n = 250) at high risk for obesity. The Pictorial Scale of Perceived Competence for Young Children assessed preschoolers’ PPC. The Bruninks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) subtests for balance, running speed and agility (locomotor), upper-limb coordination (ball skills) and strength assessed children’s actual FMS. Spearman’s rho correlations were used to assess the relationships between PPC and each BOT-2 subtest. Hierarchical linear regression analyses were conducted for each of the four BOT-2 subtests to investigate the amount of variance in FMS explained by PPC (overall model controlled for age, sex, ethnicity, and BMI z-score).

**RESULTS:** Spearman’s rho correlations showed significant correlations between PPC and FMS when data were examined separately by sex and/or ethnicity. There were significant positive correlations between PPC and ball skills for males (r = 0.20, p < 0.05) and non-Hispanic preschoolers (r = 0.18, p < 0.05). There was a significant negative correlation between PPC and balance in Hispanic females (r = 0.31, p < 0.05).

Regression analyses showed PPC was significantly related to locomotor scores (β = 1.4, r = 2.19, p < 0.05) with the overall model explaining 16% of the variance in locomotor scores, F(5, 216) = 8.43, p < 0.05. Further, PPC was significantly related to strength scores (β = 1.97, r = 0.71, p < 0.05) with the overall model accounting for 20% of the variance in strength scores, F(5, 216) = 10.48, p < 0.05.

**Conclusions:** The correlation between PPC and FMS in preschoolers varies by sex and ethnicity in LEAP study participants. Moreover, PPC is significantly related to locomotor and strength skills. Promoting FMS development in preschoolers could potentially influence their movement competence or confidence, thus enhancing their physical literacy and ultimately physical activity engagement.

**Supplement S415**

2030 | Board #43 | June 1 2:00 PM - 3:30 PM | Types Of Leisure, Leisure Motivation, And Well-being in University Students With An Empasis On Physical Activity
---|---|---|---
Jong-Ho Kim1, Stephen Brown2, Heewon Yang3 | | |
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It is well-documented that leisure is conducive to psychological well-being for a variety of population. However, a scarcity of research on types of leisure influenced by individual attributes and health status as well as contributing factors for leisure satisfaction. **PURPOSE:** The research aims to investigate the types of leisure influenced by individual attributes and health status as well as the contributing factors for leisure satisfaction. **METHODS:** Cross sectional data were collected by administering Leisure Satisfaction Scale (LSS), Leisure Motivation Scale (LMS), Types of Leisure Scale, Perceived Stress Scale (PSS), Health Risk Survey, and Demographic Survey including Body Mass Index (BMI) to 199 university students. **RESULTS:** Leisure satisfaction was inversely correlated with perceived stress (r = −0.21, p < 0.01) and amotivation (r = −0.23, p < 0.01). Perceived stress was positively associated with amotivation (r = 0.23, p < 0.05). Stepwise multiple regression shows that intrinsic leisure motivation was a single strong predictor for leisure satisfaction even after controlling for elementary school leisure, high school leisure, extrinsic leisure motivation, and perceived stress (β = 0.83, β = 0.71, r = 4.72, p < 0.01). Interaction analyses in multiple regression demonstrate that there was a significant interaction between BMI and social support, which indicates that the impact of BMI on active leisure differs depending on levels of social support (Δ R² = 0.048, F[1, 138] = 7.02, p < 0.009). There was a significant interaction between BMI and perceived stress, indicating the impact of BMI on passive leisure differs depending on perceived stress (Δ R² = 0.034, F[1, 148] = 5.23, p < 0.05). **CONCLUSION:** Intrinsic leisure motivation appears to influence leisure satisfaction, which may lead to lowered levels of stress. Conversely, leisure apathy (amotivation) may lead to elevated levels of perceived stress. University students with high BMI do not tend to engage in physically active leisure in the presence of high perceived social support. Also, university students with high BMI were more likely to engage in passive leisure in the presence of low perceived stress. These findings could shed light on the motivational strategies health care providers can use to support health-promoting leisure activities such as physical activity.

2031 | Board #44 | June 1 2:00 PM - 3:30 PM | Affective Associations as Predictors of Physical Activity in Cancer Survivors
---|---|---|---
Jeanna Tran1, Emily Van Wasshenova1, Ashley Murray1, Adrienne Boczar1, Debra Boardley1, Andrew Geers1, Rachel Mahas1, Ryan Schropp1, Jessica Maras1 | | |
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Traditional physical activity promotion programs have focused on changing cognitions with the belief that physical activity decisions are made by weighing the benefits and costs of performing the behavior. However, recent research reveals that affective associations with physical activity (e.g. positive feelings about exercise) can also
predict physical activity behavior. These findings suggest that cognitive measures and feeling measures may both be important predictors of participation in physical activity. **METHODS:** A convenience sample of cancer survivors (n=122) were included in the regression model. Predicted physical activity behavior was predicted by cognitive measures (p<0.01), worry about physical activity (p<0.01) and implicit measures (p<0.05) which were the only significant predictors of physical activity behavior. **RESULTS:** Majority of the participants were Caucasian (83%), and breast cancer survivors (62%) out of treatment with a mean BMI of 30 kg/m². Results show physical activity intentions were significantly predicted by cognitive measures (p<0.01). In contrast, positive affective associations (r=0.01) and belief measures were not significant predictors of physical activity behavior. **CONCLUSIONS:** The current study suggests cognitive beliefs predict physical activity intentions and affective measures separately predict physical activity behavior in cancer survivors. These findings could be implemented into physical activity programs focusing on both increasing cognitive beliefs about physical activity and increasing positive feelings towards physical activity.

**2032 Board #45**

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

**Weight Training and Self Determined Motivation: A Longitudinal Analysis of Previously Untrained, Sedentary Women**

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(No relationships reported)

**PURPOSE:** To examine the impact of weight training on autonomy, competency, relatedness, and self determined motivation over a period of 28 months. We hypothesized that women who participated in a 12 week weight training program would exhibit significant increases in autonomy, competency and self determined motivation over time. In addition, we hypothesized that the treatment group would exhibit a more self determined motivational profile than the control group.

**METHODS:** The sample consisted of 44 sedentary women with no prior weight training experience. The mean age was 22 years (range 18 - 29) and BMI’s ranging from 19.3 to 46.7 (M=27.0). Upon random group assignment, psychosocial and anthropomorphic data were collected from all participants at baseline. The treatment group training protocol consisted of three 45-60 minute sessions per week. The treatment group also received a training manual and supervision from certified personal trainers for 14 of their 36 total sessions. The control group received the manual after post testing (week 13) and instructions on how to perform the exercises. Follow up assessment of all psychosocial variables was conducted at 28 months post baseline.

**RESULTS:** Psychosocial and anthropomorphic data did not significantly differ across groups at baseline. A between group effect was present F(1, 39) = 4.332, p < 0.05. The treatment group also received a training manual and supervision from certified personal trainers for 14 of their 36 total sessions. The control group received the manual after post testing (week 13) and instructions on how to perform the exercises. Follow up assessment of all psychosocial variables was conducted at 28 months post baseline.

**CONCLUSIONS:** An exercise intervention typified primarily by free weight exercises over 28 months is more efficacious than a weight training instruction booklet alone for increasing self determined motivational profile. Physical exercise can be an effective intervention, with a positive effect on health and improving quality of life. However, studies show that 50% of persons starting an exercise program will drop out within the first 6 months. Thus, most people do not have the chronicles benefits provide by regular physical exercise. **Purpose:** To determine exercise behavior (personality and level of motivation) of participants during a 1 year exercise program.

**2035 Board #48**

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

**Personality And Motivational Profile Of Participants Adherent And Non-adherent To An Exercise Program**

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(No relationships reported)
Mental health can play an important role in the development of a good health-related physical fitness, especially during physical education (PE) classes. In fact, kids with low self-esteem and psychological wellbeing are often inclined to avoid carrying out physical assignments in front of their peers due to the fear to be ridiculed. Similar psychological processes occur in children with high stress and anxiety associated to exercising. This could have a negative impact on the development of an appropriate level of strength, which is considered an important indicator of wellbeing at all ages.

**PURPOSE:** To assess primary school boys’ and girls’ physical strength associated to mental health profiles.

**METHODS:** A sample of 189 children (88 boys, 101 girls) aged 10-11 participated in the study. Physical strength measurements were carried out according to EUROFIT protocol, and included 30-sec sit-ups (SU), standing broad jump (SBJ), bent arm hang (BAH), and handgrip (HG) tests. In addition, participants were asked to fill self-esteem, psychological wellbeing, anxiety, and stress questionnaires. **RESULTS:** Cluster analyses evidenced two main profiles in participants: the former profile had lower scores in SU (PP: 13.09; PMH: 17.89), SBJ (PP: 1.58; PMH: 1.93), and HG (PP: 13.15, p < 0.04), where the Adh (19.0) has a median less than the NAdh (106.5).

**Conclusion:** In this study, the longer training produced greater sociability (need to belong), lower stress, and mental health in primary school students.

**Auditory Discrimination and Short Term Memory are Preserved during Simulated Altitude and Moderate Intensity Exercise.**

Sarah Kamakawio'ole, Laura Q. Jimenez, Brian Arwari, Arlette C. Perry, FACSM, Joseph F. Signorile, FACSM, Soyeon Ahn, Kevin A. Jacobs, FACSM, University of Miami, Coral Gables, FL. (Sponsor: Dr. Kevin Allen Jacobs, FACSM)

**PURPOSE:** This study was conducted to examine the cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise to examine whether short term memory or auditory oddball task performance were affected beyond a certain threshold of simulated altitude and whether exercise improves or worsens cognitive function during these conditions.

**METHODS:** Fourteen recreationally active college students (M=9, F=5) aged 18-35 participated in this study, which consisted of six experimental days, with three simulated altitude conditions: sea level (SL), simulated moderate altitude (MA; 15.4% FIO2 = 2400 m) or simulated high altitude (HA; 12.8% FIO2 = 3900 m) and two exercise conditions: rest or moderate intensity cycling exercise at 60% altitude-specific peak power output, in a randomized-order, crossover design. Accuracy and reaction time on an auditory oddball task and a Sternberg memory task were assessed, along the amplitudes and latencies of their associated event-related potentials.

**RESULTS:** Exercise improved auditory reaction time, regardless of altitude (p<0.01), though task accuracy was not affected under any condition. In addition, simulated altitude induced lower P300 amplitudes and slower latencies during the auditory oddball task (p<0.01), while exercise improved latencies at HA and SL, but not at MA (p=0.03). Sternberg memory task behavioral performance was not affected by either simulated altitude or exercise. However, P200 latency was slowed during exercise trials (p=0.02) as well as during MA trials (p<0.01).

**CONCLUSIONS:** Acute exposure to simulated moderate and high altitudes may not significantly impact short term memory and auditory discrimination. On the other hand, an acute bout of moderate intensity cycling exercise may improve reaction time on oddball tasks, even though it does not seem to benefit short term memory. It is possible that these cognitive modalities were negatively affected by simulated altitude, as evidenced by some altered event-related potentials, but that these effects were either too small to translate into performance deficits or that there are as yet unknown compensatory mechanisms at work that preserve performance as one ascends to altitude, at least until 3900 m.

**Impact of Biological Attractiveness on Exercise Motivation and Physical Activity in Female College Students**

Elizabeth A. Easley, Mary N. Fargalla, Sarah H. Sellhorst, William F. Riner, FACSM. University of South Carolina Lancaster, Lancaster, SC.

**PURPOSE:** To determine if differences existed in health pressure and appearance-related exercise motivations and physical activity between the BA group (WHR ≤ 0.74) and less biologically attractive group (LBA, WHR ≥ 0.75).

**METHODS:** This study was conducted to examine the cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise to examine whether short term memory or auditory oddball task performance were affected beyond a certain threshold of simulated altitude and whether exercise improves or worsens cognitive function during these conditions.

**RESULTS:** There was a significant multivariate effect for biological attractiveness, exercise motivations in women may vary based on WHR. **PURPOSE.** To determine if differences existed in health pressure and appearance-related exercise motivations and physical activity between the BA group (WHR ≤ 0.74) and less biologically attractive group (LBA, WHR ≥ 0.75).

**METHODS:** Full-time female college students (19.26 ± 1.37yr) completed the Exercise Motivation Inventory-2 (EMI-2). Following the survey, waist and hip circumferences were measured and WHR was calculated. Participants then wore an Actigraph accelerometer (GT3X, Pensacola FL) for seven consecutive days. One way MANOVA was used to determine if differences existed in exercise motivations and physical activity between groups. **RESULTS:** There was a significant multivariate main effect for biological attractiveness, Wilks’ lambda = .815, F (3, 43) = 3.247, p = .031. Closer examination of the univariate results demonstrated a significant difference in health pressure-related motivation (F = 4.18, p = .05), exercise motivation (F = 4.26, p = .005 between BA (n = 23, 1.48 ± 1.34) and LBA (n = 24, 2.53 ± 1.41). There were no differences in appearance-related motivation (BA, 3.27 ± .91 vs. LBA, 3.76 ± .93) or physical activity.

**Auditory Discrimination and Short Term Memory are Preserved during Simulated Altitude and Moderate Intensity Exercise.**

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**PURPOSE:** This study was conducted to examine the cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise to examine whether short term memory or auditory oddball task performance were affected beyond a certain threshold of simulated altitude and whether exercise improves or worsens cognitive function during these conditions.

**METHODS:** Fourteen recreationally active college students (M=9, F=5) aged 18-35 participated in this study, which consisted of six experimental days, with three simulated altitude conditions: sea level (SL), simulated moderate altitude (MA; 15.4% FIO2 = 2400 m) or simulated high altitude (HA; 12.8% FIO2 = 3900 m) and two exercise conditions: rest or moderate intensity cycling exercise at 60% altitude-specific peak power output, in a randomized-order, crossover design. Accuracy and reaction time on an auditory oddball task and a Sternberg memory task were assessed, along the amplitudes and latencies of their associated event-related potentials.

**RESULTS:** Exercise improved auditory reaction time, regardless of altitude (p<0.01), though task accuracy was not affected under any condition. In addition, simulated altitude induced lower P300 amplitudes and slower latencies during the auditory oddball task (p<0.01), while exercise improved latencies at HA and SL, but not at MA (p=0.03). Sternberg memory task behavioral performance was not affected by either simulated altitude or exercise. However, P200 latency was slowed during exercise trials (p=0.02) as well as during MA trials (p<0.01).

**CONCLUSIONS:** Acute exposure to simulated moderate and high altitudes may not significantly impact short term memory and auditory discrimination. On the other hand, an acute bout of moderate intensity cycling exercise may improve reaction time on oddball tasks, even though it does not seem to benefit short term memory. It is possible that these cognitive modalities were negatively affected by simulated altitude, as evidenced by some altered event-related potentials, but that these effects were either too small to translate into performance deficits or that there are as yet unknown compensatory mechanisms at work that preserve performance as one ascends to altitude, at least until 3900 m.

**Impact of Biological Attractiveness on Exercise Motivation and Physical Activity in Female College Students**

Elizabeth A. Easley, Mary N. Fargalla, Sarah H. Sellhorst, William F. Riner, FACSM. University of South Carolina Lancaster, Lancaster, SC.

**PURPOSE:** To determine if differences existed in health pressure and appearance-related exercise motivations and physical activity between the BA group (WHR ≤ 0.74) and less biologically attractive group (LBA, WHR ≥ 0.75).

**METHODS:** This study was conducted to examine the cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise to examine whether short term memory or auditory oddball task performance were affected beyond a certain threshold of simulated altitude and whether exercise improves or worsens cognitive function during these conditions.

**RESULTS:** There was a significant multivariate effect for biological attractiveness, exercise motivations in women may vary based on WHR. **PURPOSE.** To determine if differences existed in health pressure and appearance-related exercise motivations and physical activity between the BA group (WHR ≤ 0.74) and less biologically attractive group (LBA, WHR ≥ 0.75).

**METHODS:** Full-time female college students (19.26 ± 1.37yr) completed the Exercise Motivation Inventory-2 (EMI-2). Following the survey, waist and hip circumferences were measured and WHR was calculated. Participants then wore an Actigraph accelerometer (GT3X, Pensacola FL) for seven consecutive days. One way MANOVA was used to determine if differences existed in exercise motivations and physical activity between groups. **RESULTS:** There was a significant multivariate main effect for biological attractiveness, Wilks’ lambda = .815, F (3, 43) = 3.247, p = .031. Closer examination of the univariate results demonstrated a significant difference in health pressure-related motivation (F = 4.18, p = .05), exercise motivation (F = 4.26, p = .005 between BA (n = 23, 1.48 ± 1.34) and LBA (n = 24, 2.53 ± 1.41). There were no differences in appearance-related motivation (BA, 3.27 ± .91 vs. LBA, 3.76 ± .93) or physical
activity measured in average steps between groups (BA, 6437.64 ± 2633.76 steps/day vs. 6486.39 ± 2633.76 steps/day). CONCLUSIONS: Although the health benefits of PA are well known, the use in the LBA group, it was not a strong enough motivator to result in greater physical activity in this group. This suggests that health pressures are not a major motivator for exercise in female college students regardless of WHR and BA group. Appearance-related motivation was scored similarly between groups and despite higher scores than health pressure-related motivation in both groups, both categories were classified as low-active based on their average daily step counts. More research is needed regarding motivating factors for exercise in traditional-age female college students.

Resistance training itself has many far-reaching benefits in regards to muscular strength and endurance, bone health, and metabolism. However, despite its importance women tend to participate in resistance training at an alarmingly lower rate than men. Previous research on resistance training participation focused primarily on male subjects. Limitations of this research is available on this topic. PURPOSE: To determine the reasons why college-aged women perform resistance training. METHODS: Thirty-seven college-aged women (18-24 yrs. old) participated in this study by completing an online survey. Means, standard deviations, and frequencies were calculated for all questions. RESULTS: Women perform strength training for a variety of reasons. Over 95% agreed that resistance training improves health and fitness. These findings also suggest that resistance training helps college-aged women improve mental, physical, and emotional health overall.

Individual differences have been explored with respect to predicting affective responses to exercise. As such, new measures are developed to further understand these relationships and old measures are constantly updated to be more accurate. PURPOSE: Compare two measures of exercise tolerance. METHODS: Participants (N = 268; 154 female, 114 male) completed the Preference for and Tolerance of Exercise Intensity Questionnaire (PRETIE-Q) and the Physical Activity Acceptance Questionnaire (PAAQ) and then a 15-min high-intensity interval exercise (HIIE) session. Affective valence (Feeling Scale; FS) was assessed every 3-min during (average FS during used in analyses) and enjoyment (Physical Activity Enjoyment Scale; PACES) was assessed post exercise. RESULTS: A moderate relationship existed between the PAAQ and PRETIE-Q Tolerance (r = 0.45; P < 0.001). PAAQ was related to enjoyment (r = 0.21; P < 0.001), but not FS (r = 0.10; P > 0.09). Toler was related to both enjoyment (r = 0.31; P < 0.001) and FS (r = 0.22; P < 0.001). Using hierarchical regression, PAAQ accounted for 3.8% unique variance in enjoyment (r = 0.199; P = 0.003) and PACES accounting for age, sex and BMI; the addition of Tol explained an additional 6.8% unique variance in enjoyment (r = 0.297; P < 0.001). In a separate regression, Tol explained 10.0% unique variance in enjoyment (r = 0.332, P < 0.001), after accounting for age, sex and BMI; the addition of PAAQ did not explain any additional variance (r = 0.088, P = 0.21). The PAAQ did not account for any variance in FS (r = 0.074, P = 0.28); Tol explained 4.2% unique variance in FS (r = 0.215, P = 0.002), after accounting for age, sex and BMI. CONCLUSION: Comparison of Tol and PAAQ with respect to explaining affective responses revealed a modest relationship. While both explained affective responses, Tol accounted for more variability in such responses. Further, Tol accounted for all variance explained by the PAAQ, while the PAAQ accounted for roughly one third of the variance explained by Tol; with respect to enjoyment, in order to maximize benefits and minimize adverse affective responses to exercise, understanding individual difference factors is crucial. As such, the PRETIE-Q appears to predict affective outcomes of HIIE to a greater extent than the PAAQ.
related outcomes as their PA motivation. Among women, receiving support from family members was demonstrated as a relevant promoter of PA. Social support was a great motivator among older Latino caregivers. Future research and interventions should take into consideration the importance of social support to increase PA in this population. Funded by the Department of Kinesiology and Nutrition of UIC.

2044 Board #57 June 1 2:00 PM - 3:30 PM
Association between Baseline Fitness and Exercise Adherence during a 26-Week Supervised Exercise Program
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RESULTS: Data from participants enrolled in an 18-month BWLP combining a calorie-restricted diet and supervised exercise were used in this analysis. The 26-week supervised exercise intervention consisted of moderate intensity exercise (65-75% max HR), three supervised sessions/week, progressing from 20 to 60 min/session by week 13. Baseline fitness (VO2 max) was categorized based on published age and sex norms. Logistic regression was used to examine the association between baseline fitness and a) attrition and b) exercise adherence (attended >80% of supervised sessions). The association with adherence was assessed over the entire program (weeks 1-26) and during discrete intervals (weeks 1-4, 5-8, 9-14, 15-20, and 21-26).

RESULTS: 69 participants (age 41.9±7.2 kg/m², BMI 34.3±8.8 years, 87% female) were enrolled in the BWLP. Participants were classified based on baseline fitness level: 29% very poor (VO2 max 21.8±4.2 mL/kg/min), 48% poor (24.2±3.1 mL/kg/min), 19% fair (32.2±3.8 mL/kg/min), and 1% superior (38.2 mL/kg/min). 78% (n=54) completed the 26-week supervised exercise intervention. Baseline fitness category was not associated with attrition, nor was it associated with adherence over the entire program (weeks 1-26) or at weeks 1-4, 5-8, 9-14, and 15-20. However, there was a positive association between baseline fitness category and adherence during weeks 21-26. Participants categorized as poor or above were 9.4 times more likely to attend >80% supervised sessions compared to those categorized as very poor (95% CI = 1.1-78.5; p = 0.039).

CONCLUSIONS: The strongest positive relationships with PA are for external regulation, integrated regulation, and intrinsic motivation. The patterns of these correlations appear to support Self-determination Theory - Organismic Integration - that adolescents further along the continuum towards the intrinsic motivation end are likely to engage in more PA compared to those who are towards the amotivated end of the continuum. However, in this study, external regulation appears to have a stronger relationship than introjected or identified regulation. Overall, the total RAI indicates a positive relationship between autonomous motivation and PA.

2046 Board #59 June 1 2:00 PM - 3:30 PM
The Influence Of Attentional Focus Cuing On Jump-and-reach Performance
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Movement cueing involves the provision of verbal instructions to performers prior to movement execution. Research literature examining attentional focus has clearly documented the performance advantages of adopting an external focus (e.g., focusing on the center of a basketball hoop) over an internal focus (e.g., focusing on the left elbow). Preliminary research has provided support for this assertion (i.e., Wulf & Dufek, 2009; Wulf et al., 2007); however, these preliminary quasi-experiments employed relatively small sample sizes (i.e., n = 8-12 participants). The current experiment examined the effect of attentional focus cueing on performance of a vertical jump-and-reach task.

METHODS: Sixty-five college-aged participants were randomly assigned to one of three cueing conditions: control (n = 21), external focus (n = 22), or internal focus (n = 22). A Vertec™ measurement device was used to measure jump height.

RESULTS: Interestingly, and contrary to the attentional focus literature, results demonstrated similar jump-and-reach performances between the external- (Mechan = 19.97 in.; SD = 5.38) and internal-focus groups (Minnetal = 18.91 in.; SD = 5.31; p > 0.05), as well as similar performances between the external focus and control groups (Mean = 21.55 in.; SD = 4.88; p > 0.05).

CONCLUSIONS: These findings question the applicability of the external focus effect on the performance of less complex motor skills, however, other possible explanations for the current results and future research suggestions are also offered.

THURSDAY, JUNE 1, 2017

2047 Board #60 June 1 2:00 PM - 3:30 PM
Validity Of The Multidimensional Outcome Expectations For Exercise Scale In Young Adults
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Though outcome expectation is considered an important element of the social cognitive theory (Bandura, 1977, 1986), it has received little attention in physical activity research, especially in younger populations (Hedstrom & Rogers, 2009). Moreover, when measured, this construct is often unidimensional.

METHODS: To determine the psychometric properties of the 3-factor (physical, social, and self-evaluative) 15-item Multidimensional Outcome Expectations for Exercise Scale (MOES; Wijckicki, White, & McAuley, 2009) in a sample of young adult college students enrolled in a health-related fitness course. Participants completed questionnaires assessing physical, social, and self-evaluative outcome expectations, barrier self-efficacy (Dwyer et al., 2012), and self-esteem (Robins et al., 2001), as well as the FITNESSGRAM® health-related fitness assessment to measure their cardiorespiratory fitness, muscular strength and endurance, and body composition (Cooper Institute, 2013).

RESULTS: Analyses supported the 3-factor measurement model of the MOES in young adults, χ²(81) = 312.11, p < .01, RMSEA = .09, CFI = .95, SRMR = .04 (Hu

Abstracts were prepared by the authors and printed as submitted.
While there is evidence of a positive relationship between cellular telephone (cell phone) use and sedentary behavior, but not physical activity in college-aged individuals (18-29 years old), these relationships have not been tested in individuals older than college age (≥ 30 years old). This research is warranted as cell phone use is inversely associated with age; thus these relationships may be different in older individuals. PURPOSE: To assess the relationship between cell phone use, physical activity and sedentary behavior in adults older than college age (≥ 30 years old). METHODS: Adults aged 30-63 years (N = 69, 51.8 ± 8.9 years old) wore physical activity monitors (accelerometers) for seven days and completed surveys assessing daily cell phone use, physical activity, and sedentary behavior. Pearson’s correlation analyses were performed to assess relationships between cell phone use and age, physical activity, and sedentary behavior. Participants were then split into tertiles based on total cell phone use (low, moderate, and high) and a MANCOVA (sex and age as covariates) was used to determine if there were group differences in physical activity and sedentary behavior. RESULTS: Cell phone use (≤ 125.2 ± 146.8 minutes per day) was inversely associated with age (r = −0.3, p = 0.005). Cell phone use was not associated with objectively- or subjectively-measured physical activity or sedentary behavior (r ≤ 0.1, p ≥ 0.2 for all). There were also no significant differences in physical activity or sedentary behavior between the low, moderate, and high cell phone user groups (r ≤ 2.0, p ≥ 0.12 for all). CONCLUSION: Consistent with previous research, there was an inverse relationship between cell phone use and age. Unlike what has been reported in college-aged individuals, cell phone use was not associated with sedentary behavior in adults older than college age. Because younger individuals are “digital natives” who have been raised with near-constant access to cell phones this may be their sedentary activity of choice. Conversely, adults who are older may prefer other, more traditional forms of sedentary activities such as watching television and using a desktop computer. This may explain the lack of a relationship between cell phone use and sedentary behavior in adults beyond college age.

A recent study examined the impact of TV viewing during exercise on observable volitional behavior (i.e. treadmill endurance time) among insufficiently active adults (46±15 years, 31±5 kg/m2; 68% women). Participants completed two visits in a randomized order, with 48±4 separating them. Participants could sit or walk on the treadmill (moderate intensity) as desired within a 60-minute time frame. During one visit, participants were able to view TV during exercise and while sitting. During the other, TV viewing was allowed only when seated. Despite the average participant accumulating 63±58 minutes of moderate-to vigorous physical activity (MVPA) per week, 24% of participants walked continuously for 60-min at both visits. PURPOSE: Determine differences in relevant physical, psychological, and behavioral characteristics between participants who walked 60-min in both conditions (WALK, n=6) compared to those who did not (WALK/SIT, n=19). METHODS: T-tests were used to compare physiological (BMI, %body fat, estimated VO2max ± psychological preference for and tolerance of exercise, intrinsic and extrinsic motivation), and behavioral (MVPA/week) factors. Tolerance for exercise intensity was significantly higher in WALK relative to WALK/SIT (3.2 vs. 2.5 ± 0.004). No other significant differences were observed (n=0.05) between WALK and WALK/ SIT, respectively (BMI=29.8 ± 2 kg/m2 vs. 31.6 ± 2 kg/m2, %body fat=34.0% vs. 36.0%, estimated VO2 max = 29.4±0.6ml/kg/min to 26.6±0.7ml/kg/min, intrinsic motivation=2.1 vs. 2.0, extrinsic motivation=1.04 vs.1.07, preference for exercise intensity= 2.6 vs. 2.6. Although the differences were significantly different, WALK reported nearly twice the average minutes of MVPA (83.3 vs. 48.9 min/week, p=0.20). Anecdotally, several participants indicated that, because it was already scheduled, they used this time to exercise regardless of condition. CONCLUSION: The ceiling effect in volitional walking time noted for 24% of participants warrants further investigation. Preliminary descriptive analyses suggest that tolerance of exercise may play a role, while anecdotal data indicate additional motivational factors (i.e. “making use” of experimental visits) should be accounted for. Future studies may consider implementing experimental time frames greater than 60 minutes.
There is currently research that suggests that physical activity level is a significant positive predictor of satisfaction with life (SWL) as well as a significant negative predictor of depression in older adults. The belief that an individual holds regarding their own physical activity capabilities (exercise self-efficacy) has also been found to serve as a predictor of SWL and depression. It’s currently unknown which of these two variables (physical activity or self-efficacy) is the better predictor of satisfaction with life and depressive symptoms in older adults. Thus, the PURPOSE of this study was to examine the relationships among physical activity level, exercise self-efficacy, age, SWL, and depressive symptoms in this population. We hypothesized that exercise self-efficacy would be the better predictor of SWL and depressive symptoms than physical activity level in older adults. METHODS: In 68 older adults (78.3±7.8y) we assessed depression (Geriatric Depression Scale, GDS), well-being (Satisfaction with Life Scale, SWLS), moderate-to-vigorous physical activity (MVPA, Community Healthy Activities Model Program for Seniors questionnaire), and exercise self-efficacy (SEFF). Hierarchical linear regression analyses were utilized to assess the predictive value of MVPA, SEFF, and Age for SWLS and GDS using two models (Model 1: Age and MVPA; Model 2: Age, MVPA, and SEFF). Significance was set to p<.05. RESULTS: Only age was a significant predictor of GDS in model 1. In model 2, only SEFF was a significant predictor of GDS (β = −0.34, p<0.01). Neither age nor MVPA were significant predictors of SWLS in Models 1 and 2. SEFF was a significant predictor of SWLS in model 2 (β = −0.33, p<0.05). CONCLUSIONS: These preliminary data show that exercise self-efficacy is a stronger predictor of depressive symptoms and satisfaction with life compared to age and MVPA in older adults.
individual's motivation. Future studies should look at how these motivational factors impact adherence based on the workout frequency, age of the participants, and number of years training.

2056 Board #69  June 1 2:00 PM - 3:30 PM  Correlates of Chinese College Student's Physical Activity Behavior: A Social Ecological Model Perspective Meinong huang1, Haichun Sun1. China University of Mining and Technology, xuzhou, China. 2University of South Florida, Tampa, FL. (Sponsor: Zan Gao, FACSM) Email: 411462089@qq.com

Purpose: A recent report indicated that the number of Chinese college students reached 37 million in 2015, representing the world’s largest college student population. Despite the well-known health benefits of regular physical activity (PA) participation, Chinese college students are less likely to engage in PA as compared to their counterparts in Western countries. Understanding the factors that relate to Chinese college students’ PA would provide valuable insights for future PA interventions. Guided by the Social Ecological Model, this study examined the associations among personal, social, and environmental correlates of PA participation among Chinese college students. Methods: Chinese college students (N = 741) were recruited from East region of China. Demographic information was collected, and PA and Social Ecological Model-based correlates (values, efficacy, social support, media and social media, weather, and facilities) were measured via a previously validated questionnaire for Chinese college students. Multiple regression analysis was conducted using gender and social ecological factors as independent variables and PA as the dependent variable. Results: Regression analysis suggested that gender was a significant predictor (β = .17, p < .01) with male students being more physically active. For the social ecological factors (β = .071, p = .03), efficacy (β = .40, p < .01), social support (β = .20, p < .01), and weather (β = −.18, p < .01) emerged as significant predictors; while media and social media (β = .057, p = .083) and facilities (β = −.003, p = .913) were not found to be significant predictors for college students’ PA. The model accounted for 42.6% of the variances in college students PA participation. Conclusion: Strategies and interventions are needed to promote female college students’ PA. Programs that specifically designed to develop or enhance college students’ efficacies and values toward PA and to encourage social interaction among peers might be helpful for PA participation.

While post exercise enjoyment and affective responses to aerobic exercise are fairly well documented, only recently have they been investigated within high-intensity interval exercise protocols. Further, little is known regarding how exercisers compare to non-exercisers with respect to enjoyment following high-intensity interval exercise (HIIE). PURPOSE: With respect to individual exercise history, evaluate affect during and enjoyment post; (a) continuous moderate intensity aerobic exercise (MIA); (b) high-intensity interval exercise (HIIE); and (c) a sedentary activity control condition (SED). METHODS: Participants (N = 269; 156 ♀; 20.60 ± 1.20 yrs, M♂/SD) were divided into “regular exercisers” (n = 194; 102 ♂) and “non-exercisers” (n = 75; 53 ♂) based on self-reported exercise history. All participants completed each of the randomly ordered 15-min conditions: MIA (walking), SED (quiet reading), and HIIE (2 min activity, 1 min recovery). Enjoyment (Physical Activity Enjoyment Scale) was measured post condition; affective valence (Feeling Scale; FS) was assessed pre and every 3 min during each condition. RESULTS: Regular exercisers reported greater enjoyment following HIIE [Mdiff ± SE = 10.40 ± 2.60, P < .001] and reported more positively valenced affect during HIIE [Mdiff ± SE = 0.96 ± 0.26, P < .001] relative to non-exercisers. Additionally, regular exercisers enjoyed HIIE more than the MIA condition [Mdiff ± SE = 6.12 ± 1.46, P < .001], while non-exercisers showed no difference in enjoyment between the two active conditions [Mdiff ± SE = 3.43 ± 2.35, P = .15] no differences were observed in enjoyment post or affect during the MIA condition between regular and non-exercisers. CONCLUSION: This believed to be the first study comparing regular exercisers to non-exercisers with respect to enjoyment and affective responses to HIIE. These findings both extend previous research by adding to the limited work on affective responses to HIIE and highlight the importance of exercise experience with respect to HIIE. In order to maximize exercise enjoyment and affective responses, especially when prescribing exercise, more attention needs to be given to exercise history.

2059 Board #70  June 1 2:00 PM - 3:30 PM  Does Experience Matter? Enjoyment Of High Intensity Interval Exercise With Respect To Exercise History Daniel R. Greene, Steven J. Petruzzello, FACSM. University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Steven J. Petruzzello, FACSM) Email: dgreene2@illinois.edu

INTRODUCTION: Self-determination theory (SDT; Deci & Ryan, 1985) is a prominent theoretical framework applied to assess exercise participation (Kirkland et al., 2011). SDT holds that satisfying the three basic psychological needs (BPNs: autonomy, competence, and relatedness) fosters self-determined motivation, personal growth, and psychosocial well-being (Deci & Ryan, 1985). Relations between BPNs and exercise participation may vary between sexes (Martinez et al., 2013). Given that exercise participation is highly related to health-related fitness (Blair et al., 2001) investigating whether the relations between BPNs and fitness outcomes also vary between sexes is warranted. PURPOSE: To investigate the relations between BSNs and fitness outcomes in male and female college students. METHODS: Participants were 564 male and 503 female college students (M_Ages = 20.57 ± 3.82 years) enrolled in a health and wellness course. Students completed a survey assessing the BPNs (Vlachopoulos & Michailidou, 2006), as well as the FITNESSGRAM® test battery (Cooper Institute, 2013), which includes measures of cardiorespiratory fitness (Progressive Aerobic Cardiovascular Endurance Run [PACER]), muscular strength and endurance (curl-up and push-up), and body composition (body fat %). Correlation analyses were conducted by sex to examine bivariate relationships between BPN and fitness outcomes. RESULTS: Analyses revealed that BPNs were significantly correlated with each fitness outcome (p ≤ .05). Correlation magnitudes were not statistically different between males and females based on Fisher’s r tests (p > .05). In both genders, competence had significantly higher correlations with the fitness outcomes (excluding PACER) when compared to relatedness (p < .05), but did not significantly differ from autonomy (p > .05). CONCLUSION: Results indicated that autonomy is related to components of physical fitness in men and women enrolled in a health and wellness course. Interestingly, competence had the strongest relationships with fitness outcomes. Based on this study and previous research, fitness instructors may want to promote competence by providing social support and constructive individualized feedback, believing in participants’ abilities, acknowledging their improvements and successful experiences.
Obesity in the United States is significantly higher than it was in the previous generation. West Virginia’s obesity rate currently exceeds 30% of its population. Previous literature has demonstrated an inverse relationship between BMI (body mass index) and health-related quality of life, however these associations rarely include college-aged adults. PURPOSE: To examine the relationship between BMI and health related quality of life in college aged freshman enrolled in the HERD (Higher Education Reducing Diabetes) Study at Marshall University in Huntington, West Virginia. METHODS: The HERD Study is a 4 year longitudinal, randomized study examining the effects of a freshman year, healthy lifestyle intervention on the reduction of student’s risk factors for developing type 2 diabetes and cardiometabolic disease. Freshmen were recruited during the Fall 2016 Freshman Week of Welcome at Marshall University. Quality of Life was assessed at baseline using the Short Form-12 Questionnaire. The SF-12 is a 12 item, validated survey assessing participant’s physical and mental quality of life. RESULTS: To date, 76 freshman have enrolled into the HERD study (age= 18.5±2.36 years; female=60.5% (n=46); 85.5% Caucasian (n=65); BMI= 26.5±5.85 kg/m². Fifty-three percent (n=40) of the students were deemed overweight or obese (BMI ≥ 25 kg/m²). Students with a BMI ≥ 25 kg/m² were significantly less likely to record their health as very good or excellent compared to those with a BMI < 25 kg/m² (p=0.002). Students with a BMI ≥ 25 kg/m² were more likely to record that their health (physical and emotional) interfered with social activities (p=0.004). Also, students with a BMI ≥ 25 were more likely to record that their physical (p=0.001) and emotional (p=0.007) health quality, with higher BMI contributing to reduced health quality, and emotional) interfered with social activities (p=0.004). CONCLUSIONS: The results indicated that college-aged freshman appears to have an impact on health related quality of life with higher BMI contributing to reduced health quality, productivity and social factors. Future efforts will examine strategies for decreasing BMI to improve the physical and mental health of young adults.

Physical activity (PA) can have benefits for individuals at each stage of the cancer journey, including improved fitness and quality of life. However, many cancer survivors are not meeting the physical activity recommendations. PURPOSE: The aim of this study was to explore cancer survivors’ experiences of PA across the cancer journey. METHODS: Participants were recruited from a cancer support centre and a community-based exercise programme that caters for cancer survivors. To ensure that a variety of opinions and experiences of PA across the cancer journey were captured, purposive sampling methods were used to recruit male and female cancer survivors of all ages who were either currently active or inactive. The focus group discussions were transcribed verbatim and were analysed using a thematic analysis approach. RESULTS: 7 focus groups were conducted with 41 cancer survivors. Each group consisted of 4-8 participants. Most cancer survivors reported a decrease in their PA levels during treatment which was commonly attributed to treatment-related side effects. Participants reported that a period of isolation and a decrease in wellbeing can be experienced after treatment completion. Participants identified the lack of PA advice and services throughout the cancer journey and the need for a holistic approach to rehabilitation. Many viewed exercise as a vehicle for recovery as it facilitates ‘self-power’ - taking ownership and control of one’s PA to increase wellbeing. Some participants reported that engagement in PA after treatment was empowering and that it increased their self-confidence and belief in their physical capabilities. Other participants reported that PA was difficult to initiate and maintain for a number of reasons, including the negative impact of treatment-related side effects on the physical ability to be active. Individuals reported that exercising with other cancer survivors created an accepting and supportive environment for exercise. CONCLUSIONS: These findings suggest that there is a gap in the cancer care pathway post-treatment completion. An exercise rehabilitation programme at this time could support cancer survivors to increase their physical and psychological well-being.

Beetroot juice supplementation is known to improve endurance performance in untrained and moderately trained subjects. In well-trained subjects beneficial effects of supplementation are questionable in normoxia but may be promising in hypoxia. Therefore, effects on maximal and submaximal performance during normoxia and normobaric hypoxia should be further investigated. PURPOSE: To examine the effects of beetroot juice (BR) supplementation on cycling performance in well-trained cyclists during normoxia and normobaric hypoxia (15% O₂). METHODS: Five well-trained male cyclists (V̇O₂max, 69.1 ± 5.2 ml·min⁻¹; Ẇ̇C, 5.7 ± 0.3 W·kg⁻¹) completed four exercise trials. Subjects consumed 140 ml BR (equivalent to 12.4 mmol nitrate) or placebo (PLA) (nitrate-depleted BR) for seven days in a double-blind, randomized crossover design. On day four and seven, subjects completed 3x6-min submaximal cycling at 70% lactate threshold and a 10-km time trial (TT) in either normoxia or hypoxia. Inspiratory conditions were randomized and single blinded. RESULTS: BR did not affect TT performance in either hypoxia (BR: 253.8 ± 35.6; PLA: 252.8 ± 32.3 Watt; P=0.65) or normoxia (BR: 296.8 ± 45.4; PLA: 297.4 ± 44.8 Watt; P=0.83). However, average power output during the TT was higher in normoxia than in hypoxia (297.1 ± 45.4 vs. 253.3 ± 33.9 Watt; P=0.003). Average oxygen uptake during the TT was higher in normoxia than hypoxia (441.4 ± 46.2 vs. 395.9 ± 368.7 ml·min⁻¹; P=0.008). Similarly, peak oxygen uptake during the TT was higher in normoxia than hypoxia (488.3 ± 34.9 vs. 420.4 ± 395.3 ml·min⁻¹; P=0.003). EX1 and EX2 were separated by an assigned in the morning. METHODS: To examine the effects of a single night of sleep restriction following exercise (EX1) and next-morning (EX2) exercise session. EX1 and EX2 were separated by an assigned in the morning. RESULTS: To examine recovery from EX1, and included all baseline measures. Magnitude-based inferences were used to assess recovery from EX1, and included all baseline measures. Magnitude-based inferences were used to evaluate the effects of sleep condition on these measures. RESULTS: SLP− had a ‘very likely’ negative impact (96% likelihood) on the change in 3-km TT performance compared to SLP+. Specifically, 3-km TT performance was ‘very likely’ (99% LH) slower during EX1 compared to EX1 following SLP+ (4.0%), whereas TT performance was ‘possibly’ (54% LH) slower during EX2 vs. EX1. This indicates that sleep loss can negatively impact next-morning performance. SLP− negatively impacted next-morning performance in the normobaric hypoxia condition (54% LH) compared to SLP+. This suggests that hypoxia can exacerbate the negative impact of sleep loss on physical performance.
following SLP+ - Sleep condition did not influence the change in peak torque, as peak torque during EX2 was ‘likely’ lower than EX1 with both SLP+ (89% LH) and SLP− (80% LH). Likewise, sleep condition did not impact the change in muscle soreness, as muscle soreness ‘very likely’ increased from EX1 to EX2 with both SLP+ (97% LH) and SLP− (99% LH). CONCLUSION: A single night of sleep restriction following heavy exercise had marked consequences on 3-km TT performance the next morning. Strategies to ameliorate the consequences that sleep loss have on performance should be investigated.

**RESULTS**: HIIT schemes using 60 and 80% $W'$ and the finite capacity for work > 2 mmol/L increase in BLC. Next, the $\text{sMLSS}$ workload, determined previously, then increasing 10W every 15 minutes for a total of three stages. BLC was measured every 3 minutes. MLSs was predicted by visual inspection and defined as < 1.0 mmol/L increase in BLC in the final 6 minutes of the stage. Finally, cyclists then performed two to six MLSS exercise tests, adjusting by 5W depending on lactate response, to validate the $\text{sMLSS}$. MLSs was determined at the maximal workload with < 1 mmol/L increase in BLC in the final 20 minutes. Independent t-test and Pearson correlation analysis was used to determine reliability between lactate trials. Bland-Altman plots, One-way ANOVA, and regression analyses were used to analyze differences between the types of exercise tests. RESULTS: There were no significant differences for duplicate BLC trials for all tests ($p=0.21$; $r=0.982$). Ninety-five percent confidence intervals for the $\text{MLSS}$ and MLSs were significantly correlated with the MLSS workload and percentage of max workload ($r = 0.997; p<0.001$, $r = 0.978; p<0.01$, respectively). There was no bias noted between $\text{MLSS}$ and MLSs protocols for predicting lactate accumulation. CONCLUSION: In conclusion, the $\text{sMLSS}$ was a valid and reliable predictor of MLSs in trained cyclists.

**PURPOSE**: We investigated the validity of interval prescriptions derived using $\text{CP}$ and $W'$ measures acquired from a 3-min all-out exercise test (3 MT). METHODS: Eight competitive cyclists completed a 3 MT, verification bout for determining peak oxygen uptake (VO$_{2\text{peak}}$), and subsequent HIIT bouts, noted numerically using the number of bouts by duration and %W depletion riding on a cycle affixed to a Computrainer. Using expired gas exchange data, VO$_{2\text{peak}}$ values from a verification bout were significantly correlated with and explained $\%CP$ values of HIIT schemes using 60 and 80% W' depletion for 180 and 300 s for each condition. The HIIT schemes were counterbalanced to avoid an order-effect. RESULTS: VO$_{2\text{peak}}$ (ml/kg min$^{-1}$) values from the verification bout (58.7 ± 6.9), 4 X 180 s 60% W’ scheme (57.4 ± 8.2), 3 X 180 s 80% W ’ scheme (58.3 ± 5.7), 4 X 300 s 60% W’ scheme (54.3 ± 8.0), and the 3 X 300 s 80% W’ scheme (53.7 ± 7.4) did not differ (F = 2.10, p = 0.25). Strong measurement agreement was observed for VO$_{2\text{peak}}$ between measures (ICC = 0.85, typical error = 2.37 ml/kg min$^{-1}$, coefficient of variation = 4.6%). CONCLUSION: The 60% and 80% W’ HIIT schemes for either 180 or 300 s durations evoked VO$_{2\text{peak}}$, providing empirical support for the CP concept to standardize HIIT.
CONCLUSION: Though the stamina sensor device is not a direct replacement of laboratory testing to measure performance, the stamina sensor does appear to accurately represent the subjective output (RPE) of the individual athlete.

The impact of cycling cadence on oxygen consumption has not been studied in detail but previous reports describe increased oxygen consumption at higher rates of muscle contraction, even when external work is similar. The majority of studies were performed during incremental exercise to exhaustion and there is little data on sub-maximal responses. One of the challenges is to determine the relative intensity to compare different cycling cadences during submax exercise as p%VO2peak will be influenced by the cadence during VO2peak testing. PURPOSE: The purpose of this study was to determine if peak power output (PPO) could be used to compare the metabolic responses during sub maximal exercise at different cycling rates.

METHODS: Eleven young (21±1 yr) recreationally active males completed a continuous incremental exercise test to exhaustion (VO2peak) on an electrically braked cycle ergometer at 65rpm and 95rpm. The power output corresponding to 55% PPO was calculated for each cycling cadence and, on two further occasions, participants cycled for 1-hr at 65-rpm and 95-rpm. Indirect calorimetry was used to monitor a number of metabolic variables during exercise. In addition, heart rate and blood lactate was measured during all trials. RESULTS: At VO2peak, oxygen consumption (3182±230 vs 3348±318 ml/min, p=0.002), total ventilation, respiratory rate, heart rate and lactate were all significantly greater following the 95-rpm trial (p<0.05). There were no significant differences in peak power output or ventilatory threshold between trials. During sub-maximal exercise, VO2 (2012±194 vs 2371±218 ml/min, p=0.001) and all other parameters were significantly greater at 95-rpm (p<0.05).

CONCLUSIONS: As PPO does not change during maximal exercise it can be used to control external work and compare the metabolic responses while cycling at different cadences. The mechanisms underlying the increased metabolic demand at higher rates of muscle contraction need further examination.

Various strategies designed to promote physical activity participation and enjoyment have been researched, but few studies have focused on exercising while playing video games. PURPOSE: To investigate whether playing a video game, or watching music videos while working out on an exercise cycle increases exercise enjoyment, decreases perceived exertion, and increases work output. METHODS: Using a randomized order within-subjects experimental design, college-aged males (n=24) participated in three conditions: cycling while playing an Xbox® 360 video game console (VG), cycling while watching music videos (MV), and cycling with no external media (NM). Dependent measures were exercise enjoyment (PACES), perceived exertion (RPE), heart rate (HR), and total work output (kJ). Data were analyzed using paired t-tests with Holm’s Sequential Bonferroni adjustments (SPSS v21). RESULTS: VG and MV PACES scores were statistically similar, but both were significantly higher than NM (MV: M=3.33, SD = .85, VG: M=4.31, SD = .44, p = .001, d = 1.14, MV: M=4.32, SD = .56, p = .001, d = 1.15). RPE was significantly lower in the VG condition (M = 13.21, SD = 1.56) than both the MV (M=14.46, SD = 1.71, p < .005, d = .73) and NM conditions (M =14.25, SD = 1.62, p < .001, d = .64). A significantly higher total work output (in kJ) was observed in the MV condition over the VG condition and NM over the VG condition (VG: M = 1113.12, SD = 29.21; MV: M = 1281.11, SD = 30.17, p = .001, d = 1.51 and VG: M = 1132.12, SD = 29.21; NM: M = 122.75, SD = 33.30, p < .005, d = 3.31). There were no statistically significant differences in HR between the three conditions. CONCLUSION: While there were moderate statistical differences in work output and RPE, the practical significance of these results may be most related to the large effect on exercise enjoyment in the VG and MV conditions compared to NM. With less than half of the US adult population currently meeting the 2008 updated Physical Activity Guidelines, an intervention that can make an exercise modality significantly more enjoyable may have important potential public health benefits via improved physical activity participation levels. Future research might investigate if these laboratory-based results can translate into improved volitional physical activity levels in free living adults.

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Time Deception Affects Performance But Not Metabolic Variables In Cyclists

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PURPOSE: Previous investigations have found that various types of deception (e.g., unknown task endpoint) could alter perception and consequently affect performance. We investigated whether time deception influenced performance and metabolic variables in cyclists.

METHODS: Ten semi-professional male cyclists (age 36±5 years; height 173±6 cm; weight 76.7±265 kg; with 2 years of experience) completed three 60 min cycling time trials (roller trainer) after 2 familiarization sessions. Visual feedback of elapsed time was provided, but the chronometer was manipulated to display either real (NOR), 10% slower(SLO) or 10% faster time lapse (RAP). Total distance covered and heart rate (HR) were recorded at each 10 min interval.

RESULTS: Distance completed at any 10 min time point was similar between conditions, but total distance covered over the 60 min differed among conditions (NOR = 20.7±4.1; SLO = 25.7±7.1; RAP = 23.7±5.2 Km) (p < 0.05). Post-hoc analyses indicated that both RAP (p = 0.001) and SLO (p = 0.027) covered a greater total distance than NOR, with no difference in distance covered between SLO and RAP (p=0.458). RPE (NOR = 17.3; SLO = 16.4; RAP = 18.1) and HR (NOR = 171±12; SLO = 172±17; RAP = 180±12bpm) were similar (p = 0.145) among conditions. Blood glucose increased during the time trial for all conditions, however increases in blood glucose (NOR = 7.4±10.7; SLO = 5.2±8.6; RAP = 6.8±13.3 mg/dl) were similar among all conditions. Serum creatinine, serum urea and serum urate were stable and did not differ among conditions.

CONCLUSION: These results indicate that deception (±10%) consisting of either a slower or more rapid perception of elapsed time can increase performance in a time trial, but does not affect RPE nor the measured metabolic variables in semi-professional cyclists.

The Effect Of Acute Versus Accumulated Soccer Training On Postprandial Dysmetabolism

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PURPOSE: The aim of the present study was to examine the effects of acute versus accumulated soccer match play on postprandial dysmetabolism in recreational players.

METHODS: Fifteen participants were recruited and preliminary data was collected for body composition and cardiorespiratory fitness. There was no significant difference between the groups at baseline and the groups did not differ in their pre intervention triglyceride (TG) incremental area under the curve (AUC) response to the fat load meal. On day 1, pre intervention (control(C)) blood samples were collected at 0 (fasted) and 0.75, 2, 4, 6hrs post a high fat load. Participants were randomly allocated to an experimental group (soccer (S)) of 1xpw or 3xpw small sided games training over a week period. The final session for the 3xpw was on the same day as the 1xpw training. Participants returned the next day, after completing the S, to the laboratory for post intervention blood samples. Repeated measures ANCOVA was used to compare differences and iAUC/AUC, confidence intervals (CI) and effect sizes (ES) were calculated. RESULTS: TG iAUC was significantly lower in the 1xpw compared to the 3xpw post meal (35.5 ± 6.3) compared to 35.4 ± 6.3 (p<0.05).

CONCLUSION: Playing soccer can improve the PP TG response compared to no exercise but 3 consecutive days will not attenuate the response more than 1 session per week.

Iron Deficiency And Physical Performance In Elite Female Soccer Players

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Introduction: Iron deficiency is a prevalent condition among athletes especially in women. Iron is a key element for biological functions including oxygen carrying and oxidative phosphorylation among others. This has led to the idea that its deficit may impact physical performance. In Chile approximately 5% women have Anemia and over 10% may have iron deficiency without anemia. There is ongoing research about this subject but none of it has been conducted on Chilean female athletes. PURPOSE: To determine the prevalence of iron deficiency with and without anemia in Chilean elite female soccer players and to evaluate if there is an association between iron deficiency and VO2 max or anaerobic power and fatigability. Subjects and methods: Twenty five female athletes from the Chilean National Soccer team where included in this study. After informed consent, blood samples to determine Hemoglobin and Ferritin levels were taken from them. They participated in a clinical evaluation, ergo spirometry to determine VO2 max, and RAST test for anaerobic capacity and fatigability. Data were analyzed with Pearson correlation, ANOVA, and Kruskal-Wallis tests. Results: No cases of anemia were detected. Among these athletes, 25% had Ferritin levels over 50 mcg/ml and 28% under 15 mcg/ml. No correlation or association was found between hematological variables and VO2max, maximal anaerobic capacity or fatigue index. Conclusion: The prevalence of iron deficiency was high in Chilean female elite soccer players as compared to the Chilean female population, and most participants of this study had ferritin levels that would prompt supplementation in our center. In this group we found no impact of iron deficiency or ferritin levels in physical performance. This results may have been influenced by different training levels of the participants prior to participating on this study. More research is needed in this area to determine the influence of iron in performance in female athletes.

Regulatory Fit: Impact On Anxiety, Arousal, And Performance In College-level Soccer Players

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PURPOSE: The aim of the present study was to examine the regulatory fit (RF) effect on anxiety, arousal, and performance of college soccer players. METHODS: Twenty-five female soccer players were randomly assigned to a regulatory match (M) or mismatch (MM) condition. Participants received a task framing phrase in which their performance goal either matched (M) or mismatched (MM) their chronic regulatory state. Arousal and anxiety variables were determined by ANOVA and RM ANOV A, was measured post-manipulation. The impact of regulatory fit on performance and on anxiety and arousal variables were determined by ANOVA and RM ANOV A, respectively. RESULTS: There was no difference between M (3.0 ± 0.5) and MM (2.5 ± 1.8) on performance (p>0.05). Pre (32.6 ± 4.8) to post (34.5 ± 5.4) CSAI-2R for M was not different than MM pre (35.0 ± 4.6) to post (35.4 ± 6.3) (p>0.05). Arousal variables in HF, HR, and In RMSDD in M were not significantly different pre (6.2 ± .99, 76.4 ± 15.0 bpm; 3.6 ± .54) to post (6.3 ± .99, 75.1 ± 17.5 bpm; 3.6 ± .53) compared to MM pre (6.6 ± 10.5, 75.3 ± 12.5; 3.8 ± .49) to post (6.9 ± 35.74; 6.10 ± 4.5; 4.0 ± .36), respectively (p>0.05). There was an interaction effect for PEP (p>0.05). Post-hoc testing indicated M post (0.14 ± 0.01 msec) was greater than pre (0.13 ± 0.01 msec) (p<0.05) but MM did not change post (0.15 ± 0.02 msec) to post (0.15 ± 0.02 msec) (p>0.05). CONCLUSION: PEP is an indicator of the sympathetic nervous system (SNS), thus regulatory fit may impact pre-performance arousal through SNS activation. Supported by a Hollis Grant, ASPiRE program, Ball State University.
Athletes’ performance may improve by increasing their sleep duration. This would typically be achieved by increasing time in bed at night, but this may not always be possible. One potential solution is to nap during the day, however the time taken to reach optimal performance after waking from a nap is not known. PURPOSE: To examine readiness to perform, sprint ability, and reaction time following a 2-hour nap in soccer players.

Georgia Romy1, Michele Lastella1, Nathan G. Versey2, Gregory Roach1, Charli Sargent1. 1Central Queensland University, Australia. 2Australian Institute of Sport, Bruce, Australia.

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Non-invasive and measureable techniques to identify training distress may be useful to adjust training volume. Traditionally, questionnaire data examining psychological domains have been relied on to detect training distress. Methods: To examine readiness to perform, sprint ability, and reaction time following a 2-hour nap in college soccer players. METHODS: 14 college soccer players participated in blood draws prior to the start of the season and at 3-month intervals throughout the season. Blood biomarkers included testosterone, free testosterone, total testosterone, total cortisol, free cortisol, total cortisol, growth hormone (GH), and IGF-1. Blood was collected at 8:60 AM (W4) and 10:00 AM (W12) prior to training and 4.00 PM (W1 and W2) following training. The athletes arrived fasted in the morning. T2 and T3 draws occurred ~18 h after a game. Creatine kinase (CK), free cortisol (FC), total cortisol (TC), iron (Fe), growth hormone (GH), and IGF-1 were assessed by separate repeated ANOVAs.

RESULTS: There were no significant changes in TC over time. Total testosterone (T, mean±SD; ng∙dL

2079 Board #92 June 1 3:30 PM - 5:00 PM Biomarkers of Endocrine, Muscle, and Inflammatory Health Track Training Load of a Collegiate Soccer Season

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Blood biomarkers signal health and performance concerns in athletes. However, serial comprehensive biomarker assessment to determine overtraining in elite soccer athletes remains understudied. PURPOSE: To determine if comprehensive biomarker assessment of endocrine, muscle, and inflammatory health change with training progression in collegiate soccer players. METHODS: A comprehensive panel of 14 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean±SD; height 181±6 cm, weight 77.9±6.2 kg, BMI 19.1±2.4 kg/m

2078 Board #91 June 1 3:30 PM - 5:00 PM Workload, Energy Expenditure, and Biomarker Differences in Division I Male and Female Soccer Players


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Differential physical demands and physiological responses between males and females in the same sport have rarely been explored. PURPOSE: To compare work load and biomarker changes in male and female Division I college soccer players through preseason and the first half of the competitive season. METHODS: Male (N=24; M

2076 Board #89 June 1 3:30 PM - 5:00 PM Readiness To Perform, Sprint Ability, And Reaction Time Following A 2-hour Nap In Soccer Players.

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To determine if comprehensive biomarker assessment of endocrine, muscle, and inflammatory health change with training progression in collegiate soccer players. METHODS: A comprehensive panel of 14 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean±SD; height 181±6 cm, weight 77.9±6.2 kg, BMI 19.1±2.4 kg/m

2077 Board #90 June 1 3:30 PM - 5:00 PM Physiological Variables to Detect Training Distress in Collegiate Soccer Players


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Non-invasive and measureable techniques to identify training distress may be useful to adjust training volume. Traditionally, questionnaire data examining psychological domains have been relied on to detect training distress. PURPOSE: To examine readiness to perform, sprint ability, and reaction time following a 2-hour nap in soccer players. METHODS: 12 soccer players (18.3±1.0 yrs) completed two conditions in a randomised order. In one condition, participants had 9 hours in bed (22:00-07:00h) without waking the next day and in the other condition, participants had 7 hours in bed (00:00-07:00h) with a 2-h nap the next day (14:00-16:00h). Sleep was assessed using polysomnography. Each day, participants completed four 30-min test sessions (every 30 min starting at 16:15h) that included a visual analogue scale for readiness to perform, a 7-min warm up, two 10-m sprints, and a 90-s reaction time task. Total sleep time was compared between conditions using a paired t-test. The effect of condition (no nap vs. nap) and test session (30, 60, 90, 120 min) on readiness to perform, fastest 10-m sprint, and mean reaction time were assessed by separate repeated ANOVAs. RESULTS: Total sleep time was similar between conditions (no nap 8.1±0.7 h vs. nap 8.0±1.0 h, p=0.87). There were main effects of condition (p=0.01) and test session (p=0.05) on readiness to perform, but no interaction between condition and session (p=0.09). Readiness to perform was lower in the no nap condition (68.2±20.1) vs. the no nap condition (82.4±15.4), and at 30 min (68.0±20.8) vs. both 60 min (80.0±15.3, p=0.01) and 90 min (77.8±17.9, p=0.03). There was a main effect of test session (p=0.02) on reaction time, but no effect of condition (p=0.84) and no interaction between condition and session (p=0.26). Reaction time was faster at 120 min (211.3±20.0 ms) vs. 30 min (77.8±17.9, p=0.03). There was a main effect of condition (p<0.01) and test session (p<0.05) on readiness to perform, fastest 10-m sprint, and mean reaction time were assessed by separate repeated ANOVAs. There were main effects of condition (p<0.01) and test session (p<0.05) on readiness to perform, fastest 10-m sprint, and mean reaction time were assessed by separate repeated ANOVAs. There were main effects of condition (p<0.01) and test session (p<0.05) on readiness to perform, fastest 10-m sprint, and mean reaction time were assessed by separate repeated ANOVAs.
Monitoring of nutritional markers is being used to optimize performance, improve overall health, and enhance recovery of athletes. PURPOSE: To analyze changes in nutritional biomarkers over the course of an athletic season. METHODS: A comprehensive panel of 23 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean±SD; height: 181±6 cm, body mass: 77.9±6.2 kg, VO2max: 52.9±6.1 mL×kg⁻¹×min⁻¹) at 5 time points: prior to the start of preseason (PS), and during season at week 1 (W1), W4, and W12 of the season. Blood samples from W1-W12 were obtained 32-34 hours post-match. Significant changes in biomarkers over time were assessed via 1 x 5 (group x time) repeated measures ANOVA (α<0.05) with Bonferroni correction. RESULTS: CONCLUSION: Comprehensive nutritional, vitamin, and mineral monitoring detected significant changes over the season in 60% of biomarkers obtained. Although all markers remained within normal reference ranges, future research examining the ability of clinical but not statistically significant changes in these nutritional biomarkers to explain changes in training volume throughout a competitive soccer season is warranted. Optimization may result in improved health, performance, and recovery.

Funding for this study in part by Quest Diagnostics Inc.

2081 Board #94 June 1 3:30 PM - 5:00 PM Inspiratory Power is Significantly Related to Isokinetic Knee Power in Collegiate Women Soccer Players Lawrence P. Cahalin, Nicholas H. Dible, Tiffany J. Kasa, Robert O. Poliszuk, Lawrence P. Cahalin.

PURPOSE: To examine the relationship of the PSM and IM in Division 1 collegiate women soccer players (DICWSP). METHODS: Thirteen DICWSP underwent maximal tests of EXT and FLEX at 60, 180, and 300 deg/sec as well as an endurance (ENDUR) test of repeated EXT and FLEX at 180 and 300 deg/sec. TIRE testing provided maximal inspiratory pressure (MIP), measured from residual volume (RV), and sustained maximal inspiratory pressure (SMIP), measured from RV to total lung capacity. RESULTS: The mean±SD age, height, and weight of the DICWSP was 19.5±1.0 years, 172.5±5 cm, and 63.5±5 kg, respectively. The mean±SD peak torque of EXT and FLEX at 60, 180, and 300 deg/sec were 155±17 and 75±13, 85±9 and 55±10, and 65±8 and 47±10 lbs, respectively. The mean±SD power of EXT and FLEX at 60, 180, and 300 deg/sec were 99±13 and 65±11, 175±18 and 114±26, and 170±27 and 113±34 watts, respectively. The mean±SD slope of ID ENDUR for EXT and FLEX at 180 and 300 deg/sec were -12.7 and -8.7 and -16.5 and -11.9, respectively. The mean±SD MIP and SMIP were 88±23 cm H2O and 420±132 PTU, respectively. Significant negative correlations were observed between MIP and slope of ID ENDUR for EXT at 180 and 300 deg/sec (r=-.61 and -58, respectively; p<0.05). Significant positive correlations were observed between SMIP and peak torque of EXT and FLEX at 60 deg/sec (r=.51 and 55, respectively; p<0.05) and SMIP was significantly correlated in a positive direction to mean power of EXT and FLEX at 180 and 300 deg/sec (r=.59 and .70 and r=.71 and .68; p<0.05, respectively). CONCLUSIONS: The significant positive relationships of SMIP to knee EXT and FLEX power at 180 and 300 deg/sec highlights the role that greater IMP appears to have in the development of greater power for both knee EXT and FLEX. SST appear to elicit similar adaptations in the PSM and IM highlighting the specificity of exercise especially as it relates to soccer.

2082 Board #95 June 1 3:30 PM - 5:00 PM Starters and Non-Starters Require Separate Load Monitoring and Analyses Throughout a Collegiate Soccer Season Ryan M. Curtis, Robert A. Huggins, William M. Adams, Abigail C. Colburn, Garrett J. Fontaine, Andrea R. Fortunati, David P. Looney, Chris A. West, Douglas J. Casa, FACSM. University of Connecticut, Storrs, CT.

PURPOSE: To compare differences in measures of load between starters (S) and non-starters (NS) throughout a collegiate soccer season. METHODS: Twenty NCAA Division I male soccer players (mean±SD; age 20±1 yrs, height 181±6 cm, body mass 77.9±6.2 kg, BF% 11.9±2.4%, VO2max 52.9±6.1 mL×kg⁻¹×min⁻¹) were monitored over specific intervals aligning with major time periods throughout the season: preseason to week 1 (PS-W1), W1-W4, W4-W8 and W8-W12. Mean session time (ST), PlayerLoad (PL), distance (DST), max velocity (Velmax), velocity load (VL), heart rate (HR), time spent >95%HR (HR>95%), and sprint efforts (SPE) were recorded daily with GPS units. Players were placed into groups, S (n=10) and NS (n=10) based on total playing time in matches. A group x time repeated measures ANOVA with Tukey-HSD post hoc test was used to assess differences between S and NS (α=0.05). RESULTS: Significant group by time interactions were found for ST (F3,27=5.398, p=0.005), DST (F3,27=4.607, p=0.010), and SPE (F3,27=7.137, p=0.001). Independent of group, ST was longer during PS-W1 (Mean±SE; 100±9.7min) than W1-4 (82.9±1.4min, p<0.001), W4-8 (81.8±1.0min, p<0.001), and W8-12 (76.5±1.3min, p<0.001). Furthermore, PLxmin⁻¹ was higher during W4-8 (7.19±0.27AU, p<0.001) and W8-12 (7.18±0.18AU, p<0.001) than PS-W1 (5.85±0.26AU). Velmax was lower in W4-8 (6.56±0.10m×s⁻¹) and W8-12 (5.90±0.20m×s⁻¹) than PS-W1 (7.06±0.12m×s⁻¹, p<0.001). HR was elevated W4-8 (145±24bpm) than PS-W1 (135±25bpm, p=0.004) and W8-12 (133±22bpm, p<0.001). CONCLUSIONS: Measures of load differed between various time intervals throughout the competitive soccer season, independent of match playing time, however significant differences between S and NS were present. These data suggest that load measures be analyzed separately for S and NS throughout the season due to influences of match play. This is particularly relevant when monitoring, periodizing, and prescribing training loads.
Anthropometry-based models are broadly used to indirectly estimate body fat and muscle masses. Bioelectrical impedance analysis is an advanced method for indirect measurement of the main components of body composition. PURPOSE: This study intended to evaluate agreement in assessing body fat and muscle masses in soccer players between an anthropometry-based model and the bioelectrical impedance analysis.

METHODS: Data from 46 male competitive soccer players were analyzed (Age = 25.6 ± 3.5 y, Body mass = 75.8 ± 6.7 kg, BMI = 24.9 ± 1.6 kg m^-2, mean ± SD). The anthropometry-based estimations of fat and muscle masses were obtained by means of the four-compartiment model of De Rose and Guarneres (1980) (DRG). This model was modified using the regression equation of Withers et al. (1987, cited by Norton, 1996) to estimate body density, and Siri formula (1961) to compute the percentage of body fat. Fat and muscle masses were also assessed by means of bioelectrical impedance analysis (BIA). The paired t-test was used to evaluate the differences between the two measurement techniques. The Bland-Altman approach was applied to estimate 95% limits of agreement. The statistical significance level was set at p<0.05.

RESULTS: Significant differences were observed in fat and muscle masses between DRG and BIA (respectively: 8.71 kg vs. 10.13 kg, p<0.001; and 36.80 kg vs. 37.85 kg, p<0.001). The 95% limits of agreement were from -5.13 kg to 2.29 kg for fat mass, and from -4.67 kg to 2.58 kg for muscle mass. On a percentage scale, the results were as follows: 11.36 % vs. 13.16 % (p<0.001) for fat mass, and 48.63 % vs. 50.04 % (p<0.001) for muscle mass; the 95% limits of agreement were, respectively, from -6.80 % to 3.20 %, and from -5.97 % to 3.16 %. The difference between methods revealed negligible to low sample correlations with the range of measurement for the two variables, both in absolute and percentage scales.

CONCLUSIONS: The anthropometry-based model on average underestimated the fat and muscle masses compared to BIA, in both cases in a quantity less than 1.5 kg (and less than 2 %). The bias between the methods had a harmful effect on the limits of agreement. Additional testing would be necessary to confirm these results.

In an effort to reduce soccer injury rates, the Fédération Internationale de Football Association (FIFA) developed the 11+ warm-up. Widespread uptake of this program has examined the relationship between them across the season, and their potential effect on post-season fitness measures. PURPOSE: The purpose of this study was to determine the relationship between physiological load and body composition across the season on the post-season performance of the Yo-Yo Intermittent Recovery Test 2 in Division I Female Soccer Athletes.

METHODS: Thirty female soccer athletes, age (19.4 ± 1. year) with preseason body fat percentage (22.7 ± 5.3%), participated in the Yo-Yo Intermittent Recovery Test 2 (YIYIR2) prior to their fall pre-season conditioning period. Body fat percentage was assessed pre and post-season using BodPod assessment. Zephyr Performance Systems were worn during home season games to quantify and record the athletes’ physiological load, which was averaged over the season (AVIPEL). Athletes completed a second YYIIR2 at the conclusion of their post-season play and the change in the distance covered on this assessment from pre to post-season was recorded (ChangeDist).

RESULTS: No differences were observed in YYIIR2 or body fat percentage between pre and post-season. However, AVIPEL was negatively correlated with pre to post-season change in distance covered (ChangeDist), r = -0.489, p = 0.040. Linear regression analysis also revealed ChangeDist was inversely related to AVIPEL (β = -0.448, p = 0.048). When adjusted for age and pre to post-season change in body fat percentage (ChangeBF), AVIPEL remained inversely related to ChangeDist (β = -0.446, p = 0.048).

CONCLUSIONS: Athletes with higher average physiological load across the season exhibited a decrease in performance on the post-season Yo-Yo Intermittent Recovery Test 2 when compared to pre-season, regardless of change in body fat percentage.
Further research should be done to determine whether these results are due to a true decline in fitness levels or a decline in motivation to perform on the post-season assessment.

**Background:** Due to the high metabolic and physical demands involved in soccer, an optimal strength and conditioning program for female high school soccer players is essential. The benefits of resistance training and high-intensity interval training in young athletes has been well documented; however, the effect of a concurrent strength and metabolic conditioning program on female athletes in specific sports has yet to be investigated. **Purpose:** To examine the effects of an 8-week concurrent strength and metabolic conditioning program on body composition, flexibility, speed, agility, anaerobic capacity, strength, and power in female soccer players. **Methods:** Body composition and performance testing measures were recorded in female soccer players (n = 14, age = 16 ± 1.0 years) before and after an 8-week sports performance camp that combined concurrent high-intensity interval training methods and periodized resistance training. Performance testing included 3-site skinfolds, sit and reach, pro agility test, 40yd sprint, 300yd shuttle run, and vertical jump. Strength testing included a 5-repetition maximum back squat, shoulder press, and bench press, and a 3-repetition maximum pull down. Comparisons were made using a paired samples t-test, and Pearson’s correlations between variables were calculated. **Results:** Significant improvements were made in vertical jump (p < 0.05), pro agility test (p < 0.05), 40yd sprint (p < 0.05), squat (p < 0.05), shoulder press (p < 0.05), bench press (p < 0.05), and power clean (p = 0.05). There were significant correlations between increases in power with agility and speed, as well as correlations between power and strength. **Conclusion:** An 8-week concurrent strength and conditioning program was effective for improving measures of fitness and performance in female soccer players. Overall, power and strength increased, as well as a significant decrease in time to complete the agility and speed testing.

**Background:** Explosiveness of lower limbs is an important skill as to be a quality soccer player. A few studies have been performed to investigate explosiveness using male soccer players; however, it is not well studied in females, especially during their growth process and different jump types. **Purpose:** To compare explosiveness of lower limbs in three different age categories of national level female soccer players in three types of jumps. **Methods:** A total of 49 female national level soccer players of three age categories (U15 = players under 15 years N = 17, U17 = players under 17 years N = 16, U19 = players under 19 years N = 16) were tested using a two force platforms in three types of jumps: countermovement jump free arms (CMJFA), countermovement jump (CMJ), squat jump (SJ). The following parameters were evaluated: jump height (JH), maximum take-off force (Fmax) and force difference between preferred and non-preferred leg (Fdiff). All parameters were compared using MANOVA and Bonferroni post-hoc test. **Results:** Players achieved the following values: (U15: CMJFA = 32.58±3.25 cm, CMJ = 28.19±3.81 cm, SJ = 25.38±3.33 cm, U17: CMJFA = 34.26±4.22 cm, CMJ = 29.64±3.34 cm, SJ = 28.05±3.19 cm, U19: CMJFA = 37.20±5.80 cm, CMJ = 31.89±5.47 cm, SJ = 29.98±5.17 cm). Bonferroni’s post hoc test revealed significant differences in explosiveness between U15 and U17 as well as U15 and U19 (p < 0.05). The MANOVA analysis revealed a significant age effect on JH F(2,91) = 12.61, p < 0.01, η² = 0.16 and F(2,91) = 4.19, p < 0.05, η² = 0.06. Also, significant effect was detected by different type of jump on JH(F14,282 = 33.28; p < 0.01, η² = 0.33 and Fmax(F14,282 = 24.2; p < 0.01, η² = 0.26). We also found significant effect of jump types on Fmax (F14,282 = 6.49; p < 0.01, η² = 0.09). Players achieved significantly higher Fmax in CMJ = 9.59 ± 6.79 % compared to SJ = 5.56 ± 3.89 cm (p < 0.01). Thirteen players (26.5 %) had a Fmax greater than 10% during take-off. **Conclusion:** Explosiveness is different by ages in youth elite female soccer players. Jump types influence jump height and maximum take-off force as well as force difference between preferred and non-preferred leg. The study revealed significant differences Fmax with respect to the type of jump. More than 25% of female soccer players had Fmax greater than 10%.
It may be helpful for coaches and trainers to understand risk factors that predict training distress in collegiate athletes. Recognizing who is at risk can assist in the detection of early symptoms so that training adjustments can be made and overtraining avoided. Subjective measurements of subjects’ psychological state can be collected with simple questionnaires and are useful for determining training distress. PURPOSE: To utilize the Multicomponent Training Distress Scale (MTDS) questionnaire to examine athletes’ mood and physical states for determination of training distress risk. Gender, season duration, and grade in school were considered variables of interest for predicting training distress. METHODS: 17 male and 26 female collegiate soccer players were enrolled in the study. The MTDS was administered at four time points throughout the season (at the beginning, twice during the season, and once during post-season play). Questionnaires were given to all athletes at the end of their training sessions. Multivariate analyses were performed with the dependent variables of the MTDS across time, grade in school and gender. Only the composite MTDS score is reported in this abstract. RESULTS: The overall multivariate was significant (p<0.05); the main effects for gender, time, and year in school were also significant (p<0.05). Overall, female scores were higher than males. Males exhibited less training distress throughout the season while females had increasing scores throughout the season, then declined at the end (p=0.042). Post-hoc analysis for year in school showed that freshman and sophomores had higher training distress scores compared with juniors and seniors (p=0.001). CONCLUSIONS: MTDS identified gender and year in school as possible variables that could serve as indicators for risk of training distress. College coaches and trainers should consider applying different training loads to men and women as well as underclassmen and upperclassmen.

CONCLUSIONS: Both sleep quality and sleep duration are negatively affected by increased stress and also by a perceived low mood. Interventions that could help players better manage their stress and elevate their mood could result in increased sleep quality and duration in college soccer players.
CONCLUSION: These results suggest that female collegiate soccer athletes did not experience changes in %BF or lean mass from pre- to postseason. However, there may be small increases in fat accumulation at specific sites. Monitoring of individual athletes for these types of changes might also be important.

2095 Board #108 June 1 3:30 PM - 5:00 PM
Heart Rate and Energy Expenditure in Division I College Soccer Players during a Competitive Season
Shane F. O’Riordan, Gavin Connolly, Thomas Barrett, Emmi Lawless, Marina Bello, Anthony Poysick, Nicholas Morgan, Morgan Hofacker, Marissa Bello, Anthony Poysick, Nicholas Lawless, Christopher Ordyway, Brittany Bozzini, Shawn M. Aren, FACSM. Rutgers University, New Brunswick, NJ.

Email: orior1s@cmich.edu

(No relationships reported)

PURPOSE: To assess the influence of training demands on mood, sleep, biomarkers, and performance in D1 collegiate female athletes during a competitive season.

METHODS: 12 college female soccer players (19.3 ± 1.6 yrs, 167 ± 3.0 cm, 62.4 ± 4.9 kg) were included on a weekly basis (5 days/week). All athletes were included on the same training program that included a mix of practice and competitive games. Athletes were monitored using the Polar Pro system.

RESULTS: Significant differences (p<0.05) were observed across variables measured. AvHR for CB and MF was significantly lower than FW (169.8 ± 5.8 vs. 173.7 ± 5.9 bpm, p<0.05). MF HRmax was significantly lower than all groups. CB HRmax was significantly lower than all groups. CB HRrest was also significantly lower than FW (195.5 ± 3.6 vs. 200.2 ± 5.0 bpm). AvHR% was significantly lower and %TIM was significantly higher for CB compared to all groups. %TIM2, MF were significantly higher than CB (81.7 ± 12.7 vs. 68.7 ± 20.0%) and FW (81.7 ± 12.7 vs. 68.3 ± 16.0%). EE was significantly higher for MF compared to all groups.

CONCLUSIONS: Results identified positional differences for metabolic and physiological needs during competitive DI college soccer. This information could contribute to the understanding of the game and implementing specific training regimens.

2096 Board #109 June 1 3:30 PM - 5:00 PM
Workload-related Psychological And Physiological Changes In Female College Soccer Players During A Competitive Season

Bridget A. McFadden, Alan J. Walker, David J. Sanders, Morgan Hofacker, Marissa Bello, Anthony Poysick, Nicholas Lawless, Christopher Ordyway, Brittany Bozzini, Shawn M. Aren, FACSM. Rutgers University, New Brunswick, NJ.

Email: orior1s@cmich.edu

(No relationships reported)

PURPOSE: To assess the influence of training demands on mood, sleep, biomarkers, and performance in D1 collegiate female athletes during a competitive season.

METHODS: 12 college female soccer players (N=25; Mean ± SD: 19.4 ± 1.4 yrs; 66.1 ± 1.3 kg) participated in blood draws fasted and euhydrated. T2, T3, and T4 samples occurred ~18 hours after a game. Creatine Kinase (CK), Free Cortisol (CF), and Salivary Testosterone (ST) were measured at each time-point. Workload per session (km and kcal/kg) was monitored using the Polar Pro system.

RESULTS: Significant differences (p<0.05) were observed across positions for parameters measured. AvHR for CB and MF was significantly lower than FW (169.8 ± 5.8 vs. 173.7 ± 5.9 bpm, p<0.05). MF HRmax was significantly lower than all groups. CB HRmax was significantly lower than all groups. CB HRrest was also significantly lower than FW (195.5 ± 3.6 vs. 200.2 ± 5.0 bpm). AvHR% was significantly lower and %TIM was significantly higher for CB compared to all groups. %TIM2, MF were significantly higher than CB (81.7 ± 12.7 vs. 68.7 ± 20.0%) and FW (81.7 ± 12.7 vs. 68.3 ± 16.0%). EE was significantly higher for MF compared to all groups.

CONCLUSIONS: Results identified positional differences for metabolic and physiological needs during competitive DI college soccer. This information could contribute to the understanding of the game and implementing specific training regimens.
CONCLUSIONS: There was a significant decrease in a number of performance parameters during the second game when two games were played in one weekend. There were no changes in performances during G1, played one week apart over the five weeks.

Table 1. Performance parameters.

<table>
<thead>
<tr>
<th></th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
<th>Game 4</th>
<th>Game 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (m)</td>
<td>6690.5</td>
<td>7912.9</td>
<td>7610.9</td>
<td>7734.7</td>
<td>7770.1</td>
</tr>
<tr>
<td>RSB (m)</td>
<td>72.7</td>
<td>583</td>
<td>843</td>
<td>670</td>
<td>708</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>151.6</td>
<td>12.2</td>
<td>153.6</td>
<td>7.8</td>
<td>14.4</td>
</tr>
<tr>
<td>SD (in)</td>
<td>214</td>
<td>225</td>
<td>308</td>
<td>212</td>
<td>234</td>
</tr>
<tr>
<td>M/min (in)</td>
<td>114</td>
<td>107</td>
<td>115</td>
<td>110</td>
<td>118</td>
</tr>
<tr>
<td>%BS/min (in)</td>
<td>3.9</td>
<td>7.9</td>
<td>11.4</td>
<td>9.8</td>
<td>9.8</td>
</tr>
<tr>
<td>%SD</td>
<td>3.0</td>
<td>3.1</td>
<td>4.1</td>
<td>3.2</td>
<td>3.3</td>
</tr>
<tr>
<td>%RSB</td>
<td>56.2</td>
<td>9.4</td>
<td>8.8</td>
<td>8.1</td>
<td>7.5</td>
</tr>
<tr>
<td>%HR</td>
<td>6.2</td>
<td>7.9</td>
<td>2.9</td>
<td>3.7</td>
<td>3.1</td>
</tr>
<tr>
<td>%HIE</td>
<td>1.1</td>
<td>1.1</td>
<td>1.7</td>
<td>1.6</td>
<td>1.3</td>
</tr>
<tr>
<td>%Wedge/min</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>1.9</td>
<td>2.0</td>
</tr>
</tbody>
</table>
| Significant difference (p<0.05) | *Does not significant difference between games 1 and 2 within a week.

Orthotic insoles are used to correct foot and knee position for better mechanics of movement and acute orthotic use in runners reported improved economy. However, acute usage of customized orthotics (O) have not been evaluated actively in competitive cyclists. PURPOSE: The purpose of this study was to examine the acute effects of custom insoles on steady-state (SS) cycling physiological variables as well as sprint power output. METHODS: Eight competitive cyclists (6 males, 2 females) performed four bouts of cycling at 65-70% VO2max for 10 min (two trials with standard insoles (S) and two with O) in randomized order. SS cycling VO2, heart rate (HR) and respiratory exchange ratio (RER) were evaluated in minutes 2-7. In addition, peak power was determined to two 6 sec sprints 30 seconds apart at the end of SS bout on a Lode cycle ergometer. A repeated-measures ANOVA with an a priori alpha level of 0.05 was used to compare the differences in VO2 between SS and O. RESULTS: Significant main effect for condition (S=66.7±1.33; O=67.13±1.41) HR bpm (S=151.6±2.29; O=153.6±2.33; RER cycle ergometer. A repeated-measures ANOV A with an a priori alpha level of 0.05 was also not significantly different (S=1109±54.9; O=1115±47.6 W) in the sprints. 

2099 Board #112 June 1 3:30 PM - 5:00 PM
Acute Effects Of Custom Orthotics On Sprint Power Output And Steady State Cycling
Allan H. Goldfarb, FACSM1, Alex Ehler1, Kerry Martin1, Michael Rigby1. "Univ. of North Carolina Greensboro, Greensboro, NC. "Moses Cone Health, Greensboro, NC. Email: ahgoldfa@uncg.edu

2100 Board #113 June 1 2:00 PM - 3:30 PM
A Study On The Status And Factors Of Energy Deficiency In Japanese Collegiate Rhythmic Gymnastics
ERINA MURAMATSU1, MIZUKI YAMADA2, TAMAKI FURUHATA1, KANA HARADA2, MIZUHO ADACHI1, MIKAKO SAKAMAKI-SUNAGA1, TAKAKO KOSHIMIZU3. (No relationships reported)

D-63 Free Communication/Poster - Energy Metabolism and Expenditure
Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2101 Board #114 June 1 2:00 PM - 3:30 PM
Cerebral Energy Metabolism And Executive Function After Repeated High-intensity Interval Exercise With Decreased Lactate Concentration
Hayato Tsukamoto1, Niels D. Olesen2, Lonnie G. Petersen2, Henrik Sørensen1, Henning B. Nielsen2, Niels H. Secher2, Shigehiko Ogoh, FACSM3, Takeshi Hashimoto, FACSM1. "Ritsumeikan University, Kusatsu, Shiga, Japan. The Copenhagen Muscle Research Centre, Copenhagen, Denmark. Toyo University, Kagawo, Saitama, Japan. (Sponsor: Takeshi Hashimoto, FACSM) Email: gr0168ir@ed.ritsumei.ac.jp

Abstracts were prepared by the authors and printed as submitted.
Indirect calorimetry is used to measure oxygen consumption for the purpose of accurately estimating resting metabolic rate (RMR). Laboratory devices are available for the measurement of RMR, such as the BodyGem® indirect calorimeter and the Vacumed VO2 Lab metabolic cart. Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris-Benedict (HB), and Fleisch, can also be used to provide an estimate of RMR.

**RESULTS:**

The RMR values for the HB and Fleisch prediction equations were calculated using the prediction equation estimates compared to the BodyGem® indirect calorimeter. Further studies and refinements are needed to improve the accuracy of indirect calorimetry. Further studies and refinements are needed to improve the accuracy of the estimation of RMR, such as the BodyGem® indirect calorimeter and the Vacumed VO2 Lab metabolic cart. Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris-Benedict (HB), and Fleisch, can also be used to provide an estimate of RMR.

**CONCLUSION:**

Paired simple t-tests were used for statistical analysis. This study was funded by two grants (No relationships reported).
could be used to study changes in metabolic pathways in many different environments that include logistical or cultural considerations, where urine samples could be collected and then transported for analysis via H-NMR.

Self-supported by Colin Campbell.

2106 Board #119 June 1 2:00 PM - 3:30 PM
Pre-hydration Status, Fluid Intake, And Sweat Rate Of Males Participating In Hot Yoga
Cheri J. Bednarik, R. C. Pritchett, Stephanie Campbell, K Pritchett. Central Washington University, Ellensburg, WA.
(No relationships reported)

Populations who participate in recreational exercise in hot and humid environments such as hot hatha yoga are at an increased risk for dehydration. Hot yoga continues to grow in popularity.

Purpose: This study investigates the pre-exercise hydration status, fluid balance, perception of sweat loss, of 13 male Hot Hatha Yoga participants.

Methods: Male participants (n=13, 34 ± 12.7yr; 82.0 ± 9.8 cm; 85 ± 10.2 kg) were examined during a one hour hot hatha yoga class (39.7°C ± 3.5°C, 34.3 ± 2.4% rh). Pre-exercise urine specific gravity (USG), hydration status, body mass changes, and fluid intake were recorded and sweat rate was calculated. After the hot hatha yoga session, participants were asked to perceive their sweat loss. A paired sample t test was used to identify significance between measured sweat loss and perceived sweat loss and body mass loss.

Results: Forty seven percent of the Participants began the session in a dehydrated state (USG <1.020). Sweat rate was 1.3 ± 0.6 L·h⁻¹, and although replacement fluid was available, consumption was low (0.4 ± 0.3 L·h⁻¹) and 32% did not consume any fluids. Mean percent body mass loss was 1.1 ± 0.7% from pre-exercise body mass, and about half the participants lost at least 1% of body mass. There was a considerable difference between perception of sweat loss and actual sweat loss (p=1.02). Mean perceived sweat loss was 0.8 ± 0.46 L·h⁻¹ and mean actual sweat loss was 1.05 ± 0.6 L·h⁻¹. Conclusion: These findings highlight the variability in hydration management among male hot yoga participants supports the notion that hydration guideline must be personalized and education would be beneficial.

D-64 Free Communication/Poster - Ergonomic Aids IV
Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: F

2107 Board #120 June 1 3:30 PM - 5:00 PM
Omega-3 Fatty Acids Supplementation did not Improve Cardiometabolic Benefits of 16 Weeks of Exercise Training
Email: juanfernando.ortega@uclm.es
(No relationships reported)

Purpose: To determine if supplementation with omega-3 polyunsaturated fatty acids (omega-3 PUFAs) either as enriched milk or capsules would improve the benefits of an aerobic exercise training program in the health of metabolic syndrome (MS) patients.

Methods: Four groups of MS patients were enrolled, in a 16-week high intensity interval training program combined with n3-PUFA supplementation administered in a double-blind randomized design. Thirty six MS patients ingested during the training program 500 mL of milk daily, either enriched with 275 mg of omega-3PUFA or, semi-skim milk as placebo. Another 40 MS patients received capsules containing either 846 mg of omega-3PUFA or soybean oil as placebo. Before and after intervention, MS symptoms (i.e., waist circumference, blood pressure, blood glucose, triglycerides and HDL concentrations), composite MS z-score, cardiovascular risk factors (total cholesterol (TC) and LDL cholesterol metabolism markers (HbA1c and HOMA), body weight and composition, and cardiorespiratory fitness (peak oxygen consumption; VO2max) and maximal rate of fat oxidation (F0max) were assessed. Data was analyzed using split plot ANCOVA (Time x Treatment) controlling for body weight losses.

Results: From the MS components, only blood pressure decreased significantly (P=0.001) after the exercise program without further benefit from omega-3 PUFAs in any ingestion modality (P=0.340). MS z-score, TC and LDL decreased significantly after training (P=0.001, P=0.016 and P=0.003, respectively) without differences among groups (P=0.691, P=0.095 and P=0.156, respectively). HbA1c, HOMA and body weight did not change in any group (P=0.087, P=0.762, and P=0.203, respectively). However total fat mass decreased in all groups (P=0.001) without differences among treatments (P=0.942). VO2max and F0max improved (P=0.001) in a similar fashion among experimental groups (P=0.651 and P=0.333, respectively).

Conclusions: Sixteen weeks of dietary omega-3 PUFAs supplementation either as functional food (enriched skim milk) or at a higher dose provided in capsules, did not further enhance the benefits of high intensity interval training in a group of metabolic syndrome patients.

2108 Board #121 June 1 3:30 PM - 5:00 PM
Carbohydrate Mouth Rinse Does Not Affect 60-min Running Performance in Females
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(No relationships reported)

Purpose: To examine the effect of mouth rinsing with a carbohydrate solution on endurance running performance in females.

Methods: Fifteen female recreational endurance runners (30-57 years) ran 2 races of 1-hour duration on an indoor track after an 8 hour post-prandial period with a 7 days interval between races. This time period corresponded to the 3rd-10th day of each runner’s menstrual cycle, for the eumenorrhoeic runners. Any time for the runners who were at menopause. Following a double-blind process and random order, participants rinsed their mouth, before the initiation of exercise and at 15, 30 and 45 min of exercise with 25 ml of either a 6.4% carbohydrate (RCHO) or a placebo solution (0% carbohydrate) (RP). Pre-race ehydration was insured by ingestion of 6 ml kg⁻¹ water. No fluids were ingested during exercise. Races started at 18:00 hours.

Results: There was no difference between treatments in runners hormonal status prior to each race for serum 17β-estradiol [median (inter-quartile range)], RCHO: 50.2(74.1) pmol L⁻¹ vs RP: 26.0(31.6) pmol L⁻¹, p=0.433, (p=0.59) and Progesterone (RCHO: 0.75(0.61) 1.64 nmol L⁻¹ vs RP: 0.74(0.64, 0.9) nmol L⁻¹, p=0.938, (p=0.35). Percent body mass loss due to exercise was similar between treatments (mean ± SE; RCHO: 1.9% ± 0.1% and RP: 1.9% ± 0.1%). There was no difference in 1-hour running performance, neither by treatment (RCHO: 10621.88 ± 205.98 m vs RP: 10454.00 ± 206.64 m; t=1.784, p=0.096), nor by race order (1st race: 10549.13 ± 213.67 m vs 2nd race 10526.75 ± 201.16 m; t=0.215, p=0.833) (mean ± SE). Furthermore, the mean percentage effect (±99%CI) of RCHO relative to RP, 1.67%(−1.1% to 4.4%), and Cohen’s effect size (d = 0.21) support a trivial outcome effect of RCHO for total distance covered. In addition, there was no difference between treatments in the rate of perceived exertion (p=0.14) and heart rate (p=0.06). Conclusion: Carbohydrate mouth rinsing did not improve 1-h running performance in female recreational runners competing in a low ovarian hormone condition, following an 8 h fast and when no fluid was ingested during exercise.

2109 Board #122 June 1 3:30 PM - 5:00 PM
Influence Of Carbohydrate Intake On Pacing Changes During Prolonged Cycling
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(No relationships reported)

Purpose: The effects of carbohydrate intake on temporal changes in power output during cycling were examined.

Methods: Eight male cyclists (VO2max: 62 ± 6 ml kg⁻¹ min⁻¹) completed two trials consisting of 120 min of constant load cycling at 55% Wmax, followed by a simulated 30 km time trial (TT). Subjects consumed 150 ml of a glucose-fructose solution (CHO) or a non-caloric placebo (PL) every 15 minutes during the constant-load portion of the trial, and at 7.5 km intervals during the TT. Average power output during the TT was compared between treatments, and changes in power output within trials were examined across four segments of the TT (S1 = 0-7.5 km, S2 = 7.5-15 km, S3 = 15-22.5 km, and S4 = 22.5-30 km). Power output was also averaged for the three minutes immediately before and after each feeding, to determine if changes in pacing between treatments were influenced by the proximity to CHO feedings. Magnitude-based qualitative inferences were used to evaluate differences between treatments and/or time-points.

Results: Average TT power output during the CHO trial (242 ± 30 W) was ‘likely’ greater than PL (217 ± 40 W). In the PL trial, cycling power ‘almost certainly’ decreased between S1 (235 ± 41 W) and S2 (223 ± 38 W), and ‘likely’ decreased further during S3 (201 ± 41 W). Subsequently, cycling power ‘very likely’ increased

Abstracts were prepared by the authors and printed as submitted.

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than carbohydrate intake. Excess post-resistance exercise oxygen consumption (i.e. EPOC) to a greater extent Overall, nutrient consumption prior to resistance exercise may augment the post-exercise metabolic and substrate oxidation rates following a bout of high-volume, total body resistance exercise. Methods: In a randomized, placebo controlled, cross-over study, healthy, resistance trained male subjects (n=10) subjects initially underwent baseline testing for resting energy expenditure and maximum strength. Subjects were familiarized with the resistance exercise protocol during the subsequent visit. Afterwards, across 3 separate subsequent visits, subjects consumed whey protein (PRO), carbohydrate (CHO), or no nutrients (CON) prior to a bout of high-volume resistance exercise. After exercise, subjects were tested for energy expenditure (EE), oxygen consumption (VO2), respiratory exchange ratio (RER), and heart rate (HR). Results: PRO (+23.5%; p=0.003), CHO (+12.8%; p=0.001), and CON (+9.5%; p=0.005) increased EE from resting baseline with concomitant changes to oxygen consumption (VO2), respiratory exchange ratio (RER), and heart rate (HR). PRO (+75.6%; p<0.001) and CHO (+62.2%; p<0.001) increased EE above placebo. During resistance exercise, exercise muscle oxygen consumption increased with CHO supplementation compared to placebo. Conclusion: Overall, nutrient consumption prior to resistance exercise may augment the post-exercise exercise elevation in EE. Consumption of whey protein pre-exercise may enhance exercise performance. The purpose of this study was to determine if there is a dose-response effect of CHO mouth rinse concentration on endurance performance during a one-hour cycling time trial. Methods: Competitive, male, athletes (n = 8) (31.1 ± 7.1 years, 185 ± 9 cm, 84.7 ± 15.3 kg, VO2peak 49.9 ± 7.8 ml/kg*m⁻¹·min⁻¹) completed two, 48 min high intensity intermittent cycling protocols that consisted of 6 bouts of 5 min cycling at 50% VO2peak followed by sets of three, 10-s Wingate sprints with 50 s of recovery between sprints. Prior to each set of Wingate sprints, either a 6.4% carbohydrate solution (CMR) or placebo (PLA) were rinsed for 10 s using a counterbalanced crossover design. Results: There was a significant main effect (CMR 912 ± 168, PLA 885 ± 153 W; p<0.05 ES=0.10) for mean power, but post hoc tests only revealed significant performance improvement with CMR during the 6th bout (CMR 912 ± 167, PLA 885 ± 153 W, p<0.05 ES=0.17). No treatment effect was exhibited for peak power, fatiguing index, rate of perceived exertion, or blood glucose. Most team based sport provide multiple opportunities for access to carbohydrate beverages. Conclusions: Based on the 1.9% increase in performance with a CMR on mean power observed in the current study, a CMR may serve as a practical ergogenic option for high intensity intermittent sports. Supported by Master’s Research Grant from Central Washington University’s School of Graduate Studies and Research. PURPOSE: Fatigue has been shown to decrease velocity in training, decrease repetitions able to be performed while lifting weights, and increase fatigue level from weight training. This study investigated the changes in velocity and performance of weightlifters during training sessions with glucose supplementation. METHODS: Three competitive Olympic weightlifters, aged 25.7±4.0 yrs, participated in two trials; placebo (PL), and glucose supplement (GL). Every Minute On the Minute (EMOM) sets where used to simulate a training session. At the start of each minute, the subject performed a lift at 70% of their respective One repetition Maximum, and they continued these sets for 10 min. The snatch (ST) and Clean & Jerk (CJ) were performed for 10 sets at each. A pretest (PRE) consisted of both of the lifts 10 min prior to the first lift. Both lifts were performed for 10 repetitions at 70% of the subject’s maximum weight. The first lift of each set was performed following the glucose or placebo supplement. Blood lactate (BL) and glucose (BG) were recorded prior to trial testing (BASE), PRE, after 15 min recovery (REC), and POST. RESULTS: BG increased 29% in GL (PRE: 98.0±11.1 mg·dL⁻¹, REC: 125.3±23.2 mg·dL⁻¹) and BL decreased 12% in GL (PRE: 4.2±1.7 mmol·L⁻¹, REC: 3.2±0.5 mmol·L⁻¹). PV of ST increased 4% in GL (PRE: 1.5±0.10 m·sec⁻¹, POST: 1.5±0.11 m·sec⁻¹) and decreased 3% in PL (PRE: 1.72±0.18 m·sec⁻¹, POST: 1.66±0.08 m·sec⁻¹). PV of CJ increased 1% in GL (PRE: 1.5±0.51 m·sec⁻¹, POST: 1.61±0.59 m·sec⁻¹) and decreased 4% in PL (PRE: 1.65±0.54 m·sec⁻¹, POST: 1.57±0.47 m·sec⁻¹). HR of ST increased both PL (5%, PRE: 102.1±29.8 beats·min⁻¹, POST: 107.8±33.4 beats·min⁻¹) and GL (3%, PRE: 115.1±30.4 beats·min⁻¹, POST: 118.2±32.1 beats·min⁻¹). HR of CJ decreased both PL (1%, PRE: 124.5±39.1 beats·min⁻¹, POST: 122.6±37.7 beats·min⁻¹) and GL (4%, POST: 135.4±36.3 beats·min⁻¹, POST: 131.7±40.7 beats·min⁻¹).
CONCLUSIONS: The results show that glucose supplementation intake in weightlifters is associated with exercise performance such as barbell velocity and may reduce their fatigue level. A larger sample size should be required to confirm the significance of these findings.

2114 Board #127 June 1 3:30 PM - 5:00 PM
The Repercussion of Expectation: When a Carbohydrate Rinse Becomes Detrimental to Performance
Hunter L. Paris, Kevin O. Murray, Timothy J. Fulton, Timothy D. Mickleborough, FACSM. Indiana University, Bloomington, IN.

Amongst dietary strategies for performance enhancement a carbohydrate (CHO) mouth rinse is unique in that it may promote an increased rate of CHO oxidation without ingestion. Therefore, the possibility exists that a CHO mouth rinse may lead to a premature cessation of exercise due to a more rapid depletion of glycogen stores. PURPOSE: To calculate the time course of when CHO mouth rinsing may begin to be detrimental to performance. METHODS: Eight trained, competitive cyclists [age (mean ± SEM) = 24 ± 2 y; VO$_{2max}$ = 64.5 ± 2.8 ml/kg/min] completed three simulated 40-km time trials comprised of a familiarization trial, glucose mouth rinse trial (GLC), and placebo trial (PLA). A mouth rinse was administered prior to onset of exercise, and every 5-km throughout the time trial. CHO oxidation rates were calculated based on the equation: g/min = 2.210 VC02. RESULTS: Time to deplete stored glycogen was 175 ± 17 min when using a CHO mouth rinse and 196 ± 11 min when rinsing with a noncaloric sweetener. CONCLUSIONS: Assuming a 70 kg man is fully glycogen loaded at a wet weight of 200 mmol/kg muscle and that 22% of his body mass is leg muscle, glycogen stores would roughly equal 570 g in leg muscle. There was no statistical difference (p=0.06) between conditions in the time to deplete these stores. According to calculated oxidation rates, a 70-kg man would deplete leg stores in 175 ± 17 min when using a CHO mouth rinse and 196 ± 11 min when rinsing with a noncaloric sweetener.

2115 Board #128 June 1 3:30 PM - 5:00 PM
Six Grams of Fish Oil Supplementation Mitigates Perceived Muscle Soreness Following Acute Resistance Exercise
Alyssa J. Holmes,1 Trisha A. VanDusseldorp,2 Kurt A. Escobar,2 Kelly E. Johnson,1 Matthew Stratton,1 Terence Moriarty,2 Jeremy McCormick1, Gerald Mangine,1 Tony P. Nunez1, Nick M. Beltz1, Nathan Cole1, Marvin Endt1, Chad M. Kerrick,1 FACSM,2 Christine M. Mermier1, 1Kennesaw State University, Kennesaw, GA. 2University of New Mexico, Albuquerque, NM. 1Lindenwood University, St. Charles, MO. (Sponsor: Chad Kerrick, FACSM)

High-intensity eccentric exercise is known to cause skeletal muscle damage and microstructural changes to muscle tissue with an associated inflammatory response. Previous research demonstrates increased pro-inflammatory cytokine and prostaglandin concentrations and occurs with perceived muscle soreness. The omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), commonly found in fish oils, exhibit anti-inflammatory properties that have been reported to attenuate the overall perception of muscle soreness. PURPOSE: To investigate the dose-response effect of fish oil (FO) supplementation on the magnitude and time-course of post-eccentric resistance exercise muscle soreness. METHODS: Thirty-two, college-aged men (n = 16; 23.6 ± 5.0 years, 75.7 ± 4.5 kg, 175.3 ± 4.3 cm, 63 ± 3.6 %) and females (n = 16; 23.4 ± 3.1 years, 61.7 ± 7.2 kg, 170.4 ± 6.2 cm, 33 ± 5.0 %) completed a double-blind placebo controlled 7-week supplementation period of either: 2.0, 4.0, or 6.0 g d$^{-1}$ FO or placebo (PL). Subsequently, participants completed a muscle damaging resistance exercise protocol (10 sets of 4–5-repetition maximum). RESULTS: Six grams of fish oil per day (total 6g: containing 2.4g eicosapentaenoic acid and 1.8g docosahexaenoic acid), while the placebo group took 6 capsules of safflower oil per day for 3 weeks. All participants performed an acute eccentric leg exercise (10 sets of 10 repetitions with 3-min rest between sets at an isokinetic speed of 30°/sec) to induce muscle soreness. Time to peak soreness (Tmax) differed between the fish oil and placebo groups. A larger sample size would be required to confirm the significance of these findings.

2116 Board #129 June 1 3:30 PM - 5:00 PM
The Potential Of Omega 3 Supplementation To Reduce Muscle-inflammation After Muscle-damaging Exercise
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Muscle inflammation which follows exercise-induced muscle damage (EIMD) relates to strength loss, muscle-soreness and impaired recovery (Lynn and Morgan, 1994). It remains unclear whether omega-3 fatty acids (O-3) supplementation blunts the exercise-induced-inflammation associated with EIMD.

PURPOSE: Following supplementation with O-3, indirect markers of muscle damage were examined after EIMD to determine if supplementation had any beneficial effect in reducing muscle inflammation. METHODS: Eight healthy, recreationally active caucasian males (28.1 ± 3.4 yrs) were randomly allocated to a supplementation group (SUP, n = 4) to receive 2.85g/day O-3 supplementation or a placebo group (CON, n = 4) for three weeks. After three-weeks, participants performed a bout of EIMD, which consisted of performing 10 sets of 15 repetitions of leg extension on a Rating of Perceived Exertion (RPE) of 7/10 (Borg, 1982). Creatine Kinase (CK) from venous blood samples, isometric right-leg strength, squat-jump test and perceived soreness were determined, as indirect markers of muscle-damage at Baseline, immediately after EIMD (POST) and 48 hours after EIMD to coincide with the delayed muscle inflammatory response. RESULTS: There were no differences between groups at Baseline and POST. There was a trend for smaller increase of CK levels (pre vs 48h post EIMD) on the SUP group (38.8% increase) compared with the CON group (105.6% increase; P = 0.051). There was no significant effect (baseline vs. 48 h post EIMD on muscle strength between SUP and CON group (P = 0.05), however, CON showed a larger decrease in strength compared to SUP (<6.3% vs SUP). No differences in jump height were found between SUP and CON (P = 0.05). There was no significant difference in muscle soreness at 48 h post EIMD between SUP and CON group (P = 0.171). CONCLUSION: Three weeks of O-3 supplementation decreased exercise-induced muscle inflammation after eccentric exercise. The encouraging results from this pilot study have led to designing further work related to this topic. The lack of statistical significance may be adduced to the limitations of the study design. Supplementation with O-3 can be beneficial in sedentary individuals re-starting physical activity and in athletes undergoing heavy exercise regimes, decreasing the exercise related muscle inflammation.
A damaging bout of eccentric resistance exercise is known to hinder athletic performance. Fish oils are rich in omega-3-polyunsaturated fatty acids and have been purported to modulate the inflammatory response to exercise. It is possible that regular fish oil supplementation may assist in maintaining athletic performance following eccentric resistance exercise, but little is known regarding the optimal dose for stimulating benefits. PURPOSE: To examine the effect of fish oil (FO) supplementation dosing on athletic performance recovery following a muscle-damaging bout of eccentric exercise. METHODS: Thirty-two college-aged, resistance-trained males (n = 16; 23.8 ± 3.1 years, 61.7 ± 7.2 kg, 170.4 ± 6.2 cm) and females (n = 16; 23.4 ± 3.1 years, 67.1 ± 7.2 kg, 170.4 ± 6.2 cm) supplemented with 2.0, 4.0, 6.0 g·d⁻¹, FO or placebo (PL) for 7 weeks. Following 7 weeks of supplementation, participants completed pre-exercise (PRE) assessments of vertical jump (VJ) height, maximal voluntary contraction of the knee extensors, 40-yard sprint time, and T-test agility followed by a muscle damaging resistance exercise protocol (10 sets of 8 four-second eccentric squats at 70% one-repetition maximum, 5 sets of stairs or curling dumbbells into an Energy-surge exercise in subjects’ aerobic threshold routine was developed for metabolism acceleration. A unique 2-minute Energy-surge exercise routine was developed for metabolism acceleration. PURPOSE of this study was to determine if the Energy-surge protocol (performed four times/day) reduces subjects’ weight and girth sizes. METHODS: Fifty-four subjects (mean age 39 ± 8) with BMI of >30, and were recruited for this 60-day study. Subjects were randomly assigned to either the Experimental group which performed the 2-minute, Energy-surge exercises, four times a day or the Control group who were instructed to “exercise more.” No dietary changes were required for either group. The Experimental group were shown how to make many movements such as climbing stairs or curling dumbbells into an Energy-surge exercise in subjects’ aerobic threshold for two minutes. Experimental subjects recorded their exercises and send daily to a research assistant via text or email. The dependent variables were weight (pounds) and Body Summation of 10 girth measurements. A 2x2 ANOVA was used to calculate differences. RESULTS: There was a significant difference between groups (P<0.0001). The change of the groups were as follows: Experimental (N=24) mean reductions = -15.2lbs and -16.0” vs. Control (N=23) mean changes = +2.2lbs and +2.5.” CONCLUSION: The 2-minute Energy-surge exercise protocol performed four times a day was effective in reducing subjects’ weight and body circumferences. Isolated tests of body composition showed that experimental subjects change were primarily driven by the continuous rise in obesity. A unique 2-minute Energy-surge exercise routine was developed for metabolism acceleration. PURPOSE: To examine the effect of fish oil (FO) supplementation dosing on athletic performance recovery following a muscle-damaging bout of eccentric exercise. METHODS: Thirty-two college-aged, resistance-trained males (n = 16; 23.8 ± 3.1 years, 61.7 ± 7.2 kg, 170.4 ± 6.2 cm) and females (n = 16; 23.4 ± 3.1 years, 67.1 ± 7.2 kg, 170.4 ± 6.2 cm) supplemented with 2.0, 4.0, 6.0 g·d⁻¹, FO or placebo (PL) for 7 weeks. 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2121 Board #134
June 1 2:00 PM - 3:30 PM
Insulin Resistance Response to a Treadmill’s High Intensity Interval Training in Postmenopausal Women
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(No relationships reported)

PURPOSE: Considering that high-intensity interval training (HIIT) might offer faster and/or more efficient results in improving insulin sensitivity and glycemic control than low-intensity exercise, we conducted a study to analyze the response of insulin resistance to HIIT.

METHODS: 24 post-menopausal individuals were selected among those enrolled in our existing Lifestyle Modification Program (Move for Health). Physical activity level, socio-demographic characteristics, and health status were identified through the International Physical Activity Questionnaire (version 8 - long form). Performance was determined by trunk flexibility, handgrip test, cardiopulmonary fitness on treadmill. After an overnight fast (8-12 hours), plasma or serum was used for glucose and insulin assays. For the intervention protocol the patients were subjected to 43 minutes of supervised exercise twice weekly for 10 weeks. The HIIT included 10 minutes of warm-up at 70% of HR max, followed by 4 series of 4 minutes each on 90% HRmax with 3-min intervals between series for active recovery at 70% of FCMax, ended with 5 minutes backing to calm. Results were expressed as mean, standard deviation, frequency and percentage. Chi-square test (c2), ANOVA repeated measure and the range model repeated measures were used with a 5% significance level.

RESULTS: The sample consisted of low-income post-menopausal women with intermediate education referring self-perception of good health, although overweight and with good weekly physical activity and grip strength fitness but poor trunk flexibility. After 10 weeks of HIIT, the values changed for cardiorespiratory fitness markers by increasing 23.8% (time on treadmill test). The 37.5% unfit flexibility (≥P25) were reassigned either to P25-P75 (33.3%) or >P75 (11.1%). Regarding the insulin-resistance status, the HIIT resulted in normalization of 50% of the former hyperglycemics (25% at baseline) and also in 16.7% of the hyperinsulinemics (≥P25) were reassigned either to P25-P75 (33.3%) or >P75 (11.1%). Regarding the performance was determined by trunk flexibility, handgrip test, cardiopulmonary fitness on treadmill.

CONCLUSIONS: The protocol was shown to be effective in improving aerobic fitness and flexibility, additionally to discrete effects on insulin sensitivity although ineffective in reducing abdominal adiposity and overweight.

2122 Board #135
June 1 2:00 PM - 3:30 PM
Effect Of Aerobic Exercise Intensity On Glycated Hemoglobin, Fitness, And Adiposity In Individuals With Type 2 Diabetes: Results From HART-D
Neil M. Johannsen,1 Damon L. Swift,2 Carl J. Lavie,3 Conrad P. Earnest,4 FACSM4, Steven N. Blair, FACSM4, Timothy S. Church5, Louisiana State University, Baton Rouge, LA. 1East Carolina University, Greenville, SC. 2Ochsner Medical Center, Ochsner Clinical School - University of Queensland School of Medicine, New Orleans, LA. 3Texas A&M, College Station, TX. 4University of South Carolina, Columbia, SC. 5Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Steven N. Blair, FACSM)
Email: njohan1@lsu.edu
(No relationships reported)

PURPOSE: To examine changes (A) in HbA1c, CRF, strength, and adiposity in individuals with T2DM while retrospectively categorizing AER by intensity.

METHODS: 196 men (n=74) and women (age=57.1±1.8y; BMI=34.4±1.8kg/m2; mean±SD) from the HART-D study (NCT00458133) were randomized to 9 months of AER, RES, or combined training (COMB) or to a non-exercise control (CON). Compliant participants (>70% of AER sessions) with complete baseline and follow-up data for HbA1c, CRF (maximal METS), isokinetic strength, and anthropometry (weight, waist circumference (WC), and fat mass) were included. AER intensity was determined using residuals (positive-HI, negative-LO) for average training intensity (%MET-R) adjusted for baseline CRF, age, and sex.

RESULTS: AER intensity was greater in COMB-HI, COMB-LO, and AER-HI (+0.53%, -0.82 to -0.18, -0.39%, -0.70 to -0.07, -0.48%, -0.82 to -0.14, resp; mean, 95%CI) compared to CON (+0.18%, -0.12 to 0.49; all P<0.01) and COMB-HI compared to AER-LO (-0.40%, -0.36 to 0.35; p<0.04). A trend for greater AER-HI was noted between AER-HI and AER-LO (P>0.05). ACRF was higher in COMB-HI and AER-HI (1.2 METS, 0.8 to 1.3 METS, 0.9 to 1.6) compared to all other groups (range ACRF -0.2 to 0.5 METS; all P<0.007). Astrength was higher in COMB-HI and RES (14.0N, 5.8 to 22.2; 16.2N, 10.6 to 21.8) compared to AER-HI and AER-LO (2.0N, -0.6 to 6.6; -4.2N, -12.3 to 3.8; all P<0.008). Significant change in weight was only observed in COMB-HI (-1.6kg, -2.9 to -0.2) compared to CON (0.4kg, -0.8 to 1.6; P=0.03). WC was significantly reduced in all groups (range -1.7 to -3.1 cm; P≤0.03 for all) except AER-LO (P=0.07) compared to CON. COMB-HI, COMB-LO, and RES reduced fat mass (-2.1kg, -3.1 to -1.0, -1.5kg, -2.5 to -0.6; -1.3kg, -2.0 to -0.6, resp) compared to CON (0.0kg, -0.9 to 1.0; P≤0.02 for all). CONCLUSION: Our analysis suggests that individuals with T2D who conduct their AER at an intensity above age, sex, and CRF average responses may see greater improvements in glucose control, CRF, strength, and adiposity.

2123 Board #136
June 1 2:00 PM - 3:30 PM
The Effect of Exercise and Diet Interventions on Type-2 Diabetic Patient
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(No relationships reported)

PURPOSE: This study probes into intervention of exercise and diet for type-2 diabetic patient, in order to provide scientific basis for diabetic prevention.

METHODS: The research object is selected from the healthy people aged above 50. There are 160 type-2 diabetic patients in walking group, 186 in walking & strength exercise under diet control group, 56 in control group. Their disease course in 2-8 years and have a 3 months comprehensive intervention. Intervention plans: (1) Walking group: Add 20% of walking steps (at a speed of above 60 m/min) on basis of average daily exercise quantity, people in this group exercise for 3-5 times a week. (2) Comprehensive interval group: On the basis of walking, resistance training is added, which includes 3 sets of press-up, sit-up and back extension, and people shall do more than 10 for each set of above exercise or a maximum number according to personal ability. At the same time, the diet intervention is carried out. First, determine a daily total heat. Then calculate the required daily food exchange list and make proper distribution by a proportion of one-fifth, two-fifths and two-fifths or equally one-third for breakfast, lunch and supper respectively. (3) Detection indexes: (1) Personal information, state of disease, daily physical exercise condition, medication condition and diet habits. (2) Blood glucose: FBG and Hba1c. (3) Blood fat: TC, TG, HDL-C and LDL-C.

RESULTS: (1) The FBG of intervention group is reduced from 8.67mmol/L to 7.32mmol/L; walking group reduced from 7.45mmol/L to 7.25mmol/L (p>0.05); however, the FBG of control group increases from 8.79mmol/L to 10.26mmol/L (p<0.05). (2) The Hba1c of comprehensive intervention group is reduced from 8.05% to 7.66%(p>0.05); walking group is reduced from 7.04% to 7.01%(p>0.05); control group increases from 8.63% to 9.07%. (3) The HDL-C of comprehensive intervention group is increased from 1.32mmol/L to 1.55mmol/L (p<0.01); walking group is increased from 1.41mmol/L to 1.45mmol/L (p=0.01); while, control group falls from 1.52mmol/L to 1.24mmol/L (p<0.01).

CONCLUSIONS: Comprehensive intervention of exercise and diet is more effective.
non-adherent behavior count was 1.4 (SD=0.6) at BL and 0.2 (SD=0.6) PW (p<0.05). The mean persuasion behavioral count with and without permission was 6.8 (SD=3.5) at BL and 2.9 (SD=1.5) at PW (p<0.05). The mean overall self-perceived proficiency and intent to use MI was 7.6 (SD=1.1) at BL and 8.8 (SD=0.7) PW (p<0.05).

CONCLUSIONS: Preliminary findings of this pilot study did not identify significant change in MI proficiency. However, trainees used significantly less persuasion, patient evaluations remained high and clinician self-evaluation scores improved significantly. Short-term measures from these varied methods of evaluation may provide useful feedback to clinicians for ongoing MI skill development.

**2125 Board #138**

June 1 2:00 PM - 3:30 PM

Results Of An Eim Based Lifestyle Modification Program On Clinical Outcomes In Obese, Pre-diabetic Patients

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(No relationships reported)

Purpose

to determine if an Exercise Is Medicine (EIM) modeled, lifestyle modification program, including nutrition education and support, exercise programming and health coaching would produce enhanced clinical outcomes and greater reduction in risk than current standard of care in an obese, pre-diabetic population.

Methods

data was collected from a single center clinical practice with trained nutritionists and exercise physiologists. Inclusion criteria consisted of obese patients (BMI >30 kg/m²) which had additional comorbid health conditions. The 12-week program consisted of: initial assessment (baseline fitness and health markers and goal planning), a health intervention (lifestyle and nutrition counseling, personalized individual and group training, and health education), and outcome assessment (repeat fitness and health assessment). Participants in this program were compared to similarly matched control patients who were given standard of care treatment (pharmaceutical recommendations on diet and exercise), and had received similar health marker screening at initial visit and again between 3 and 6 months post physician appointment.

Results:

A total of 362 participants met criteria to be included in this data set. 69 intervention group with a mean starting age of 60 years of age and a starting BMI of 38.0 kg/m², 293 control, with a mean starting age of 71 years and starting BMI of 34.8 kg/m². The intervention group saw reduction in HbA1C (5.9 vs 5.7%), Total cholesterol (170 vs 159 mg/dL), and Triglycerides (154 vs 136 mg/dL), and weight (238 vs 222 lbs). By comparison, the HbA1C and weight of the control group were not significantly changed from baseline (HbA1C 6.5 v 6.5%; Weight 219 v 212 lbs). After 10 weeks of LSM the BP normalization achieved 17.8% for SBP and 9.3% for DBP. The top quartile of blood pressure (SBP: 142.2/88.5 mmHg) differed from the lower quartile (120.6/69.2 mmHg) by being older and lower either, schooling, income, physical activity (IPAQ) and aerobic capacity (VO2max). The p75 showed a low quality diet (HEI score) with more processed foods higher CHO/fiber, sodium/potassium and saturated fat). They showed also a higher body fatness and prevalence of metabolic syndrome (MetS) along with MetS comorbidities of inflammation, peroxidation and insulin resistance but, without differences in the Framingham score. After 10 weeks of LSM the BP normalization achieved 17.8% for SBP and 9.3% for DBP with a net effectiveness of 8.5% and 2.4%, respectively. The reduction of BP was followed by increased aerobic conditioning and reduced intake of processed foods along with decreased values of BMI, abdominal fatness and comorbidities.

CONCLUSIONS: Based on this effectiveness and, if applied nationwide, one would save medications for 3.1 million of Brazilian hypertensives at an estimated saving of US$ 1.47 billion a year!

**2126 Board #139**

June 1 2:00 PM - 3:30 PM

The Antihypertensive Benefits Of Yoga: A Meta-Analysis

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Yoga practice elicits changes in resting blood pressure (BP) ranging from -20 to +10 mmHg. Reasons for this large variability in the BP response are not clear. PURPOSE: To investigate the efficacy of Yoga as antihypertensive therapy and identify moderators of the BP response to Yoga. METHODS: Database searches identified 44 controlled Yoga trials that involved adults ≥19 yr, yielding 49 interventions. Analyses followed random-effects assumptions. RESULTS: Participants (N=3,376) were middle-aged (48.2±16.1yrs), overweight (27.3±3.8kg/m²) adults with hypertension (systolic BP [SBP]/diastolic BP [DBP], 129.3±14.0/80.9±9.1 mmHg). Yoga was practiced 3.9±3.1 sessions/wk for 61.0±22.0 min/session for 14.8±13.5 wk. Overall, Yoga elicited moderate reductions in SBP (d = -0.48, 95%CI: -0.63, -0.33; -4.3 mmHg) and DBP (d = -0.50, 95%CI: -0.64 -0.35; -3.4 mmHg) compared to control (p<0.001). Yoga produced greater SBP reductions among: samples with hypertension (-11.8 mmHg, k=13) than prehypertension (-6.6 mmHg, k=20) and normal BP (-2.9 mmHg, k=14, p>0.001); interventions located in India (-9.9 mmHg, k=21) than non-Indian Asia (-7.0 mmHg, k=9) and non-Asian (-4.2 mmHg, k=17, p<0.012) countries; and interventions with the largest variance (i.e., standard error) in the BP response (-20.0 mmHg, k=15) than moderate (-6.5 mmHg, k=14) and small (-1.6 mmHg, k=16, p<0.001). Yoga produced greater DBP reductions among: samples with hypertension (-10.2 mmHg, k=5) than prehypertension (-5.4 mmHg, k=14) and normal BP (-2.1 mmHg, k=24, p<0.001); interventions located in India (-4.0 mmHg, k=20) than non-Indian Asia (-2.3 mmHg, k=8) and non-Asian (-0.8 mmHg, k=15, p<0.019) countries; and samples that practiced Yoga with a balanced combination of breathing, postures, and meditation/relaxation (-5.8 mmHg, k=25) than Yoga mostly focused on a single practice (e.g., left nostril breathing) (-2.3 mmHg, k=18, p=0.006). CONCLUSION: Overall, 60 min of Yoga practiced 4 sessions/wk lowered BP ~3-4 mmHg among adults with prehypertension. Yoga reduced SBP/DBP -12/10 mmHg among adults with hypertension, reductions nearly double of those reported with aerobic exercise. Yet caution is warranted in the clinical translation of our findings until future controlled trials specifically designed to target BP confirm them.

**2127 Board #140**

June 1 2:00 PM - 3:30 PM

Effectiveness Of A 10-wk Lifestyle Modification Program In Reducing Hypertension In Brazilian Free-Living Adults

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PURPOSE: High blood pressure (BP) is a strong, independent and etiologically relevant risk factor for cardiovascular diseases. Free distribution of more than 15 medications for HyPERtension and DIAbetes (HIPERDIA program) clearly shows the important role of drugs in the Brazilian Government’s effort to tackle these two diseases. Each medicated BP subject has an estimated cost of US$ 39.50. However, drug therapy has been largely unsuccessful in halting and reversing the hypertension epidemic and more emphasis must be placed on primary prevention guidelines. BP is often associated with unhealthy lifestyles such as consumption of high fat and/or high-salt diets and physical inactivity.

METHODS: A lifestyle modification program (LSM) involving dietary counseling and regularly supervised physical activity (“Move for Health”) has been used here, since 1991, for NCDs primary care. Cross-sectional analysis of clinical, anthropometric, dietary and physical activity data from 1317 subjects (2006-2016) was used to characterize the BP at subjects at baseline. Next, a sub-sample (n=453) was submitted to a 10-wk LSM and repeated assessments. Statistical comparisons were defined by p<0.05.

RESULTS: The BP rate (higher than 140/90 mmHg) was 51.2% for SBP and 42.7% for DBP. The top quartile of blood pressure (142.8/88.5 mmHg) differed from the lower quartile (120.6/69.2 mmHg) by being older and lower either, schooling, income, physical activity (IPAQ) and aerobic capacity (VO2max). The p75 showed a low quality diet (HEI score) with more processed foods higher CHO/fiber, sodium/potassium and saturated fat). They showed also a higher body fatness and prevalence of metabolic syndrome (MetS) along with MetS comorbidities of inflammation, peroxidation and insulin resistance but, without differences in the Framingham score. After 10 weeks of LSM the BP normalization achieved 17.8% for SBP and 9.3% for DBP with a net effectiveness of 8.5% and 2.4%, respectively. The reduction of BP was followed by increased aerobic conditioning and reduced intake of processed foods along with decreased values of BMI, abdominal fatness and comorbidities.

CONCLUSIONS: Based on this effectiveness and, if applied nationwide, one would save medications for 3.1 million of Brazilian hypertensives at an estimated saving of US$ 1.47 billion a year!

**2128 Board #141**

June 1 2:00 PM - 3:30 PM

The Effects of a Group Exercise Rehabilitation Session on Stroke Survivors

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(No relationships reported)

UK stroke mortality rates are falling, but > 50% of stroke survivors have functional disabilities. These impairments reduce capacity to perform activities of daily living (ADL) such as walking, basic self-care and independence, focused on a single session of stroke. Disability predisposes them to a chronic sedentary lifestyle, leading to further deconditioning and muscle atrophy, compounding disability. Cardiorespiratory fitness (CRF) is markedly reduced in a stroke population, with survivor VO₂ max > 50%
below a healthy age-matched population. Hypertension (HTN) is a modifiable risk factor for stroke, yet 75% of recurrent stroke sufferers have HTN. In the UK there is no routine exercise provision for chronic stroke survivors. PURPOSE: To investigate the impact of a weekly community-based group exercise session on key health parameters and functional capacity of stroke survivors. METHODS: 10 (63.70±13.21 yrs; 4 females; 6 males) stroke survivors were referred by an acute stroke rehabilitation team to a community-based exercise session. This referral pathway was set up as a collaboration between the local health care providers and the University of Kent. Participants attended one week a complete, a series of cardiovascular conditioning exercises (circuit format), strength and flexibility training. Health (weight, BMI, resting heart rate, resting systolic and diastolic blood pressure (SBP and DBP), wrist circumference) and functional capacity (six-minute walk distance (6MWD), timed up and go, grip strength) assessments completed after 10 sessions (10 weeks).

RESULTS: Reducing in SBP (136.30±14.40 mmHg vs 150±14.19 mmHg p=.006) and DBP 76.70±10.91 mmHg vs 83 mmHg p=.035). 6MWD increased from (392±112.29 m to 321.90±106.88 m p=.001). CONCLUSIONS: A once a week exercise session reduced SBP to <140 mmHg and DBP in stroke survivors, who were already medicated with anti-hypertensives. Improved physical capacity evidenced by increased 6MWD. Walking speed increased from 53.65.m.minit−1 (3.2 kph) to 65.33 m.min−1 (3.9 kph); improved walking speed ≈3.0 METs (~2.5mph). This study emphasizes the importance of continued exercise rehabilitation post-stroke for further HTN risk factor management (secondary prevention) and continued recovery of physical condition.

2129 Board #142 June 1 2:00 PM - 3:30 PM
Mechanical Adaptations In Walking Performance Using Ankle Foot Orthoses For Patients With Peripheral Arterial Disease
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(No relationships reported)

PURPOSE: Part of the limited success of community-based walking programs for people with peripheral artery disease (PAD) and intermittent claudication (IC) in the calf is a lack of strategies to manage pain during exercise. Carbon fiber ankle foot orthoses (AFO) could delay the onset of IC as they store elastic energy during stance that assists the calf muscles during gait propulsion. Clinical dogma may limit AFO implementation as many practitioners believe that AFO will reduce muscle recruitment during gait with a decline in function over time. Our purpose was to determine the gait adaptations in ankle mechanics, walking speed, and calf muscle recruitment when using AFOs to supplement a community walking program.

METHODS: Fifteen patients with PAD (Age=67±12 yrs) were fitted with bilateral AFO. An initial 3D gait analysis with plantar flexor electromyography data was completed 1 week after fitting. We used a within-session comparison of walking with/without the AFO. Patients were then given standard advise to walk at home using the devices ad libitum for 12 weeks. Twelve patients completed follow up testing after 12 weeks. Differences between conditions and test times were analyzed using paired t-tests.

RESULTS: The AFO reduced peak ankle plantar flexion power during the propulsion phase of walking at initial testing (mean±SE with AFO=1.5±0.2 W·kg−1, without AFO=2.6±0.3, p<0.001). Peak ankle plantar flexion moment and calf muscle recruitment did not change between conditions (p>0.05). The same pattern of results occurred at 12 weeks with no change in the variables over time (p>0.05). Gait speed was constant between conditions and over time (p>0.05; pooled initial=1.09 m sec−1, pooled 12 weeks=1.06 m sec−1). CONCLUSIONS: Maintenance of calf muscle recruitment when using the AFO was an unexpected, but favorable finding that contradicts conventional wisdom. Patients maintained normal values of ankle motion using AFO and sustained their gait velocity over time. The AFO reduces power demands on the calf muscle which has potential to reduce IC while still maintaining muscle integrity and walking function. Funding: Pilot and Mini-grants from NIH (PA) levels and quality of life. Applying affordable wearable fitness bands to track exercise. Arterial stiffness (AS) is an independent risk factor for CVD that increases exponentially in women following menopause. PURPOSE: The current research was designed to investigate the acute AS response to postmenopausal women. METHODS: A total of 13 women (age = 66.85 ± 4.41 years) completed the study. Subjects completed both a HIIE and a MCE treadmill protocol on separate occasions. Time of the MCE intervention was adjusted to match the average number of heart beats observed during the HIIE intervention. Pulse wave velocity (PWV), augmentation index (AIx), central systolic blood pressure (CSBP), and central diastolic blood pressure (CDBP) were measured pre exercise, 15 min post exercise, and 30 min post exercise to assess arterial stiffness. RESULTS: No significant interaction (p >.05) between exercise intervention and time was determined for PWV, AIx, CSBP, or CDBP. No change in PWV was found from pre to post exercise (p =.109). A trend was found for a greater decrease in AIx following HIIE compared to the decrease in AIx following MCE (p =.086). A significant decrease in AIx was found from pre exercise to 15 min post exercise (p = .002; Mpre = 33.91, M15min = 27.40) and from pre exercise to 30-min post exercise (p =.035; Mpre = 33.91, M30min = 28.67). CONCLUSION: The results of this study indicate that whether postmenopausal women perform MCT or HIIE, the acute response of central arterial stiffness does not differ. No change in PWV from pre to post exercise was found for either exercise intervention.

2131 Board #144 June 1 2:00 PM - 3:30 PM
Physical Activity After Hospitalization For Acute Coronary Syndrome: Correlates Of Exercise Days Using Objective Measures
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(No relationships reported)

Exercise is essential in the secondary prevention of acute coronary syndrome (ACS). To date, there is a lack of data examining factors associated with objectively measured exercise in ACS patients post-discharge, a critical window for (re)forming health habits. PURPOSE: The purpose of this study was to examine factors associated with lack of exercise among ACS patients over the first 5 weeks post-discharge. METHODS: ACS patients (myocardial infarction or unstable angina; N=269) from a hospital in Upper Manhattan were enrolled into an observational cohort study. Patients wore a wrist-based accelerometer for 35 days post-discharge. Days in which participants accumulated ≥30 min of moderate to vigorous physical activity in bouts ≥10 min were considered exercise days, expressed as % of days exercised over the 35 day wear period. Multivariable logistic regression models were used to examine correlates of non-exercise (0 days over the 35 day period), which included sociodemographic factors (age, sex, race, body mass index [BMI], partner status, social support), psychological factors (depression, post-traumatic stress disorder), health status/disease severity (GRACE risk score, Charlson comorbidity index [CCI], perceived mental and physical health [SF-12]), and hospital length of stay (LOS) and procedures (coronary artery bypass grafting [CABG], percutaneous coronary intervention [PCI]). All models were adjusted for age, sex, race, and ethnicity. Data are reported as odds ratios (OR) and 95% confidence intervals (CI). RESULTS: Among the 269 patients, 63.6% did not exercise at all. Factors associated with non-exercise were GRACE risk score (OR: 1.03; 95% CI: 1.01-1.04; p=0.003), LOS (OR: 1.15; 95% CI: 1.05-1.26; p=0.002), PCI (OR: 0.26; 95% CI: 0.12-0.58; p=0.001), CABG (OR: 5.46; 95% CI: 1.50-19.86; p=0.010), BMI (OR: 1.09; 95% CI: 1.03-1.15; p=0.003), and perceived physical health (OR: 0.96; 95% CI: 0.93-0.98; p=0.002). CONCLUSION: In ACS patients in whom exercise participation was objectively measured for 35 days post-hospitalization, factors related to poorer physical health and greater disease severity, but not psychological factors, were associated with low frequency of exercise. Future research may be warranted to elucidate how to address these factors to increase exercise post-ACS.

2132 Board #145 June 1 2:00 PM - 3:30 PM
Predicting Biomarkers through Affordable Fitness Band in Chinese Breast Cancer Survivors
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PURPOSE: Breast cancer survivors (BCS) are at great risk for low physical activity (PA) levels and quality of life. Applying affordable wearable fitness bands to track PA while also serve to provide predictive utility regarding clinical biomarkers may
enhance health professionals’ ability to prevent and manage disease reoccurrence for BCS. This cross-sectional study described objective PA data from the Xiaomi Mi wrist band among Chinese BCS while evaluating if PA data is predictive of clinical biomarkers.

METHODS: A total of 95 Chinese BCS (X̄age = 44.8 ± 7.9 years; X̄steps = 22.2 ± 3.5) participated in baseline measurements of a larger parent intervention. Inclusion criteria were: 1) ≥ 21 years old; 2) diagnosed with stage 0-III breast cancer; and 3) completed primary cancer treatment 3 months to 10 years earlier with no new or recurrent cancer. BCS were given the fitness band for 4 weeks after which blood assays were taken to assess biomarker levels. The PA outcome was average steps/day while biomarkers were: 1) ≥ 21 years old; 2) diagnosed with stage 0-III breast cancer; and 3) completed primary cancer treatment 3 months to 10 years earlier with no new or recurrent cancer. Greater predictive utility of the Xiaomi Mi for clinical biomarkers was significantly predictive of HDL, r² = .06, p = .04, with marginal predictive utility of average steps/day seen for CEA, r² = .04, p = .08. Specifically, higher average steps/day was associated with slightly higher HDL and CEA levels. Yet, patients’ PA failed to significantly predict other biomarkers.

CONCLUSIONS: Use of PA data from a wearable fitness band has some predictive utility for certain biomarkers. Notably, findings suggest health professionals may want to focus on increasing PA in BCS with lower HDL levels while tracking abnormally high CEA levels. Greater predictive utility of the Xiaomi Mi for clinical biomarkers might be seen with larger samples of BCS.

Pancreatic cancer is the fourth most common cause for cancer death. Despite progress in diagnosis and therapies in recent years, the 5-year survival rate of all stages is still only 6%. Exercise-related research in this patient group is widely missing. PURPOSE: It is well known, that cancer patients frequently experience reduced physical fitness due to the disease itself as well as treatment-related side effects. However, studies of physical fitness in pancreatic cancer patients are missing. Therefore, we assessed cardiorespiratory fitness and muscle strength in this patient group.

METHODS: Sixty-five pancreatic cancer patients, mostly after surgical resection, were included in this study. Cardiorespiratory fitness was assessed using cardiopulmonary exercise testing (CPET) and 6-minute walk test (6MWT). Hand-held dynamometry was used to evaluate isometric muscle strength. Physical fitness values were compared to reference values from a healthy population. Associations between sociodemographic and clinical variables with patients’ physical fitness were analyzed with multiple regression models. RESULTS: Cardiorespiratory fitness (VO2peak, 20.5 ± 6.9 ml/min/kg) was significantly lower (<24%) compared to healthy reference values. In the 6MWT pancreatic cancer patients nearly reached predicted values (555 vs. 562 meters).

Maximal voluntary isometric contraction (MVIC) of the upper (-4.3%) and lower extremities (-13.8%) were significantly lower compared to reference values. Overall differences were larger in men than in women. Participating in regular exercise in the year before diagnosis was associated with greater VO2peak (p<.05) and MVIC of the knee extensors (p<.05). CONCLUSIONS: Pancreatic cancer patients had significantly impaired physical function. In regard to both, cardiorespiratory function and isometric muscle strength, already in the early treatment phase (median 95 days after surgical resection). Our findings underline the need to investigate exercise training also in pancreatic cancer patients to counteract the loss of physical fitness. Supported by the German Cancer Aid (SUPPORT-Study; Grants No. 110513 and 110552)

BACKGROUND: Using the traditional random-effects model, a recent meta-analysis of randomized controlled trials reported a statistically significant standardized mean difference (SMD) reduction in cancer-related fatigue (CRF) as a result of aerobic exercise (SMD, -0.22, 95% CI, -0.39 to -0.04, p = 0.01). However, a recently developed inverse heterogeneity (IVhet) model has been shown to be more valid than the traditional random-effects model.

PURPOSE: The purpose of this study was to compare these previous meta-analytic results with those using the IVhet model.

METHODS: Using data from a previous meta-analysis that included 36 SMD effect sizes (ES’s) representing 2,830 adults (1,426 exercise, 1,404 control), results were pooled using the IVhet model.

In addition, absolute and relative differences between the IVhet and random-effects models for CRF were calculated as well as influence analysis with each SMD ES deleted from the IVhet model once. Non-overlapping 95% confidence intervals were considered statistically significant.

RESULTS: A statistically non-significant reduction in CRF fatigue was found as a result of aerobic exercise using the IVhet model (SMD, -0.08, 95% CI, -0.31 to 0.14, p = 0.46). The IVhet model yielded a SMD ES that was 0.14 (63.6%) smaller than the random-effects model. With each study deleted from the IVhet model once, results remained statistically non-significant with SMD ES’s ranging from -0.11 (95% CI, -0.33 to 0.11) to -0.06 (95% CI, -0.28 to 0.16).

CONCLUSIONS: The results of the current study suggest that there is currently insufficient evidence to support the use of aerobic exercise for reducing CRF in adults. Future studies should consider use of the IVhet versus traditional random-effects model when conducting aggregate data meta-analyses. Supported by NIH Grant U54GM104942

Asthma-COPD overlap syndrome (ACOS) is characterized by persistent airflow limitation and symptoms associated with both asthma and chronic obstructive pulmonary disease (COPD). However, those with ACOS have worse health outcomes than those with asthma or COPD alone. Regular physical activity may be important in the management of ACOS and the prevention of cardiometabolic comorbidities.
Purpose: To investigate the association between physical activity and the presence of ACOS, and second, to investigate the association between physical activity levels and cardiometabolic risk factors in adults and older.

Methods: The Canadian Community Health Survey (CCHS) is a cross sectional survey that collects information pertaining to the health determinants, health care utilization, and health status of Canadians. Data from respondents with ACOS (n= 1,569) and those without a respiratory condition (n= 64,175) from CCHS version 1.0, 2013 were analyzed. Physical activity was used to categorize respondents as active or inactive. Self-perceived health, body mass index and physician-diagnosed high blood pressure were used as outcomes. Descriptive statistics were used to calculate the frequencies of outcomes (physical activity level, self-perceived health, high blood pressure, and BMI) within the ACOS and no respiratory disease groups.

Regression analyses were conducted to determine the association between physical activity and ACOS, and between physical activity levels and cardiometabolic risk factors in ACOS.

Results: Those with ACOS were 59% less likely to be physically active than those without a respiratory condition (OR = 0.59, CI = 0.50-0.71). Physically active adults with ACOS had higher odds of good self-reported health (OR = 2.66, CI = 1.71-4.16), and were 60% less likely to report high blood pressure (OR = 0.60, CI = 0.43-0.86) than those who were inactive. BMI seemed to be an important correlate for self-perceived health, and high blood pressure, but was not significant when used as an outcome. Conclusion: Physical activity levels among adults with ACOS are low. This may increase their risk for poor health outcomes. Future research is needed to determine the effectiveness of exercise within this population.

Individuals with exercise-induced bronchoconstriction (EIBC) often experience symptoms such as wheezing, coughing and shortness of breath during or following exercise; this may lead to greater perceptions of in-task effort and less enjoyment. Sustained explosive efforts during EIBC are associated with increased dyspnea but lower affect and enjoyment compared to MICE. Therefore, SIE may not be recommended for adherence to regular exercise in adults with EIBC.

Two thirds of participants with EIBC preferred MICE and all participants without EIBC preferred MICE. Those without EIBC had a higher enjoyment scores for SIE compared to those with EIBC. The Physical Activity Enjoyment Scale was completed by participants following each minute during exercise. Ratings of perceived exertion (RPE), ratings of perceived dyspnea (RPD) and 1-item feeling scale (1-FS) were monitored each minute during exercise.

Results: The Physical Activity Enjoyment Scale was completed by participants following each minute of unloaded cycling and MICE (65% peak power output for 20 minutes) sessions. Ratings of perceived exertion (RPE), ratings of perceived dyspnea (RPD) and 1-item feeling scale (1-FS) were monitored each minute during exercise. The Physical Activity Enjoyment Scale was completed by participants following each exercise protocol. Participants were also asked if they preferred EIBE or MICE after the second session. Sessions were completed in random order. Results: Among those with EIBE, average RPE was not different during MICE (13.4±1.9) compared to SIE (11.5±0.5, p =0.29), there were no differences in average RPD during MICE (4.5±1.4) compared to SIE (4.3±0.6, p =0.81), average affect was greater during MICE (2.8±1.6) compared to SIE (2.0±1.5, p =0.05), and differences in physical activity enjoyment scores for MICE (93.0±5.6) compared to SIE (77.0±4.6, p =0.09) were approaching significance. There were no differences in RPD or affect between those with and without EIBE for either SIE or MICE. Those without EIBE reported higher RPE during SIE and had a higher enjoyment scores for SIE compared to those with EIBE. Two thirds of participants with EIBE preferred MICE and all participants without EIBE preferred MICE. Conclusion: SIE was associated with similar exertion and dyspnea but lower affect and enjoyment compared to MICE. Therefore, SIE may not be recommended for adherence to regular exercise in adults with EIBE.

Purpose: Evidence of physical activity (PA) as beneficial for health stems mainly from observational studies. Findings from randomised controlled trials (RCTs) often differ and systematic reviews of RCTs demonstrate mixed results making translation into clinical practice difficult. An overview of existing review evidence is needed to identify PA interventions that are effective in preventing or treating major chronic disease.

Methods: We searched the Cochrane Database of Systematic Reviews for reviews of RCTs restricted to 20 major chronic diseases. A minimum of two authors independently screen search outputs, selected studies, extracted data and assessed quality of included reviews using AMSTAR. The pairs will be contrasted in terms of frequency and degree of concordance in their results and whether differences affected the citation rate.

Results: Of the 56 Cochrane reviews within our data set, we found 33 non-Cochrane reviews that met the eligibility criteria. The full analysis will be completed by the end of 2016 and final results will be presented fully for the first time at the ACSM meeting.

Conclusion: This is the first study comparing systematic reviews that were conducted within and outside the Cochrane Collaboration, in particular with respect to physical activity interventions for chronic diseases. Unlike a previous study using meta-analyses on medication therapy within the cardiovascular literature, we applied a more precise methodological approach that concurrently points out how differences can be explained. The findings of our study should make an important contribution to the field of evidence-based physical activity and emphasize that a critical appraisal of systematic reviews reporting physical activity interventions is highly recommended for health professionals.
INTRODUCTION: Rheumatoid arthritis (RA) and Ankylosing spondylitis (AS) are systemic, autoimmune diseases causing severe joint inflammation, leading to joint damage and functional disability. Both diseases may feature co-morbidities e.g. cardiovascular disease (CVD) and hypercholesterolemia. RA is most prevalent in individuals aged ≥18 years, with an estimated prevalence distribution of 0.4-1.3% worldwide. AS has an age onset of 15-35 years, typically affecting 7-9/100,000, with a 3:1 male-to-female ratio. PURPOSE: Evidence of benefits of exercise, and its hypothesised mechanisms in RA and AS patients were explored. METHODS: Research literature on stage of disease, amount and type of exercise and classification levels were assessed using Medline and Scopus databases.

RESULTS: Pre-evaluation includes staging of level of function (class I-IV) and assessment of disease activity and co-morbidities. Recommended amount and type of exercise vary depending on the site and amount of impaired joints, presence/absence of inflammation, joint stability and previous joint replacements. The FITT-Prop principle (frequency, intensity, time, type and progression) is followed in exercise prescription. Evidence of benefit of aerobic, and resistive exercise programs shows an increase in aerobic capacity, muscle strength, self-reported functional ability, endothelial function, blood pressure, lipid profile, autonomic function and muscle mass, with a decrease in body fat percentage and trunk fat mass. Inflammatory disease is characterised by increased levels of circulating TNFα that induces cachexia and lead to deterioration of muscle strength. Pro-inflammatory cytokine production may also predispose patients to atherosclerosis, loss of muscle mass, and metabolic disorders (insulin resistance and dyslipidemia). Exercise not only improve functional outcome, but also induces an anti-inflammatory response, specifically suppressing TNFα production and stimulating the production of anti-inflammatory cytokines (IL-1ra and IL-10) via muscle derived IL-6.

CONCLUSIONS: Scientific literature supports the benefit of exercise to both improve functional ability and reduce CVD mortality and other co-morbidities. Mechanisms of the effect of exercise are on functional and anti-inflammatory level.

Canada has the highest prevalence rate of multiple sclerosis (MS) globally (291 per 100,000). People with MS often experience intense fatigue, muscle weakness, decreased aerobic endurance, loss of flexibility, and impaired balance and gait. To mitigate these symptoms, which negatively affect quality of life, physical activity is often recommended.

Purpose: To examine the effectiveness of a 16-week exercise program on improving common symptoms of MS.

Methods: Nine adults diagnosed with MS (M±s: 51.3 ± 11.7 years; range: 42-65 years, 1 male) completed a progressive exercise program including cardiovascular, strength, flexibility, balance, and proprioception exercises (60 minutes, twice a week for 16 weeks). General measures of health, physical fitness, functional movement, cognitive function, and quality of life were collected pre-, mid-, and post-program.

A one-way ANOVA with repeated measures (Session: pre-, mid-, post-program) was performed on all dependent measures (s < 0.05). Effect sizes were calculated using the partial omega-squared (ω²) test.

Results: Collectively, participants showed significant (p < 0.05) improvements from pre- to post-program on the timed up-and-go (TUG) (ω² = 0.21) and wall push-up tests (ω² = 0.45). Strong trends (p < 0.10) toward improvement were shown for flexibility (ω² = 0.19), comfortable walking speed (CWS) (ω² = 0.28), gait cadence (ω² = 0.20), Vitality (ω² = 0.26), fatigue (ω² = 0.17), and mental health (ω² = 0.18). Individually, five participants showed improvement in mental health, six showed improvement in cadence, and seven showed improvement in one or more of TUG, wall push-ups, flexibility, CWS, vitality, and fatigue (all pre- to post-program).

Conclusions: The pre-post exercise program was successful in providing significant improvement in mobility (TUG) and upper body strength (wall push-ups). Although not statistically significant, strong trends were recognized in the areas of gait (CWS and cadence, which support the significant improvement in TUG) and quality of life (vitality, fatigue, and mental health), which may be functionally meaningful. Future research could investigate the possibility of using exercise to slow the progression of the degenerative effects of the disease.

Supported by the University of Windsor Strategic Priority Fund.
Mulan Quan is a modern form of Tai Chi created specifically for women. Purpose: To explore the effects of Mulan Quan exercise on vascular function, pulmonary function and cardiovascular fitness in middle-aged and elderly women. Methods: Twenty middle-aged and elderly women were recruited from the Senile University of Chengdu, China. Women who were sedentary and had never practiced Mulan Quan were included in the control group (n=10, 57±3 years old), and those who had been practicing Mulan Quan for 4 years or longer were included in the exercise group (n=10, 60±5 years old). The exercise group practiced Mulan Quan 40-60 minutes each time, 3 times each week. Pulse wave velocity (PWV) and ankle-brachial index (ABI) were measured by Omron sphygmomanometer and cardiovascular fitness was evaluated by a step test. Independent t-tests were used for group comparisons. Results: For vascular function, PWV values from both sides were significantly lower (p<0.05) in the exercise group than in the control group (left side: 1372.00±136.57 cm/s vs. 1539.00±134.77 cm/s, p<0.05). ABI values from the right side were significantly lower in the exercise group than in the control group (1.07±0.07 vs. 1.14±0.06, p<0.05); there was no group difference in ABI values from the left side. For pulmonary function, the mean forced vital capacity (FVC) was 2326.50±327.75 ml vs. 1938.00 ± 514.08 ml, p<0.05. For cardiovascular fitness, CRF significantly improved over time in women (absolute VO2peak [2.23 ± 0.68% vs 1.84 ± 0.74%, p< 0.001]). CONCLUSION: This 12-week Mulan Quan exercise program attenuated the age-related decline in VO2peak in women, but not in men in comparison to previously published rates of decline. Decline in upper and lower body muscle force was attenuated in both men and women across all muscle groups compared to previously published normative rates of change.

Post-event cardiac rehabilitation (CR) improves cardiorespiratory fitness (CRF) and quality of life (QoL) while reducing depression and anxiety. Unfortunately women are less likely than men to participate in CR, despite research showing women benefit from CR. Aims: To compare the effects of CRT versus TM versus no exercise (CONT) on older adults with CMS risk factors. Methods: Participants (n=30) were referred to a exercise-based CR program located in Auckland, NZ. All participants underwent baseline and follow-up assessment which included a ramped ECG monitored maximal exercise test with gas analysis, a QoL (Short Form-36), and Hospital Anxiety and Depression Scale (HADS) questionnaire. Participants completed 3 weekly sessions of aerobic (40-70% VO2peak), resistance (1-2 sets; 12-15 reps at 40%-80% 1RM) and balance and flexibility exercise, totalling approximately 60 minutes/session. Significantly different (p<0.05) pre- vs. post-program values were identified by dependent t-tests. Results: Post-program CR significantly increased (18.5 ± 6.3 to 21.1 ± 7.5 ml.kg⁻¹.min⁻¹) despite no significant increase in HRpeak (131.9 ± 28.7 to 132.1 ± 40.1 bpm) and respiratory exchange ratio (1.03 ± 0.1 to 1.03 ± 0.2) during maximal exercise testing. Resting heart rate decreased significantly (72.4 ± 11.8 to 68.6 ± 10.8 bpm), whilst no change in systolic (126.3 ± 24.2 to 129.8 ± 16.0 mmHg) or diastolic blood pressure (82.0 ± 16.0 to 79.2 ± 8.2) was observed. SF36 summary scores for physical (49.4 ± 4.1 to 72.6 ± 37.3) and mental health (74.9 ± 15.9 to 82.8 ± 10.1) increased significantly while the HADs anxiety (5.6 ± 3.4 to 3.6 ± 2.3) and depression (2.9 ± 2.4 to 1.8 ± 1.8) scores were significantly lower post-program. Conclusions: Twelve weeks of exercise-based exercise CR is safe and effective for increasing CRF, and QoL, while reducing depression and anxiety in elderly women.
Continued Improvement and Maintenance in Older Veterans After Two Years of Gerofit Exercise Program
Lydia Paden, Odessa Addison, Jamie Giffuni, Leslie I. K zeal. Veterans Health Administration, Baltimore, MD.

(Purpose: Gerofit is an outpatient facility-based clinical exercise program for Veterans ≥65 years that was developed at the Durham VA and Medical Center. This model was implemented at the Baltimore VA Medical Center (BVAMC) Geriatric Research Education and Clinical Center (GRECC) in 2013. Participants in Gerofit receive individualized exercise programs based on their functional assessments to improve function and mobility. We assessed lower extremity function and mobility changes in Veterans who completed ≥ 2 yr of Gerofit.

Methods: Older Veterans (≥65 yr) with primary care at the BVAMC were referred to Gerofit. Veterans attended Gerofit sessions up to 3 d/wk. Assessments included measures of: lower extremity function (Short Physical Performance Battery (SPPB); 30 second chair stands), endurance (six-minute walk (6MW)), gait speed (10 meter walk), agility (8 foot up and go (TUG)) and balance (four-square step test (FSST)). A repeated measure ANOVA was used to compare function and mobility changes at baseline, 1 and 2 yrs of participation. When significant differences were found a Bonferroni Post hoc was used.

Results: Twenty-five Veterans (24 male, 69 ± 4.2 yr (mean ± SD), 72% African American, BMI 32.9 ± 6.5 kg/m2) completed 2 yr of Gerofit. Data are presented as baseline, 1 yr, 2 yr. Lower extremity function improved 37% between baseline and 2 yr testing as measured by chair stands (12.1 ± 5, 15.6 ± 7,16.6 ± 8.1; p < .001). Endurance increased 12% (502.8 ± 146.1, 533.5 ± 179.6, 569.3 ± 176; p < .001). TUG scores decreased 15% (7.6 ± 2.2, 6.9 ± 2.6, 6.7 ± 2.7; p < .05) and FSST decreased 8.7% (11.2 ± 3.8, 9.8 ± 3.1, 10.3 ± 4.50; p < .05). SPPB and 10 meter walk did not significantly improve (p = 0.15 and p = .78). No test resulted in significant changes between 1 yr and 2 yr (p = .20).

Conclusions: Veterans who participated in two years of Gerofit demonstrated significant improvements in dynamic balance, including lower body function, endurance, and agility. The SPPB did not significantly change and this may be due to the ceiling effect as baseline scores were 10 or higher. Participation in Gerofit results in the significant changes in function after 1 year. These changes are maintained with exercise for a second year and suggest the importance of adhering to an exercise program to maintain physical function with aging.

Commitment and follow through to an exercise and weight-loss program can be challenging. One of the ways to improve retention is through self-monitoring techniques such as weekly journaling. During our study comparing high-intensity interval training (HIIT) and walking as forms of exercise among post-menopausal women we attempted to use qualitative methods to explain the participants’ experiences. 

Purpose: To investigate the thoughts and feelings, specifically related to the challenges and successes, participants experienced while completing a 12-week exercise program. 

Methods: Participants (N=18) were post-menopausal (56 ± 5.94 years), sedentary female volunteers, randomly assigned into one of two exercise groups. Both groups exercised five out of seven days for 12 weeks. At the end of each week, participants submitted their answers to five open-ended reflective questions about their experience in the program, including the challenges and successes that week. This was done through an email exchange with a member of the research team. Additional specific follow-up questions were asked when needed.

A total of 187 weekly email exchanges were collected and coded using Dedoose software. Data were analyzed via a general inductive approach to identify significant themes. A constant comparison process was employed to analyze the data to identify commonalities and differences between the two groups and among individuals. Data saturation was reached. Trustworthiness was established via peer review. 

Results: For both exercise groups, the major theme of support developed. This included support from family, peers, and the researcher. Between the groups different challenges were identified including adhering to the intervention and weather challenges.

Conclusion: When working with clients attempting to lose weight and commit to an exercise program, support is a key component of success. When possible, family, co-workers, and others should be included in the process to encourage and help participants reach their goals. Weekly check-ins with a member of the research team is another way to facilitate program compliance and retention. Supported by Grant T30254 2014.04 from University of Scranton and Marywood University, Scranton, PA.
the Adult Physical Fitness Program cohort of CPX from 981 individuals (44±12 yr.; 51% male) without known cardiovascular or metabolic disease. Pearson and partial correlations examined the relationship between HR and HR acceleration (HRacc), HR recovery (HRrec), HR reserve (HRres), % age-predicted max HR achieved (%APHR), and chronotropic index (CI). Similar comparisons were made with HbA1c and HR responses in a subset of individuals (n=121). Additionally, individuals were grouped as (normal [NFG], impaired fasting glucose [IFG], diabetic [T2D]) based on ADA classification and compared for differences in HR responses.

RESULTS: FG was positively correlated (P<0.01) with resting HR (r=0.085) and inversely with HRres (r=-0.125). HbA1c was positively correlated (P<0.01) with CI (r=0.200) and inversely with %APHR (r=-0.214), HRrec (r=-0.233), and HRres (r=-0.338). After adjusting for age, sex, body mass index (BMI), and cardiopulmonary fitness (CRF), HbA1c remained inversely correlated with HRrec (r=-0.187, P<0.05). HRres displayed a graded relationship among groups being highest (P<0.05) in NFG and lowest (P<0.05) in T2D. Resting HR and CI were higher (P<0.05) while HRacc, HRrec, and %APHR were lower (P<0.05) in T2D compared to NFG. HRacc and %APHR were lower (P<0.05) in T2D compared to IFG. Differences among groups for CI, %APHR, and HRres remained significant after adjusting for age, sex, BMI and CRF. CONCLUSIONS: These data suggest that impairment in exercise HR response observed in chronic hyperglycemia is also present in prediabetes which should be considered when interpreting CPX data and developing an exercise prescription.

### 2152 Board #165 June 1 3:30 PM - 5:00 PM Treadmill vs. Cycle Ergometry Graded Exercise Test Responses in Multiple Sclerosis Patients

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Email: gigriff@uic.edu

(No relationships reported)

**INTRODUCTION:** Cardiorespiratory fitness is measured by peak oxygen consumption (VO2peak) and is one of the strongest predictors of all-cause and cardiovascular disease mortality. In a healthy adult population, VO2peak values obtained on a treadmill are approximately 10-15% higher than those yielded by cycle ergometry. VO2peak testing in those with multiple sclerosis (MS) is typically performed on a cycle ergometer, as loss of walking mobility or balance issues may limit treadmill walking. Therefore, potential mode-specific differences in VO2peak may result in the inability to accurately assess MS patients’ risk and lead to inaccurate exercise prescriptions in this cohort.

**PURPOSE:** To compare hemodynamic, ventilatory, and cardiopulmonary responses between graded exercise tests performed on both a treadmill and cycle ergometer in individuals with relapsing-remitting MS.

**METHODS:** Twenty persons with MS (42±11 years; 11:10 years since diagnosis) completed two VO2peak tests approximately 1 week apart, with random order of testing. Treadmill tests consisted of a constant, self-determined speed with an increase in grade of 2% every two minutes. Cycle ergometry tests increased wattage by 15 watts per minute. A repeated measures ANOVA was used to investigate differences in testing response to both treadmill and cycle ergometry. RESULTS: Treadmill testing resulted in VO2peak values that were 11% higher and respiratory exchange ratio (RER) values were 8% lower than those obtained via cycle ergometry. As expected, treadmill testing results were VO2peak similar to healthy adults. Therefore, exercise prescriptions or study designs cannot directly calculate submaximal workloads for one mode based on maximal data obtained from the other. Additionally, while HRpeak values are within normal limits, they’re bordering chronotropic incompetence.

<table>
<thead>
<tr>
<th>Treadmill</th>
<th>Cycle Ergometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2peak (ml/kg/min-1)</td>
<td>27.0 ± 6.7*</td>
</tr>
<tr>
<td>HRpeak (beats/min-1)</td>
<td>159 ± 19</td>
</tr>
<tr>
<td>SBPpeak (mmHg)</td>
<td>166.8 ± 20.5</td>
</tr>
<tr>
<td>DBPpeak (mmHg)</td>
<td>72.7 ± 13.3</td>
</tr>
<tr>
<td>RPE</td>
<td>17.9 ± 1.9</td>
</tr>
<tr>
<td>VEpeak (L/min)</td>
<td>75.5 ± 21.2</td>
</tr>
<tr>
<td>RER</td>
<td>1.09 ± 0.08*</td>
</tr>
</tbody>
</table>

Table 1. Mean ± SD. *p<0.05 between Treadmill and Cycle Ergometer

**CONCLUSIONS:** VO2peak obtained from the graded exercise test was 34.9±10.0 ml/kg/min. Actual and predicted VO2peak values were not correlated for either submaximal test (6MWT: r=0.28, P=0.31; YMCA: r=0.08, P=0.79).

**PURPOSE:** Assessing cardiopulmonary fitness is important for determining health status and prescribing exercise. Measurement of peak oxygen uptake (VO2max) is the gold standard for the evaluation of cardiopulmonary fitness. However, VO2max testing is not always feasible as it involves trained personnel, expensive equipment, and the ability of the test-subject to safely exercise until exhaustion. The ability to accurately predict VO2max using submaximal protocols is important, particularly in special populations such as pregnant women. A validated test to predict fitness levels in pregnant women will allow health care providers to evaluate their patients’ health status as well as tailor their patients’ exercise prescriptions; thus, maximizing the established benefits of exercise during pregnancy. The 6-minute walk test (6MWT) and the YMCA submaximal cycle test (YMCACT) are currently validated tests to predict VO2max in non-gravid populations; however, neither test has been validated during pregnancy. Therefore, the purpose of this study is to determine the validity of the 6MWT and the YMCACT as predictors of cardiopulmonary fitness in healthy weight women during mid-pregnancy. METHODS: Women (18-24 weeks gestation) with low-risk pregnancies participated. At Visit 1, participants completed the 6MWT and the YMCACT in randomized order. Both tests were used to predict VO2max according to validated protocols/equations for non-gravid populations. At Visit 2, participants completed a graded exercise treadmill test (VO2exp) using the Bruce Protocol. The predicted VO2max from each submaximal test and the measured VO2max were compared using Pearson Product Moment Correlation Coefficients.

**RESULTS:** 16 women participated in the study (pre-pregnancy BMI = 23.8±4.3 kg/m², Age=30±1.3±2 yr, Gestation age=22.0±1.3 wk). Mean predicted VO2max values were 36.3±3.9 and 41.1±19.0 ml/kg/min for the 6MWT and the YMCACT, respectively. Mean VO2max obtained from the graded exercise test was 34.9±10.0 ml/kg/min. Actual and predicted VO2max values were not correlated for either submaximal test (6MWT: r=0.28, P=0.31; YMCA: r=0.08, P=0.79).

**CONCLUSIONS:** The 6MWT and YMCACT do not accurately predict VO2max values during mid-pregnancy. These tests should not be used to estimate peak fitness levels among pregnant women.

### 2154 Board #167 June 1 3:30 PM - 5:00 PM A Novel Maximal Treadmill Exercise Testing Protocol in the Morbidly Obese: A Descriptive Report

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(No relationships reported)

**INTRODUCTION:** Although the results from treadmill exercise tests have been widely used as a marker of fitness and prognosis for various diseases, morbidly obese individuals often terminate testing at a level of discomfort far below their physiologic maximum. This early termination demonstrated in morbidly obese individuals may be due to bio-mechanical factors, low levels of fitness and the parameters of more traditional exercise testing protocols. Given the increasing obesity epidemic facing the United States and the world, it would be prudent to investigate exercise testing protocols for this population to assist with disease prognosis and stratification as well as the provision of appropriate exercise prescriptions. PURPOSE: To describe the utilization and psychometric properties of a novel treadmill test protocol used in morbidly obese individuals. METHODS: The data was pooled from baseline maximal exercise testing data of all subjects currently enrolled in a pre-bariatric surgery exercise training study who used this novel protocol. The protocol used a constant speed (2mph), graded exercise test which increased at a rate of 2% every 2 minutes. Metabolic data was collected, heart rate was measured with 12 lead ECG, blood pressures were measured manually, and rating of perceived exertion was assessed using the modified Borg Scale.

**RESULTS:** In total, the results from 7 participants were included in this analysis, all female, non-hypertensive and without diagnosed cardiopulmonary disease.
Cardiorespiratory fitness (CRF) level among women living with fibromyalgia (FM) has been documented with some contradictory results most probably due to differences in the methodological approaches used. Furthermore, some studies have suggested that aerobic capacity was affected in patients with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) 24 hours after performing a maximal CRF test. To our knowledge, no research has looked at the capacity to recover after a maximal CRF test specifically to morbidly obese individuals.

**PURPOSE:** The ability to measure VO2max is important for determining health status and prescribing exercise. However, directly measuring VO2max is not always feasible, particularly in special populations such as pregnant women. Therefore, the purpose of this study was to create pregnancy-specific equations to predict cardiorespiratory fitness using baseline and exercise data. Indirect Assessment Of VO2max

**CONCLUSION:** This novel treadmill exercise testing protocol yielded peak testing results that could be considered to be acceptable criteria for a maximal effort for this specific population of morbidly obese individuals, based on pooled average values of Peak %APHRMax, peak RER, and test duration. More research is needed to investigate the psychometric properties of this test and to develop testing parameters specific to morbidly obese individuals.

### Baseline data

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Height (cm)</th>
<th>Body Weight (kg)</th>
<th>BMI</th>
<th>Waist Circumference (cm)</th>
<th>Resting Heart Rate (bpm)</th>
<th>Rest SBP (mmHg)</th>
<th>Rest DBP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg 33.14</td>
<td>168.97</td>
<td>136.89</td>
<td>48.00</td>
<td>129.57</td>
<td>87.29</td>
<td>115.00</td>
<td>78.14</td>
</tr>
<tr>
<td>SD</td>
<td>4.64</td>
<td>4.73</td>
<td>27.60</td>
<td>10.01</td>
<td>24.67</td>
<td>19.19</td>
<td>5.80</td>
</tr>
</tbody>
</table>

### Pooled testing data

<table>
<thead>
<tr>
<th>Peak VO2 (ml/kg/min)</th>
<th>Exercise Time (min)</th>
<th>Peak RER</th>
<th>Peak HR (bpm)</th>
<th>Peak % Age Predicted HR Max</th>
<th>Peak SBP (mmHg)</th>
<th>Peak DBP (mmHg)</th>
<th>Peak RPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg 19.52</td>
<td>12.00</td>
<td>1.00</td>
<td>166.00</td>
<td>0.89</td>
<td>170.00</td>
<td>74.00</td>
<td>6.36</td>
</tr>
<tr>
<td>SD 8.52</td>
<td>4.00</td>
<td>0.07</td>
<td>17.06</td>
<td>0.08</td>
<td>16.59</td>
<td>8.39</td>
<td>2.29</td>
</tr>
</tbody>
</table>

### RESULTS

VO2max is considered like the most valuable objective predictor of cardio-respiratory fitness and general health. Many evidence based studies prove that higher level of VO2max is adversely related to prevalence of many diseases, such as cardio-metabolic syndrome, ischemic heart disease, hypertension, diabetes II and others. However, only very few general practitioners can afford complete equipment for direct estimation of this important fitness biomarker.

**PURPOSE:**

a) To find the highest correlation between the fitness markers, which don’t need O2-CO2 analyzer for their assessment (W170, Wmax) on one side and VO2max on the other side.

b) To determine regression equations which could be used for calculating VO2max and VO2max/kg.

**METHODS:**

The data of 2778 spirometric tests (2015 males and 762 females) from the data-base of our institute in the period 1995 till 2015 were included into the study. The subjects were healthy competitive and leisure athletes and also non-athletes aged 9 to 95 years. All performed bicycle ergometer test with step wise increased workload up to the exhaustion.

**RESULTS:**

The highest correlations were found between maximal performance achieved in watts (Wmax) and VO2max, and between Wmax/kg and VO2max/kg in both men and women. Regression equations for indirect assessment of VO2max are:

- Men: VO2max = 0.0905 x Wmax + 0.54 (l/min) (R=0.89); VO2max/kg = 8.3 . Wmax/kg + 13 (ml/min/kg) (R=0.83)
- Women: VO2max = 0.0083 x Wmax + 0.67 (l/min) (R=0.85); VO2max/kg = 8.0 . Wmax/kg + 13 (ml/min/kg) (R=0.83)

**CONCLUSION:** The regression equations can be used for assessment of VO2max and/or VO2max/kg body weight respectively even in those testing procedures, where bicycle ergometry enables to measure maximal performance during step wise increased workload, however, where no O2-CO2 analyzer is available. The data can serve as a feedback information about the effectiveness of physical activity in wider range of population then direct VO2max measurement, limited by the capacity of specialized laboratories.
Heart rate recovery (HRR) after intense exercise is one aspect of chronotropic incompetence (CI), the inability to match HR response to metabolic demands. Impaired HRR after peak exercise has been observed in HIV+ adults. However, physical activity (PA) and cardiorespiratory fitness (CRF) are both associated with improved exercise recovery, but their influence on HRR in this population has not been established.

**PURPOSE:** To evaluate the association between PA, CRF, and HRR; and test the hypothesis that HIV+ Hispanic adults classified as active and with good CRF will have higher %HRR after peak exercise compared with those inactive and with low CRF.

**METHODS:** A group of 89 adults (59 HIV+ and 30 HIV−) completed an exercise test on a treadmill with ECG and gas exchange measures (i.e., HR and VO₂) using CPX (CosMed USA), and estimated VO₂peak was calculated using the FRIEND (Fitness Registry and the Importance of Exercise: National Database) registry equation and the equation from Wasserman et al. VO₂peak data were assessed for variation around the median and comparisons were made.

**RESULTS:** Patients were on average 48 (13) y and 62% male. VO₂peak as measured by CPX on average was 23.7 (9.8) ml/kg/min. The Wasserman equation average prediction for VO₂peak was 27.8 (9.4) ml/kg/min which resulted in an percent predicted of 88%, whereas the FRIEND equation resulted in average predicted VO₂peak of 42.2 (10.3) ml/kg/min, resulting in 56% of predicted.

**CONCLUSIONS:** In a large sample of patients with known moderate to severe cardiomyopathy, the standard reference equation by Wasserman assessed them as slightly below average whereas the FRIEND equation assessed the same patients as having severely impaired performance. Caution should be used in the interpretation of CPX results when using current VO₂peak estimation equations and further development of these equations seems warranted.
Vertical jump testing is a commonly used method for measuring an individual’s anaerobic (explosive) power (Markovic, et al., 2004). Reliable and repeatable assessment of the vertical jump has implications in many health, wellness, and physical activity domains. The Vertec™ and force plate (gold standard) are devices used for accurately measuring vertical jump height; research conducted on these devices have shown their validity in measuring jump height (Buckthorpe, et al. 2012). The force plate and the Vertec™, although accurate at measuring vertical jump height, are costly and not easily accessible to many coaches and the general public. An accurate and accessible field measure would allow assessment of vertical jump height and power in many settings.

**PURPOSE:** The purpose of this experiment was to examine the reliability and validity of the My Jump app (utilized on Ipod mini) compared to the Vertec™.

**METHODS:** Sixty-five college-aged participants performed three maximal countermovement vertical jumps. A Vertec™ measurement device was used in conjunction with the My Jump app to measure jump height. Jump heights from the Vertec™ were then correlated to those from the My Jump app. Peak power values were calculated using the Sayers equation (Sayers et al. 1999). The Pearson product-moment correlation coefficient was determined between the jump heights measured by the Vertec™ and the My Jump app.

**RESULTS:** The average jump height measured by the Vertec™20.1 in. (5.4) was significantly higher than the height from My Jump app 16.1 in. (4.5). A strong and significant correlation was found between the two height measurements, r=0.814, p<0.01 and for peak power measurements r=0.933 p<0.01.

**CONCLUSIONS:** The My Jump app may provide a reliable measure of vertical jump height in multiple settings without the need of costly equipment such as force plates or Vertec™. We chose to compare the My Jump app to the Vertec™ because the Vertec™ is more commonly used to measure jump height due to the expense compared to a force plate. The lower height values using My Jump app may stem from the fact that subjects reach for the rungs on the Vertec™ while My Jump app measures the flight time to determine the vertical height of the center of mass. However, the ease of use and portability makes the app an accessible tool for measuring jump height in multiple settings.

Dance is a jumping intensive activity, and, similar to other sports, ankle sprains among dancers are the most common traumatic injury, typically occurring when landing from a single leg jump. Ankle sprain injuries happen among dancers most often by age thirteen and have a high recurrence rate often leading to long term disability. As dance medicine epidemiology studies continue to evolve, it is evident that a gender disparity in many settings common in the dance workplace and different shoe wear often required of the women which place them in the loose pack position of the ankle joint.

**PURPOSE:** Estimating aerobic fitness in the busy outpatient clinical setting with gold standard maximal fitness testing is challenging due to time, staffing and equipment access limitations. Short tests that can be performed with minimal equipment and staff may overcome these limitations, and improve clinician ability to provide customized exercise recommendations and track fitness responses over time. This study piloted whether a peak fitness level could be estimated by a short, simple Ruffier exercise readiness test.

**METHODS:** Seventeen adults (32.6 ± 10.8 yrs; 26.0 ± 10.7 kg/m²; 9 F) participated. During one testing session, participants performed a Ruffier fitness readiness test (30 squats in 60 s) and a Balke maximal treadmill fitness test. In the Ruffier test, heart rate (HR) was measured pre-test, immediately post and 1-min post-test. Ruffier scores were calculated and classified from the 3 HR values. During the Balke test, endurance time and peak values for HR, rate of oxygen use (VO₂peak), ventilation (VE) and respiratory quotient (RQ) were captured.

**RESULTS:** Mean HR values during the Ruffier test were 68.7 ± 9.9 bpm (pre-test), 129.5 ± 9.7 bpm (immediately-post) and 88.4 ± 19.5 bpm (1-min post), which represented a significant change over time; p<0.001. The Ruffier score averaged 8.8 ± 3.4 points (from 0-20 points). The Balke VO₂max measured averaged 39.7 ± 11.6 ml/kg·min, with a peak HR of 179.3 ± 14.4 bpm and RQ of 1.2 ± 0.08. Average endurance time was 21.2 ± 4.5 min. Correlation between Ruffier scores and VO₂peak value revealed a Pearson correlation coefficient r = 0.540 (two-tailed p-value of p=0.024, at 0.05 level).

**CONCLUSIONS:** Moderate associations were found between the fitness scores of the two tests from this group. The 45 s Ruffier exercise test may be useful for quickly identifying patients with poor aerobic fitness levels in the clinical setting, but may not be long enough to produce physiological responses that could discern fine gradations of fitness.

**Purpose:** The role of hip adductor strength in persons with bilateral and unilateral knee injury is not well reported nor well understood. Studies that examined adductor strength often report no significant differences. Such studies include persons with unilateral and bilateral knee injuries, such as patellofemoral pain (PPFP). This pilot investigation separated those with unilateral or bilateral knee injury to assess differences in adductor strength and abductor-to-adductor strength ratio.

**Methods:** Males and females, ages 18-24, with a history of unilateral (n=10; 6 F, 4 M; PPFP) or anterior cruciate ligament reconstruction (ACL/R) or bilateral knee injuries (n=10; 6 F, 4 M; B PPFP or B ACL/R) of at least 6 months ago, were recruited from local universities. The Knee Outcome Survey-Sport Activity Scale (KOS-SAS) questionnaire was completed by all participants. Hip adductor and abductor strength was measured with a calibrated dynamometer. The ratio of abductor to adductor strength, and peak hip muscle strengths were compared between groups and limbs (p<0.05).

**Results:** Between groups, there were no significant differences in age, height, weight, BMI, Tegner Activity Level, or KOS-SAS (p>0.05). Hip adductor strength was significantly weaker (p=0.03) in persons with unilateral (2.8 ± 1.7 %BW*HT) compared to bilateral (6.0 ± 1.9 %BW*HT) injury. The hip adductor-to-abductor ratio was significantly greater (p=0.004) in persons with unilateral (1.6 ± 0.5 %BW*HT) compared to bilateral (3.3 ± 1.9 %BW*HT) injury. There were no significant differences between limbs in adductor strength in either group (p=0.6).
**Conclusion:** Hip adductors were significantly stronger in both limbs in persons with bilateral knee injury compared to persons with unilateral knee injury. In order for the hip adductor strength to be greater in persons with unilateral knee injury, the hip adductor strength [denominator] must be weaker. How persons compensate for an injury may depend on unilateral or bilateral involvement. This pilot study would be improved by including additional participants in PFPs or ACLR groups.

**Impact Of CrossFit And Non-CrossFit Programs On Range Of Motion**


(Relationships reported)

Range of motion (ROM) is vital for daily living and exercise. Flexibility is especially important since tightness limits ROM and often results in muscle imbalances leading to injury. Different types of training have different effects on ROM. CrossFit, a higher intensity program, is often stigmatized as a muscle building exercise regimen that decreases ROM. Previous studies have shown lower intensity programs may increase flexibility and decrease injury. To date, few studies have addressed ROM comparisons of CrossFit and non-CrossFit programs. **Purpose:** The purpose of this study was to compare shoulder and hip joint ROM in individuals participating in CrossFit and non-CrossFit fitness programs. **Methods:** An original protocol was developed with random assignment used to examine the ROM differences in a CrossFit and non-CrossFit fitness program observing 26 volunteers, consisting of nine males and 17 females aged 21.3 ± 4 years. Baseline ROM assessments for shoulder flexion, shoulder internal rotation, shoulder external rotation, hip flexion, hip extension, hip internal rotation were measured. Participants were randomly assigned to a CrossFit and non-CrossFit group. The participants completed eight-weeks of training, attending three, one hour sessions per week and refrained from any additional training. After training, the participants were tested using the same protocol as pretesting. Paired samples t-tests determined within group changes and one-way ANOVAs determined between group changes, and the alpha level was set at 0.05. **Results:** The CrossFit group revealed a statistically significant difference in left shoulder external rotation (pre: 80.85 ± 12.13; post: 62.28 ± 14.89; p = 0.033). No other statistically significant differences were found in the non-CrossFit group or between groups when comparing joint ROM in bilateral shoulder flexion, shoulder internal rotation, shoulder external rotation, hip flexion, hip extension, and hip internal rotation. **Conclusion:** This study followed current research trends, as there were few meaningful differences in ROM between and within CrossFit and non-CrossFit programs. However, this study found the CrossFit group to have a decrease in shoulder joint external rotation.

**Marijuana Use and The Health and Fitness of Physically Active Users and Non-Users**

Jonathon Lisano, Matthew Christensen, Alissa Mathias, Marcus Chavez, Kristina T. Phillips, Jeremy D. Smith, Laura K. Stewart. University of Northern Colorado, Greeley, CO.

Email: Lisa3700@bears.unco.edu

(No relationships reported)

Although an increasing number of states are legalizing marijuana (MJ) for recreational use, research examining the chronic fitness and health related effects of MJ use in humans has been limited. **PURPOSE:** To examine the health and fitness of physically active MJ users and non-users. **METHODS:** Physically active, healthy males (N = 23) were placed into groups based on MJ use: marijuana users (MU; n = 12) or non-users (NU; n = 11). Physical activity level and MJ use were confirmed using products at least once per week for the past 6-months. NU had not used MJ within the past 12-months. Descriptive measures including age, body mass (BM), resting heart rate (RHR), 123.2 ± 8.4 mmHg SBP, and 70.3 ± 10.0 mmHg DBP. RFEV1max (54.7 ± 10.2 min; p = 0.5). Rate of perceived exertion at termination for MU and NU were (8.9 ± 1.1 %) of VO2 max respectively, with no differences between the groups (p = 0.3, p = 0.8). **CONCLUSION:** The health and fitness of MU were not different from NU. We speculate that all individuals in the study were physically active and had VO2max, LT and OBLA in higher fitness categories, it is possible that exercise provided protection against any marijuana related side effects in a healthy, male population. Funded by: FRP-NPP at UNC.

**Effect Of Pacing Strategy During The Final Two Minutes of a Self-paced VO2Max Test (spv)**

Sangwoo Lee1, Nicholas Hanson1, Carter Reid1, Timothy Michael, FACSM2, Carol Weideman1, Cory Scheidler3. Western Michigan University, Kalamazoo, MI. 1Northern Kentucky University, Highland Heights, KY.

(No relationships reported)

Self-paced VO2max tests (SPVs) have increasingly been used as an alternative to traditional closed-loop protocol with predetermined workload increases. SPVs have been shown to produce values that are as high, and sometimes higher, than traditional protocol. What is not known is if the pacing strategy during the final two minutes of the test affects the maximal values attained. **PURPOSE:** Compare two different pacing strategies, conservative and aggressive, during the final two minutes of a 10-minute SPV. **METHODS:** Fourteen healthy subjects (29.36 ± 5.6 years; mean ± SD) volunteered to participate. After a familiarization session, subjects completed two SPVs. The SPV protocol was determined by random assignment with a total test time of 10 minutes exactly. Subjects were asked to maintain prescribed ratings of perceived exertion (RPE) levels of 11 (light), 13 (somewhat hard), 15 (hard), 17 (very hard) and 20 (maximal exertion). During the final stage, subject used either a conservative (CON) or aggressive (AGG) pacing strategy. In CON, subjects were asked to use the entire 2 min. stage and gradually build to RPE20. Conversely, in AGG they were asked to start the last stage immediately at RPE20, knowing full well they would have to decrease their speed toward the end of the test. The primary variables collected were relative VO2max (ml/kg/min), respiratory exchange ratio (RER) and maximum heart rate (HRmax). After the study they were asked which strategy they preferred. Paired samples t-tests were used to compare the mean values found in each condition. **RESULTS:** There was no difference in VO2max values between AGG (58.8 ± 8.8 ml/kg/min) and CON (58.3 ± 7.9). Similarly, no differences were seen in HRmax between AGG (186.7 ± 4.2 bpm) and CON (187.0 ± 4.9 bpm). The maximal RER recorded in AGG (1.25 ± 0.09) was significantly higher (p = 0.05) than CON (1.18 ± 0.07). Of the 12 subjects that responded to the question about preference, 7 (58%) preferred the AGG strategy. **CONCLUSION:** These results suggest that the pacing strategy used during the final two minutes of an SPV does not affect the maximal VO2 or HR values that are elicited. The maximal RER was higher in AGG, which suggests a higher anaerobic component with this strategy. Perhaps more subjects chose that strategy because they felt that a greater amount of effort was involved.

**Validation of a 6-s Cycle Ergometry Sprint to Measure Peak Power in Recreationally Active Females**

Scott M. Graham1, Fergal Grace2, Nicholas Sculthorpe3, Julian Baker1, Chris Connnaboy4, Marianne F. Baird1. 1Edinburgh Napier University, Edinburgh, United Kingdom. 2Federation University, Ballarat, Australia. 3University of the West of Scotland, Hamilton, United Kingdom. 4University of Pittsburgh, Pittsburgh, PA.

Email: S.Graham@napier.ac.uk

(No relationships reported)

The 30-s Wingate Anaerobic Test (WAnT30) is frequently used to determine peak anaerobic power (PP). When PP, which is generally achieved within the first 5-s is the primary measure of interest, there may be no advantage in completing a 30-s test. It is not clear if a shorter test can be validated against the WAnT30. To determine if a modified 6-s anaerobic test could be used to measure PP as an alternative to the WAnT30, knowledge of the 6-s anaerobic component with this strategy. Perhaps more subjects chose that strategy because they felt that a greater amount of effort was involved.

**Effect Of Pacing Strategy During The Final Two Minutes of a Self-paced VO2Max Test (spv)**

Sangwoo Lee1, Nicholas Hanson1, Carter Reid1, Timothy Michael, FACSM2, Carol Weideman1, Cory Scheidler3. Western Michigan University, Kalamazoo, MI. 1Northern Kentucky University, Highland Heights, KY.

(No relationships reported)

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**Effect Of Pacing Strategy During The Final Two Minutes of a Self-paced VO2Max Test (spv)**

Sangwoo Lee1, Nicholas Hanson1, Carter Reid1, Timothy Michael, FACSM2, Carol Weideman1, Cory Scheidler3. Western Michigan University, Kalamazoo, MI. 1Northern Kentucky University, Highland Heights, KY.

(No relationships reported)
discomfort and would allow performance of other maximal tests in the same session. The regression equation provided in this study could be used to predict an individual’s PP during WAnT from WAnT6.

### Board #182
**June 1 3:30 PM - 5:00 PM**
**Evaluating Upper-body Strength And Power From A Single Test: The Ballistic Push-up**
Ran Wang, Jay R. Hoffman, FACSM, Eliahu Sadres, Sandro Bartolomei, Tyler W.D. Muddle, David H. Fukuda, Jeffrey R. Stout, FACSM, *University of Central Florida, Orlando, FL. Wingate Institute for Physical Education and Sport, Netanya, Israel. (Sponsor: Jay Hoffman, FACSM)*

Email: wagnermanx@knights.ucf.edu

(No relationships reported)

Muscular strength and power are major determinants for many explosive, short duration sporting events. Consequently, the assessment of muscular strength and power is imperative for training program design and talent identification purposes. The one repetition maximum (1RM) squat and bench press are the most frequently used field tests for assessing lower and upper body strength, respectively. However, time constraints and maximal testing for untrained individuals may limit the use of 1RM testing in large population groups. Additionally, there has been only a limited number of investigations that have focused on the evaluation of upper body muscular power.

**PURPOSE:** The purpose of this study was to examine the reliability of the ballistic push-up (BPU) exercise, and to develop prediction equations for 1RM bench press and upper-body power. Specifically, recreationally-active men completed a 1RM bench press and two BPU in three separate testing sessions. Intraclass correlation coefficients (ICC) of peak and mean force, peak velocity, flight time, and peak and mean power were calculated and used to examine the reliability of the BPU. Mean force, flight time and peak velocity was used to develop equations to predict the 1RM bench press, and time-based and velocity-based upper-body power. **RESULTS:** ICC’s ranged from 0.849 - 0.971 for the BPU measurements. Multiple regression analysis provided the following 1RM bench press prediction equations: 1RM = 0.31 × Mean Force - 1.64 × Body mass + 0.70 × (R² = 0.837, SEE = 11 kg); time-based power prediction equations: Peak Power = 11.0 × Body Mass + 2012.3 × Flight Time - 338.0 (R² = 0.658, SEE = 82 W); and velocity-based prediction equation: Peak Power = 8.1 × Body Mass + 818.6 × Peak Velocity - 762.0 (R² = 0.797, SEE = 115 W); Mean Power = 5.2 × Body Mass + 435.9 × Peak Velocity - 467.7 (R² = 0.838, SEE = 57 W). **CONCLUSIONS:** Results indicate that the BPU is a reliable test for both upper body strength and power. Furthermore, the mean force generated from the BPU can be used to predict 1RM bench press, while peak velocity and flight time measured during the BPU can be used to predict upper-body power. These findings support the potential use of the BPU as a valid method to evaluate upper-body strength and power.
The NCAA recently added women’s triathlon to its “emerging sports” program. Prior literature has focused on the attributes of highly trained, junior elite, and recreational triathletes and comparative benchmark data of varsity intercollegiate triathletes are currently unavailable.

PURPOSE: To examine physiological attributes of NCAA varsity intercollegiate triathletes.

METHODS: Six male (age 19.0 ± 1.1 yrs) and 3 female (age 18.7 ± 0.6 yrs) varsity intercollegiate triathletes underwent physiological testing during maximal treadmill run and cycling protocols, and a 1km pool swim time trial performed on separate days. Physiological indices assessed for each protocol are presented in the table. Data were compared to determine sex differences between athletes in the present study and versus highly trained, junior elite and recreational triathletes as reported in the literature.

RESULTS: Group differences were observed between males and females for the run and cycle protocol.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Male</th>
<th>Female</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run VO\textsubscript{peak} (ml/kg/min)</td>
<td>66.2 ± 5.9</td>
<td>49.1 ± 4.6</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>HRmax (bpm)</td>
<td>194.8 ± 8.3</td>
<td>201.0 ± 7.2</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Lactate Peak (mmol/l)</td>
<td>7.8 ± 2.5</td>
<td>11.0 ± 3.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>BIKE VO\textsubscript{peak} (ml/kg/min)</td>
<td>60.9 ± 6.2</td>
<td>51.5 ± 2.1</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>HRmax (bpm)</td>
<td>188.3 ± 3.6</td>
<td>184.7 ± 13.9</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Lactate Peak (mmol/l)</td>
<td>10.7 ± 2.5</td>
<td>8.4 ± 1.6</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Peak Watts</td>
<td>323.5 ± 14.4</td>
<td>283.3 ± 38.1</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Watts/kg</td>
<td>4.7 ± 0.2</td>
<td>4.7 ± 1.3</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>SWIM HRmax (bpm)</td>
<td>182.2 ± 9.4</td>
<td>190.6 ± 9.2</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>HRavg (bpm)</td>
<td>170.2 ± 8.8</td>
<td>180.6 ± 10.1</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Breaths per lap</td>
<td>8.7 ± 1.4</td>
<td>11.0 ± 0.8</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>1 km time (min:sec)</td>
<td>12:45.6 ± 0.46</td>
<td>14:34.8 ± 1.03</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Sex appears to have no significant effect on the percent difference of bilateral and unilateral torque asymmetries despite several different known physiological aspects. This could be due to the fact that our subject population was recreationally trained individuals, which can represent multitude of sports, workouts and training programs. Future research should investigate sex differences in sport-specific athletes.

The bench press and pushup are popular exercises used to develop strength and power. They are also often associated with equal benefits in developing upper body muscular endurance. However, it is unknown how they are related as pushups use a bodyweight load while the bench press uses greater weight.

PURPOSE: To investigate the correlation between bench press and pushup repetitions to failure relative to a bodyweight load.

METHODS: Fourteen recreationally trained males (age=24.71±2.64yrs, height=177.29±6.87cm, mass=83.74±9.41kg) performed 1 RM bench press test and an isometric pushup to determine bodyweight load supported in both the up and down positions. Grip width on the bench press was measured as the distance between middle fingers and this distance was used for hand placement during pushups. Subjects were positioned for a pushup with their hands on an AMT1 force plate and their feet off the plate. Isometric force was measured for 3 seconds in the up and down positions, in random order. For the down position, tripods were parallel to the floor, while for the up position, tripods were perpendicular to the floor. Days 2 and 3 consisted of performing repetitions to failure for either the bench press or pushup exercise. For the pushup, subjects performed repetitions following an 80/s tempo. The test was terminated if they failed to complete a full repetition, could not maintain cadence or there were three faults in form. For the bench press, subjects performed repetitions to failure with a load that was equal to the average relative bodyweight force of the up and down pushup positions.

RESULTS: There was a very low relative correlation (r=0.299) between bench press repetitions to failure (29.5±7.59) and push up repetitions to failure (33.0±16.53). Load for the bench press test, relative to their 1RM (0.51±0.07) was significantly less than the pushup down position (0.75±0.03), up position (0.71±0.03), and the average of the up and down positions (0.73±0.03) relative to their body mass.

CONCLUSIONS: The bench press and pushup may be used as two distinct and different exercises that use very different loads, which could result in dissimilar upper body muscular endurance adaptations.
was 152.60±74.04mm. Non-dominant Q dynamic PT was 219.50±68.14Nm and H was 152.60±47.04Nm. Non-dominant Q isometric PT was 240.02±80.49Nm and a RER higher than 1.15.

CONCLUSIONS: A progressive speed skating test till exhaustion appears to measure maximum aerobic capacity of elite skaters. Nonetheless, many other data collections should be done with different levels of skaters, at different ages and gender, with the aim of creating a VO2max. estimating chart and also confirmed with a laboratory-based VO2max. measurement on cycle ergometer.

2179 Board #192 June 1 3:30 PM - 5:00 PM Muscle Function Tests as Field Measures of Tibial Bone Strength
Rebekkah J. Reichert, Andrew Denys, Sherah McCurdy, Vanessa R. Yingling, FACSM, California State University, East Bay, Hayward, CA. (No relationships reported)

Osteoporosis is a leading cause of fracture and morbidity in older populations (Colonom: Emeric & Saag, 2006). An effective strategy in minimizing the risk of osteoporosis is an active lifestyle in adolescence (Turner, 2004). Suboptimal bone strength in individuals who do not reach peak bone mass during childhood or adolescence may contribute to the development of fractures later in life (Bachrach, 2001). Bone strain and, thus, structural adaptations of bone are due to muscle forces acting on bone during activity. (Robling, 2009). Therefore, field measures of muscle force could be used to assess skeletal health. PURPOSE: The purpose of this study is to investigate the relationship between common muscle function tests (1 rep max/body weight, relative grip strength, peak power) and bone strength variables in a healthy college-age population. METHODS: Twenty participants from CSU East Bay, 9 females and 11 males (age yrs) 23.4±2.5, height (m) 1.71±0.1, body fat % 20.8±9.6) performed a relative grip test using a hand dynamometer, a one repetition maximum (1 RM) on a leg press machine and a vertical jump test using the Vertec. Peak power was then calculated from vertical jump height. Moment of inertia (I), cortical area (CA), cortical bone mineral density (cBMD), and strength-strain index (SSI) were measured using peripheral Quantitative Computed Tomography (pQCT) to determine bone strength at the 50% luna site. Correlation analysis determined muscle bone relationships. RESULTS: 1 RM/BW and relative grip strength were not significantly correlated with bone strength parameters. Peak power resulted in significant, positive correlations with J (R²=0.6089, p<0.008), CLAR (R²=0.6030, p<0.008), and SSI (R²=0.5948, p=0.009). Peak power resulted in a significant, but negative relationship with cBMD (R²=0.7080, p=0.002). CONCLUSION: Our findings suggest peak power is a significant surrogate measure of bone strength in a healthy college-age population. Although cBMD had a negative relationship with peak power, this finding is possibly due to low numbers of participants at this stage. This study is important because health professionals and physical educators can use peak power as a practical and non-invasive method of determining bone strength and health.

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RESULTS: There were significant relationships between age and VJ power output ($r=−0.635; P=0.001$) and age and isotonic MP ($r=−0.410; P=0.009$). The correlation coefficients were similar ($r=−0.412$), however, there is a moderate difference (effect size=0.31) between the relationships.

CONCLUSIONS: Single-joint isokinetic power output may demonstrate a weaker, but similar relationship with age when compared with more functional VJ assessments.

2183 Board #196
June 1 3:30 PM - 5:00 PM
Improved Fitness Trends In Firefighter Recruits Over A 12-year Span
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Firefighting is a physically demanding occupation. As a population, firefighters (FFs) are at high risk for many health-related issues (e.g., sudden cardiac events, obesity, hypertension, fatigue, depression, post-traumatic stress disorder, anxiety). Physical fitness is an effective preventative strategies FFs can use to improve health and performance, as well as combat multiple health risks. PURPOSE: Examine physical fitness parameters and assessments in FFs from 2004 through 2016. METHODS: Participants were male FF recruits (Age=556, 26.3±2.4 yrs; ht: 179.98±37.2 cm, wt: 87.20±15.0 kg) from the Illinois Fire Service Institute. Baseline descriptive measurements included waist (89.98±11.4 cm) and hip circumference (95.71±9.8 cm), and BMI (26.97±4.21). Baseline fitness testing included measurements of cardiovascular endurance (1.5-mi run (12.87±1.77 min, M:SD: estimated VO₂max (41.54±5.10 ml·kg⁻¹·min⁻¹), muscular endurance [60-s sit-ups (31.6±8.5 reps), 60-s push-ups (40.3±12.3 reps), bench press (28.99:11.4 reps)], and flexibility [sit and reach (30.65±7.8 cm)] during the first week of a 6-wk fire academy. RESULTS: Significant differences were shown across time (P≤0.001, all ES=0.86-0.99) for weight and BMI, waist and hip circumference, 1.5-mi run time, 60-s push-ups, 60-s sit-ups, muscular endurance, and flexibility. Analyses examining trends over the 12-yr span revealed relationships between time and 1.5-mi run time (r=0.67, 60-s push-ups (r=0.51), muscular endurance (r=0.56), and flexibility (r=0.74). CONCLUSIONS: Over the span of 12 years, male FF recruits have shown increases in various fitness parameters (cardiovascular endurance, muscular strength/endurance, flexibility) while measures of weight, BMI, waist and hip circumferences have remained relatively stable and consistent. Measures of cardiovascular endurance (1.5 mi run time) improved by 11.9% over this time period, and measures of muscle strength/endurance (e.g., push-ups) increased by 21.8%. The data suggest that the fitness levels of male FFs are increasing as they begin their career in the fire service. These increases in fitness may reflect national efforts in the fire service to promote fitness and may lead to decreases in disease and work-related disability.

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Physical Activity Intervention Fitness Of Male’s Middle Students In China: A Systematic Review And Meta-analysis
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Purpose: Approximately 50 % of Chinese adolescent are not physically active enough to achieve health benefits. The purpose of this study was to systematically review and meta-analyze the effect of fitness for Chinese middle students interventions on physical activity.

Methods: CNKI, Wanfang Data, Weipu Data and Web of Science Database were systematically searched to identify all relevant randomized controlled trials that evaluated the effect of fitness for Chinese middle students on physical activity from 2011to 2015 years. According to the study design, the data of the boys were selected for analysis. The studies were described and effect size data were included in meta-analyses.

Results: Eighteen studies were included in the review and ten reported statistically significant improvements in physical activity. A meta-analysis of ten studies showed a statistically significant effect (SMD=0.21, P<0.004 < 0.01) of Grip on physical activity immediately post-intervention. The intervention had a statistically significant effect (SMD=0.20,P=0.006<0.01) of the Sit and Reach. However, it is not statistically significant effect of Vital Capacity (SMD=0.19,P=0.25). Height (SMD=0.16,P=0.12) and Weight (SMD=0.13,P=0.06) on physical activity immediately post-intervention.

Conclusion: Daily activity is to be effective at increasing weekly duration of exercise in middle students, but the effect size is small. Training Chinese adolescents to encourage increased physical activity may provide an effective method for reaching their fitness health. More studies with detailed quantification of total physical activity will help to find more precise relative estimates for different levels of activity of Chinese adolescents.
INTRODUCTION: Peak and mean power assessed, by a vertical jump, has been shown to be a strong predictor of bone mineral content (BMC) in children and adolescents. However, this relationship has not been demonstrated in young women. PURPOSE: To examine the relationship between vertical power and BMC in college-aged women. METHODS: Body composition and BMC was assessed by dual-energy X-ray absorptiometry in 77 women (age: 20.9 ± 2.2 years, height: 163.3 ± 12.7 cm, body mass: 60.9 ± 8.5 kg). Peak and mean vertical power was determined using a Vertec® scale and was calculated by the Sayers and Lewis equations, respectively. RESULTS: Peak and mean vertical power were 3109 ± 521 Watts and 841 ± 125 Watts, respectively. Relationships were observed between BMC and peak vertical power (r = 0.52, p < 0.001) as well as mean vertical power (r = 0.58, p < 0.001). Multiple linear regression (r = 0.63, p < 0.001) resulted in the following equation: BMC = 0.436 - (0.00107 * Peak Power) + (0.00635 * Mean Power). Additionally, a strong relationship was observed between body mass and BMC (r = 0.75, p < 0.001). CONCLUSIONS: The results of this study indicate that 46% of the variability in BMC of college-aged women can be predicted by peak and mean vertical power. These findings support the use of an assessment of vertical power as a predictor of bone strength in young women. We recommend that college-aged women with a goal to improve BMC perform plyometric types of activities that involve jumping and rebounding.

PURPOSE: To analyze the agreement of ventilatory responses of continuous and interval specific Taekwondo cardiopulmonary exercise tests. METHODS: Twelve male taekwondo athletes (age: 20 ± 2 yrs; body mass: 67.5 ± 5.7 kg; height: 173 ± 8 cm) visited the laboratory three times. The University ethics committee approved this study (opinion #765.698). In the first visit, resting ventilatory variables were measured continuously with expired gas analyzer VO2000 (MedGraphics, Saint Louis, USA), with 20s sampling. Ventilatory thresholds were determined by the ventilatory equivalents method. Shapiro-Wilk test was performed to verify normality. Parametric data were described by average (standard deviation), 95% Confidence Interval of Median, and compared using Wilcoxon test (effect size: z/√n). Non-parametric data were described by median (interquartile range), 95% Confidence Interval of Median, and compared using Kruskal-Wallis test (effect size: z/Vn). Ventilatory responses agreement was assessed with Intraclass Correlation Coefficient (ICC) and ICC 95% confidence interval calculation. P<0.05 was adopted for all tests. RESULTS: The results are present in Table 1. CONCLUSION: Besides the absence of significant difference between the test, interval, and continuous methods may not be interchangeable to assess Taekwondo athletes’ ventilatory responses. Additionally, interval seems to yield higher performance, with shorter kick intervals, for peak and ventilatory thresholds in the specific tests. Supported by CAPES, FAPERJ, and CNPq.
was measured using a VO2 max test, and anaerobic power was measured using a

**METHODS:** Aerobic fitness and anaerobic power were measured in a sample of

**RESULTS:** A total of 13 female athletes completed this study. Maximal aerobic fitness

**CONCLUSIONS:** Preseason training can have a positive effect on aerobic endurance

**PURPOSE:** To examine training-induced changes in aerobic fitness and anaerobic power in a sample of division I, female college basketball players.

**METHODS:** Aerobic fitness and anaerobic power were measured in a sample of female college basketball players before and after preseason training. Aerobic fitness was measured using a VO2 max test, and anaerobic power was measured using a Wingate test. Preseason training lasted one month and consisted of 8 hours per week of a combination of weight training, high-intensity interval sprint training, and skill workouts. Paired-sample t-tests were used to examine change pre- and post-intervention. Pearson correlations were conducted to examine potential associations among variables.

**RESULTS:** A total of 13 female athletes completed this study. Maximal aerobic fitness significantly (p = .013) increased after preseason training, from 47.9 to 49.9 kg/m²/min. Relative peak power and relative mean power significantly increased after preseason training from 8.8 ± 0.7 W/kg to 9.2 ± 0.7 W/kg; p=0.028. Entry Level Operators demonstrated greater TF (p=0.529), PAnP (p=0.598), or VO2max (p=0.145). Differences between groups were evaluated using independent samples t-tests, or Mann-Whitney U tests if required (p < 0.05). **RESULTS:** Entry Level Operators demonstrated greater 

**PURPOSE:** To determine if within-country sex differences in 20-meter shuttle run test (20mSRT) performance are related to global gender inequality indices. METHODS: A systematic review was carried out to identify studies that reported 20mSRT descriptive data on apparently healthy children and youth aged 9 to 17 years. Descriptive data were standardized to running speed (km/h) at the last completed stage. Within-country 20mSRT performance for girls and boys were calculated as population-weighted mean z-scores relative to children of the same age from all countries. Within-country population-weighted mean z-scores for girls and boys were subtracted to represent the mean z-score difference in 20mSRT performance for each country, described as Z<sub>g−b</sub>. Five gender inequality indices were identified as potentially relevant in describing sex differences in 20mSRT performance across countries (i.e., Gender Equity Index, Gender Empowerment Measure, Global Gender Gap Index, Gender Inequality Index, and Social Institutions and Gender Index). Pearson’s correlations were calculated to describe the associations between Z<sub>g−b</sub> and indices of gender inequality. **RESULTS:** Sex-specific z-scores were calculated from 1,141,514 children and youth (48% female). Within-country 20mSRT performance of girls and boys were very strongly correlated (r = 0.92; 95%CI: 0.87, 0.96). The sex differences in performance (Z<sub>g−b</sub>) were calculated for 45 countries representing five continents. The mean Z<sub>g−b</sub> was 0.04 ± 0.23 with values ranging from -0.48 (girls had a better 20mSRT mean z-score relative to boys) to 0.67 (boys had a better 20mSRT mean z-score relative to girls) standardized units across the 45 country sample. Z<sub>g−b</sub> across countries were moderately and negatively correlated with the Global Gender Gap index (r = -0.42; 95%CI: -0.65, -0.12). Correlations across all other indices were of low-to-moderate strength, ranging from r = 0.23 (95%CI: -0.46, 0.11) to r = 0.25 (95%CI: -0.05, 0.52). **CONCLUSIONS:** Although various indices measure gender inequality, it appears that the underlying constructs of these indices vary substantially. Furthermore, gender inequality does not fully explain sex differences in 20mSRT performance, and other broad country-level aspects may better explain the differences between boys and girls.
INTRODUCTION: Football specific testing is done at all levels of football to assess player’s strength, speed, and agility. Differences exist in anthropometric profiles between skill position players and non-skill position players. These differences in physical performance measurements are due to the nature of physical requirements based on position. PURPOSE: To look at the relationship between body fat percentage (BF%), and speed, agility, jumping, and strength performance measurements. METHODS: Eighty-five (n=85) football players participated and were categorized into two groups: skill players (n=55) and non-skill players (n=30). BF% was assessed via air plethysmography for all players. Physical performance measurements included: clean and jerk, bench press, squat, 40-yard dash, pro agility, broad jump, and vertical jump. Pearson’s product moment correlation coefficient was calculated between BF% and physical performance measures. Bivariate correlation comparisons were conducted to identify differences in correlation coefficients of skilled to non-skilled athletes. Statistical significance set at p ≤ 0.05. RESULTS: Significant correlations were observed in the relationship between speed, strength, and agility measures and BF%. As for speed (r=.740, p=.003; and r=.730, p=.005 respectively), BF% was associated with more efficient SFGT performance, whereas chronic HRV was associated with physical activity and strength measures. These outcomes indicate that HRV parameters may reflect the physiological status of FFs and the complex interaction between HRV, physical activity and fitness outcomes. Supported by the NSCA’s Senior Investigator Research Grant.

INTRODUCTION: The purpose of this study was to determine the relationship between heart rate variability (HRV) versus firefighter (FF) occupational performance, fitness characteristics and physical activity measures. METHODS: Twelve male structural firefighters (age: 37.3±7.6 yr; height: 183.2±7.1 cm; body mass: 90.4±13.7 kg; body mass index: 26.9±2.4 kg m−2) wore an accelerometer for 19.1±5.8 days to measure physical activity. Physical activity was also quantified by a self-reported log. HRV was determined with a portable ECG device upon waking for 20:8±4.6 days. HRV was assessed daily, upon waking, and included SDNN, RMSSD, High frequency (HF) and low frequency (LF) components. FF’s completed a simulated fire ground test (SFGT) and a battery of fitness tests including estimated 1-repetition maximum shoulder press, deadlift, bench press, bent over row and kettlebell swing, and a submaximal prediction of aerobic capacity. HRV was assessed the day of the SFGT (acute) and averaged over all days during the observation period (chronic). Descriptive statistics were calculated as mean ± standard deviation and Pearson product moment correlation coefficients were calculated. The level of significance was set at p ≤ 0.05. RESULTS: SDNN values recorded the same day as the SFGT were correlated with decreased SFGT time on 3 individual SFGT tasks (r=.7→.745, p<.05) and overall SFGT time (r=.735, p=.016). Chronic HF was correlated with frequency of moderate-to-vigorous physical activity (r=.728, p=.011). RMSSD and SDNN were also correlated with shoulder press strength (r=.885, p<.001; and r=.875, p=.01 respectively) and bench press strength (r=.775, p=.008; and r=.758, p=.011 respectively). CONCLUSIONS: Increased acute HRV was associated with more efficient SFGT performance, whereas chronic HRV was associated with physical activity and strength measures. These outcomes indicate that HRV parameters may reflect the physiological status of FFs and the complex interaction between HRV, physical activity and fitness outcomes. Supported by the NSCA’s Senior Investigator Research Grant.

INTRODUCTION: Physiological outcome measures were assessed in female, male, and premenopausal (PM) rats to determine the effect of a college-level physical activity (PA) class on fitness level and BMI. METHODS: Participants were 124 college students (mean age: 20.8±1.0 years, 59% male, 33% of whom enrolled in a PA class for the semester). The PA classes met two or three times a week for a total of 150 minutes/week, focusing on different activities addressing health-related physical fitness. Body mass index (BMI), Progressive Aerobic Cardiovascular Endurance Run (PACER), curl-ups, push-ups, trunk lift, and sit and reach tests were administered to the participants at the beginning (pretest) and end (posttest) of the semester. Performances of each measure at the two test points were compared separately by gender with paired-samples t-tests and with an alpha level set at 0.05. RESULTS: For males, significant improvements (p < 0.001) occurred between pre- and post-test results in PACER laps (59.4 ± 21.8 vs. 65.6 ± 22.8), curl-ups (55.4 ± 20.7 vs. 62.1 ± 19.0), push-ups (23.6 ± 6.6 vs. 27.2 ± 7.8), and trunk lift inches (10.2 ± 2.2 vs. 12.5 ± 2.1). Sit and reach (inches) showed a non-significant improvement (17.3 ± 3.7 vs. 17.5 ± 3.5, p = 0.10), and no improvement was shown in BMI (25.8 ± 4.7 vs. 25.8 ± 4.5, p = 0.38). As for females, significant improvement (p < 0.01) was observed in PACER laps (35.3 ± 11.7 vs. 40.7 ± 12.7), curl-ups (43.6 ± 21.8 vs. 50.4 ± 20.4), push-ups (18.8 ± 6.6 vs. 21.1 ± 8.1), trunk lift inches (11.8 ± 2.5 vs. 13.0 ± 1.7), and sit and reach inches (18.6 ± 3.6 vs. 19.3 ± 3.9). The only measure remaining unchanged in females was BMI (23.6 ± 3.1 vs. 23.6 ± 3.0, p = 0.73). CONCLUSIONS: While there may be a tendency of weight gain and fitness decline among university students, PA classes focused on health-related physical fitness may be effective in maintaining body mass index and improving health-related physical fitness in college students. Future research needs to examine the longevity of these changes in fitness, find ways to help students continue along a similar trajectory of improved health, and explore whether improved fitness levels lead to improved academic performance.
to 0.69), having an unhealthy lean mass [OR 2.51 (95% CI 1.74 to 3.60), unhealthy levels of fat mass [OR 0.46 (95% CI 0.29 to 0.74)], unhealthy SLJ performance [OR 1.55 (95% CI 1.09 to 2.19)], unhealthy handgrip performance [OR 3.77 (95% CI 2.12 to 6.20)], and unhealthy muscular index score [OR 2.22 (95% CI 1.42 to 3.47)].

CONCLUSIONS: In conclusion, body composition and MF influence bone health on a sample of children and adolescents from Colombia. Thus, promoting strength adaptation and preservation in Colombian youth will help to maximize bone health, an important protective factor against osteoporosis later in life.

The measurement of Hand Grip Strength (HGS) is one of the methods for evaluating the maximum isometric strength of the hand and forearm muscles, that is related to predictive factors of health conditions of people. In addition, this is an indicator that relates the physical condition of young people with their Body Composition (BC), identifying Cardiovascular Risk (CR) factors in the university population. 

PURPOSE: The purpose of this study is to relate the HGS and the BC associated with the CR factors in the Students of Elective Course of Physical Activity and Sports (SECAPS) of the Pontificia Javeriana University (PJU) Bogota, D.C. Colombia. 

METHODS: Descriptive correlational study, which 91 students aged an average of 22.5±4.5 years old, were assessed n=40 (44%) males and n=51 (56%) females. To evaluate the HGS was used an hydraulic hand dynamometer owner’s manual JAMAR®1, it was registered two measurements of Right Hand (RH) and Left Hand (LH) in seated position, using the best result for analysis. A biochemical impedance scale OMROM® HBF-510LA, was used to evaluate the BC, which shows the percentage of Body Fat (BF) and Skeletal Muscle (SM). 

RESULTS: Values of HGS for RH and LH were compared, demonstrating that in the RH were higher than the LH for both genders, the difference of HGS was 8.4% (4.5%). For 78% of students n=71, are in an average classification low for HGS for the population. BC shows that the BF was classified as high, 24.2% (n=22) and very high, 35.2% (n=32) for both genders. It was evidenced that the BF of females 23.1% (n=21) was classified as very high in comparison to males, 12.1% (n=11). The SM, had a behavior classified as normal 65.9% (n=60), with a trend to the lower limit of SM with low level in males 62.5% (n=25), according to OMROM® parameters. Conclusion: For males, was found a relation between HGS and BC, lower SM, greater BF and less HGS, become predisposing factors to develop CR. On the other hand, females showed a normal SM, higher BF and less HGS, it looks apparently normal, but hides a healthy appearance that prevents the CR control. Those indicators are useful to reorient the objectives of integral formation towards create healthy habits to SECAPS.

INTRODUCTION: Muscle biopsies have played a large role in the understanding of skeletal muscle physiology. While discomfort from the biopsy process is often reported, it is unknown if the activation of pain pathways and/or the administration of lidocaine during the procedure affects the motor control of the same muscle.

PURPOSE: To examine the effects of a skeletal muscle biopsy on the motor unit firing properties of the vastus lateralis (VL) in young men.

METHODS: Fifteen young men (Age: 22 ± 2 years) underwent skeletal muscle biopsies of the VL of the right leg. Prior to and following the biopsy, subjects completed a maximal effort contraction. Four surface electromyographic signals were detected from the VL during the maximal contraction and decomposed into their constituent motor unit action potential trains. The relationship between maximal motor unit firing rate (FR) and recruitment threshold (RT) were calculated for each subject pre- and post-biopsy. Separate Paired-Samples T-Tests were run to determine changes in slope coefficients and y-intercepts. 

RESULTS: Our findings showed no significant change in slope (Pre: 0.40 ± 0.32, Post: 0.40 ± 0.21; p > 0.96) or y-intercept (Post: 29.0 ± 7.3; Post: 30.8 ± 7.6; p =
During muscle regeneration. More studies are needed to further characterize the specific drive towards a balance between anabolic and catabolic processes that reflect a balance between anabolic and catabolic processes.

CONCLUSION: Despite reports of discomfort, the results of the present investigation suggest that the motor unit firing properties of the VL of young males are minimally affected by the process of a skeletal muscle biopsy. Specifically, our data shows no significant change in the relationship between \( FR_{\text{max}} \) and \( RT \). Researchers and scientists that utilize muscle biopsies can take comfort in knowing that the process does not affect the motor control of the muscle during subsequent contractions.

The purpose of this study was to investigate serum levels of CORT and GH during muscle damaging exercise. The competitive (anabolic vs catabolic) hormones growth hormone (GH) and cortisol (CORT) following muscle damaging exercise.

RESULTS: The participants reported significant muscle strength decrement about the responses of the competitive. (40% decrease in muscle strength) and muscle soreness post exercise (p<0.01-0.001). Serum CORT levels showed a 40% increase from 95.7±113.9 ng/mL at baseline to 306.5±29.8 ng/mL at 6, 48 and 120 hours after exercise, respectively, compared to 22.0 Femoral neck

<table>
<thead>
<tr>
<th>Age</th>
<th>BMI</th>
<th>Stress fracture type</th>
<th>DXA (g/cm2) and Z-score (g/cm2)</th>
<th>DXA (g/cm2) and Z-score (g/cm2)</th>
<th>Total T (ng/dL)</th>
<th>Vitamin D (ng/mL)</th>
<th>Serum Ca (mg/dL)</th>
<th>PTH (pg/mL)</th>
<th>24 hour urine Ca (mg/dL)</th>
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<tbody>
<tr>
<td>40</td>
<td>22.0</td>
<td>Femoral neck</td>
<td>0.882 -2.2</td>
<td>-0.858 -0.9</td>
<td>372</td>
<td>59</td>
<td>9.8</td>
<td>21</td>
<td>259</td>
</tr>
<tr>
<td>47</td>
<td>27.7</td>
<td>Tibial metatarsal</td>
<td>0.982 -0.7</td>
<td>0.691 -1.1</td>
<td>216</td>
<td>48</td>
<td>9.4</td>
<td>33</td>
<td>440</td>
</tr>
<tr>
<td>44</td>
<td>23.5</td>
<td>Tibial</td>
<td>1.092 -1.1</td>
<td>1.116 0.4</td>
<td>230</td>
<td>23</td>
<td>9.8</td>
<td>32</td>
<td>188</td>
</tr>
<tr>
<td>22</td>
<td>23.1</td>
<td>Metatarsal</td>
<td>1.024 -1.1</td>
<td>1.002 -0.4</td>
<td>242</td>
<td>36</td>
<td>10.0</td>
<td>24</td>
<td>476</td>
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Levels of testosterone (T) were low normal in 3 of the 4 men. 24 hour urine calcium was elevated in 2 of the 4 men. DXA Z-score at the spine was frankly abnormal in 1 man with a femoral neck stress fracture. The remaining 3 of 4 men had Z-scores within normal limits, however lower than expected for an endurance athlete (less than -1.0.).

CONCLUSIONS: Alterations in testosterone as well as pituitary gonadotrophins (FSH and LH)[1] have mainly been reported in long distance runners [2], but we suspect such alterations exist in endurance athletes of all types. With the increase in US participation in triathlons, this finding may become more prevalent.

Studies at our institution have suggested concerns for low BMD in competitive cyclists with increases in markers of bone resorption. [3, 4] However, abnormal T levels have not been found in this cohort. There may be alterations in urinary calcium and transient changes in PTH playing a role.

The combination of endurance activities coupled with limited energy availability may lead to low T and stress fractures, features of a “male athlete triad.” Patients may not complain of hormonal symptoms such as muscle loss or low libido at these levels.

Thus, we urge our colleagues to ask endurance male athletes about energy balance and nutrition.

Circulating Sclerostin Responses To Acute Weight And Non Weight Bearing Sport Activity In Pre Adolescent Males

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(No relationships reported)

Mechanical loading, i.e. physical activity and/or exercise, promotes bone formation during growth. Sclerostin, a glycoprotein, mediates osteocytes’ response to mechanical loading by inhibiting the Wnt/catenin pathway thereby inhibiting bone formation.

METHODS: In order to assess the response of circulating sclerostin following an acute session of three different sport activities. METHODS: Fifty-five pre-adolescent boys (age 10.1±1.2yrs) participated in a single practice of either soccer (N=20), running (N=17) or swimming (N=18). Anthropometry, habitual PA, nutritional intake, biological maturity, bone mineral density and content, and fitness status were measured at baseline. Blood samples were collected before and within 30 min post-exercise. Participants did not differ in any baseline measures. RESULTS: Sclerostin showed a modest decline (∼P<0.5) in response to soccer (pre: 213±45 pg/ml vs. post: 189±41 pg/ml and running (pre: 221±56 pg/ml vs. post: 193±49 pg/ml) but not in response to swimming (pre: 209±45 pg/ml vs. post: 203±58 pg/ml). Sclerostin changes (independent of group) were correlated with mean speed (r=0.41; P<0.05), total number of accelerations and decelerations (r=0.51; P<0.05) and number of jumps (∼P<0.6; P<0.05). CONCLUSION: Results of this study suggest that acute weight bearing exercise inhibits sclerostin levels slightly. Further work is needed to determine if this slight reduction alters bone mineral content.

Foot Posture and Mobility in Normal and Pronated Feet during Gait using High-Speed Stereo Radiography

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(No relationships reported)

Background and Purpose: Individuals with extremely flat or high arch foot postures have been shown to be at risk for the development of orthopaedic foot disorders. The longitudinal arch angle (LAA) as quantified by video camera and 3D motion capture has been shown to be at risk for the development of orthopaedic foot disorders. The purpose of this study was to use high-speed stereo radiography to assess midfoot posture and mobility in normal and pronated feet throughout the stance phase of gait.

Methods: A total of 13 feet from 7 subjects (mean age = 24 years; range 22 to 29 years) were examined in this study. Clinical LAA measures assessed with a goniometer were used to select 7 pronated feet (129.6°) and 6 normal feet (140.5°). Radiopaque beads (2 mm dia) were taped to the navicular tuberosity, the medial aspect of head of the first metatarsal, and the medial malleolus prior to static loaded and walking trials. 3D coordinates of the beads were captured during gait using a high-speed stereo radiography system. The LAA in the sagittal plane was measured throughout the stance period (Fig 3).

Post-Footwear Effects On Ankle Range Of Motion Post-Acute Weightbearing Exercise

THURSDAY, JUNE 1, 2017 6:00 PM - 7:30 PM

JUNE 1, 2017

Low vs. High Intensity Training: Effects on Ankle Range of Motion in Tennis Athletes

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(No relationships reported)

Purpose: The purpose of this study was to compare the effects of 1 week of low-intensity training to high-intensity training on ankle range of motion in tennis players.

Methods: Ten recreational tennis players (age: 23.1±3.3 years, body mass index: 24.1±3.3 kg/m²) were randomly assigned to either a low-intensity group (LI; n=5) or a high-intensity group (HI; n=5) for 1 week. The LI group performed low-intensity training (40% of VO2max) three times a week, with intensity monitored using HR monitoring. The HI group performed high-intensity training (80% of VO2max) three times a week. The training program was designed to maintain intensity, with the focus on distance and intensity. The training program was designed to maintain the intensity, with the focus on distance and intensity. Ankle range of motion (ROM) was measured at the beginning and end of the training period using a goniometer. The ankle ROM was measured in three planes: dorsiflexion/plantarflexion, eversion/inversion, and abduction/adduction.

Results: There were no significant differences in ankle ROM between the groups at the beginning of the training period. After the training period, the HI group showed a significant increase in ankle ROM compared to the LI group. The HI group showed an increase in ankle ROM by 15° compared to the LI group, which showed a decrease of 10°. This finding is significant because it suggests that high-intensity training can improve ankle ROM in tennis players, which may decrease the risk of ankle injuries.

Conclusions: The findings of this study indicate that high-intensity training can improve ankle ROM in tennis players, which may decrease the risk of ankle injuries. However, further research is needed to confirm these findings and determine the long-term effects of high-intensity training on ankle ROM.

D-70 Free Communication/Poster - Interval Training

The Effects Of A Six-week HIIT Program On CVD Risk Factors In Sedentary Individuals

Melissa A. Whidden, Nicholas M. Hoster, Melissa A. Reed. West Chester University, West Chester, PA.

(No relationships reported)

Regular physical activity is linked to improved cardiovascular (CV) health. High intensity interval training (HIIT) is a type of CV exercise that involves interchanging intervals of high intensity exercise (usually 80-100% of maximum heart rate) with lower intensity recovery periods. PURPOSE: The purpose of this study was to assess the effect of a six-week HIIT program on modifiable cardiovascular disease (CVD) risk factors. METHODS: Total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, fasting plasma glucose (FFG), blood pressure (BP), resting heart rate (RHR), and body fat percentage (BF%) were assessed before, halfway through, and after the six-week program in nine sedentary young adults. Subjects performed three sessions per week for six weeks at a work-to-rest (W:R) ratio of 1:4, where they were required to sprint and walk. RESULTS: There was a significant increase in FPG from the pre-program to the post-program assessment (P<0.03). There was also a significant decrease in diastolic BP (DBP) (P<0.03) and RHR (P<0.04) from the pre-program to post-program assessment. CONCLUSIONS: These data suggest that HIIT is effective in significantly reducing DBP and RHR. However, a six-week, 18 session HIIT program at a 1:4 W:R ratio may not be effective for reducing the risk for CVD through idealizing blood lipids, SBP, body composition, or anthropometry measurements in this population. This study contributes to the necessity to find an optimal HIIT program length, training session duration, and W:R ratio to help establish the most advantageous training program to reduce the risk of CVD.

High-Intensity Interval Training Elicits Higher Enjoyment Than Moderate Intensity Continuous Exercise

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(No relationships reported)

Lack of adherence to exercise programs is widespread in the United States, with approximately 50% of individuals withdrawing within 6 mo of initiation. Insufficient time is cited as the greatest barrier to adherence, yet in order to improve overall health, 150 min/wk of moderate-intensity continuous exercise (MICT) is recommended for all adults. Recently, scientists have identified superior health-related adaptations in response to high-intensity interval training (HIIT) compared to MICT. In addition, some data show higher enjoyment with HIIT compared to MICT; however, these findings are not universal. PURPOSE: To examine potential differences in enjoyment of low-volume high-intensity interval training (HIIT) compared to MICT in an attempt to elucidate the feasibility of HIIT as a component of regular exercise programming. METHODS: Differences in enjoyment, affect, and perceived exertion between MICT and HIIT were monitored in 12 recreationally active men and women (age=29.5 ± 10.7 yr, VO2max=41.4 ± 4.1 mL/kg/min, BMI=23.1 ± 2.1 kg/m²). Initially, maximal oxygen uptake was determined to establish workloads for two subsequent exercise bouts, whose order was randomized: HIIT (eight 1 min bouts of cycling at 85% maximal workload (Wmax) with 1 min of active recovery between bouts) and MICT (20 min of cycling at 45% Wmax). Ratings of perceived exertion (Borg 1-10), affect, heart rate (HR), and blood lactate concentration (BLA) were measured during exercise. Additionally, the Physical Activity Enjoyment Scale was completed 10 min after exercise.

Abstracts were prepared by the authors and printed as submitted.
performance of trained and untrained individuals. Therefore, previously untrained individuals should take caution when beginning exercise programs that require consecutive sessions of high intensity exercise.

**CONCLUSIONS:** The current study suggests that high intensity exercise results in greater muscle damage in both previously trained and untrained individuals vs. low intensity exercise; however, these effects are greater in untrained than trained individuals. Therefore, previously untrained individuals should take caution when beginning exercise programs that require consecutive sessions of high intensity exercise.

**2209**  
**Board #222**  
**June 1 2:00 PM - 3:30 PM**  
**Effects of Different Tempos of a Side-step Interval Exercise on Heart Rate and Muscle Activation**

Robert S. Thiebaud¹, Takashi Abe¹, Jonathan C. Bravo², Nicolas Giovannitti¹, Avery P. Sullivan¹. ¹Texas Wesleyan University, Fort Worth, TX; ²National Institute of Fitness and Sports, Kanoya, Kagoshima, Japan.  
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(No relationships reported)

**PURPOSE:** To investigate how different tempos of a side-step interval exercise influence heart rate and muscle activation responses. METHODS: Recreationally active men (n=8) and women (n=2) participated in this study. The average maximum oxygen uptake (VO2 max) of participants was 50.1 ± 10 yrs and age was 21 ± 3 yrs. The side-step interval exercise consisted of moving from side to side repetitively over a two-meter distance for 1 minute with 1-minute rest periods between. Blood was drawn at the initial visit and immediately after completion each exercise intensity period. Individuals rated their perceived muscle soreness before each exercise session. RESULTS: Levels of myoglobin in UT were significantly higher after high intensity exercise (65.2 ng/ml; p = 0.05); however, there was no significant difference between myoglobin in TR at high intensity exercise vs. baseline (41.0 ng/ml). While CK was elevated post exercise training for both groups (p < 0.01), this was higher for trained individuals (UT: 143.4 vs. TR: 203.6 ng/ml; p < 0.01). There was no significant difference in perceived muscle soreness between TR and UT individuals; however, UT individuals experienced soreness significantly sooner (p < 0.01). Specifically, UT individuals had significantly higher perceived soreness after one day of high intensity exercise, while TR individuals experienced significant soreness after 3 and 4 days of exercise (p = 0.04, p = 0.02). There were no significant differences in perceived muscle soreness in either TR or UT individuals after low intensity exercise.

**CONCLUSIONS:** Side-step interval exercise acutely produces sufficient levels of HR and muscle activation to promote improvements in aerobic and muscular fitness but future chronic studies are needed.

**2210**  
**Board #221**  
**June 1 2:00 PM - 3:30 PM**  
**Effects of High Intensity Interval Training Frequency on 1.5 Mile Run Times in Air Force Cadets**

Jared Dahle¹, Dale Wagner², ¹United States Air Force Academy, USAF Academy, CO; ²Utah State University, Logan, UT.  
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(No relationships reported)

**PURPOSE:** To measure the severity of skeletal muscle breakdown via myoglobin and muscle breakdown due to overexertion. Exertional Rhabdomyolysis is potentially life threatening, and has been diagnosed in individuals who overexert themselves during exercise. Individuals who participate in between sets. Four sets of SIT work bouts. This suggests that the generation of peak speed sufficiently stimulates adaptive mechanisms that lead to increases in aerobic and anaerobic capacity. However, psychological perceptions of self-efficacy, enjoyment, and intentions to participate were not different between groups post-training. Future research should investigate these perceptions throughout the training program duration.

**EXPERIMENTAL DESIGN:** Thirty-six US Air Force ROTC cadets was studied. METHODS: Twenty-seven cadets (21.6 ± 2.8 years) were stratified then randomly assigned to 3 groups: a high frequency group (HF) that performed HIIT 3x week, a low frequency group (LF) that performed HIIT 2x week, and a continuous training group (CT) that performed continuous 3x week. HIIT protocols consisted of 4 x 3 min intervals at 90-100% of maximal oxygen consumption (VO2 max) with 4 min of recovery and 4 x 30s all out sprints with 4 min recovery. Baseline 1.5 mile run performance was measured, then restated at 6 and 10 weeks. RESULTS: All groups significantly improved in mean run time (LF: 7.3% ± 4.2, p<0.001; HF: 9.7% ± 3.5, p<0.001; CG: 8.7% ± 4.8, p<0.001). No significant differences between groups were found (p<0.05). Additional workouts beyond the 6-week point yielded no significant gains in run performance for any group. CONCLUSION: Two days per week of HIIT training was as effective at improving 1.5 mile run performance as either 3 days/week of HIIT or continuous training.

**CONCLUSIONS:** The current study suggests that high intensity exercise results in greater muscle damage in both previously trained and untrained individuals vs. low intensity exercise; however, these effects are greater in untrained than trained individuals. Therefore, previously untrained individuals should take caution when beginning exercise programs that require consecutive sessions of high intensity exercise.
High intensity interval training (HIIT) is a rapidly growing area of research due to the beneficial physiological outcomes achieved in a time efficient manner. Sprint interval training (SIT) decreases exercise duration even more by utilizing supramaximal intensity intervals of even shorter duration while still maintaining significant improvements. However, research on effects of SIT in women is lacking. PURPOSE: The present investigation focuses on SIT and power development in college-aged adults. In addition, more research is needed into SIT and its impact on power development in females. In addition, more research is needed into SIT and its impact on power development in females.

METHODS: Participants (n=11) were randomized into one of three groups: two intervals (2INT), three intervals (3INT), or endurance group (END). All groups completed their assigned protocols three times a week for eight weeks for a total of 24 sessions. 2INT sprinted two 20-second all-out bouts with 20 sec active recovery between sprints for a total of 10 minutes. END cycled continuously for 20 minutes at 60% of their VO2max. Wingate testing (anaerobic power) was completed at baseline, mid-, and post-intervention. RESULTS: Average VO2max increased from pre to mid-test (33.8±6.2 ml/kg/min vs. 35.5±6.8 ml/kg/min), and was maintained from mid to post-test (35.6±6.8 ml/kg/min vs. 35.7±7.3 ml/kg/min). (F(2,62)= 57.65, p<0.001. PTE increased significantly from pre to post test (19.6±4.2 lb vs. 131.7±48.8 lb), F(1,35)=8.00, p<0.001. P. DFT did not change from pre to post-test (71.2±21.4 lb vs. 70.2±21.7 lb), F(1,35)=0.13, p=0.73. CONCLUSION: SPRINT interval cycle ergometer training is effective for increasing aerobic fitness and muscular strength over a 6-month training period among physically active middle-age adults. Grant: NASA/NSBRI MA03401

Sprint Interval Training and Power Output In College Age Females

Jenna Thompson, Sophie Olson, Leigha Emberton, Mark Blegen, FACSM. St. Catherine University, St. Paul, MN. (Sponsor: Mark Blegen, FACSM)

Cycling training induces adaptive cardiovascular benefits both centrally and peripherally in previously sedentary individuals. Less is known about what exercise prescription is necessary to improve fitness in already active, healthy middle aged adults. Cycling is not a well accepted exercise to enhance strength, especially in healthy active adults. PURPOSE: To determine if participation in a novel cycling program affects aerobic fitness (VO2 max) and leg strength. METHODS: Participants (N=41, M/SD age=45.5±8.1) were healthy adults recruited to complete a 6-day/wk exercise program on a cycle ergometer for 6-months. All participants self-reported at least 30 min of vigorous exercise, 3 times/wk prior to joining the study and met NASA developed fitness standards. Participants exercised 6 day/wk, using high intensity routines (SPRINT) developed and designed to protect fitness of middle aged active healthy astronauts. SPRINT includes (a) 30 min continuous aerobic cycling at or above 75% of max heart rate (HRmax), (b) long, 4x4 min intervals at or above 90% HRmax with 3 min active rest, (c) medium 6x2 min intervals at 70, 80, 90, 100, 90, and 80% of HRmax, respectively with 2 min active rest, and (d) short, 30 sec sprint intervals with 20 sec active rest. Participants reported that they did not change other exercise during the study. VO2max was measured (via indirect calorimetry) pre, (3 months), and 6 month post intervention. Isometric leg strength, including peak torque extension (PTE) and flexion (PFT) was measured (pre and 6 month post intervention) on the right leg using the Biodyne3 dynamometer. Results were assessed via repeated measures ANOVA. RESULTS: Average VO2max increased from pre to mid-test (33.8±6.2 ml/kg/min vs. 35.5±6.8 ml/kg/min), and was maintained from mid to post-test (35.6±6.8 ml/kg/min vs. 35.7±7.3 ml/kg/min). (F(2,62)= 57.65, p<0.001. PTE increased significantly from pre to post test (19.6±4.2 lb vs. 131.7±48.8 lb), F(1,35)=8.00, p<0.001. P. DFT did not change from pre to post-test (71.2±21.4 lb vs. 70.2±21.7 lb), F(1,35)=0.13, p=0.73. CONCLUSION: SPRINT interval cycle ergometer training is effective for increasing aerobic fitness and muscular strength over a 6-month training period among physically active middle-age adults. Grant: NASA/NSBRI MA03401

High intensity interval training (HIIT) is an effective and well-documented training method that utilizes periods of maximum effort followed by periods of moderate to low effort to achieve aerobic adaptations. CrossFit® (CF) is a novel training program defined as a strength and conditioning system built on constantly varied functional movements executed at high intensity aimed to improve both anaerobic and aerobic systems.

METHODS: To compare the total caloric expenditure between a traditional HIIT protocol and a best-matched CrossFit® protocol.

RESULTS: Measurements were obtained from 22 CrossFit® male athletes (age = 34.8±8.0 years, BMI = 28.3±3.7 kg/m²). Graded exercise tests (GXT) were performed in order to determine speeds at which the HIIT protocol was performed. The protocol consisted of 20 total intervals, 10 at 90% of the max speed during GXT and 10 at 50% of the max speed of GXT. Participants also completed a Crossfit® protocol consisted of as many rounds as possible of a 15 calorie row, 10 pushups, and 5 deadlifts at 135 lbs. Caloric expenditure was measured using the Oxycon mobile metabolic system by multiplying the average oxygen consumed over the 20 minute trial by 5.0 kcal. Intensities were matched amongst all participants based on pre-exercise data, ensuring that all participants were performing the HIIT at the same relative intensities.

RESULTS: The high speed of the HIIT routine was 13.6±1.6 km/h, while the low speed was 7.5±0.9 km/h. The two routines did not differ in terms of caloric expenditure; 358.2±47.2 calories during HIIT compared to 340.8±41.0 calories during CF, P=0.2. After controlling for history of CrossFit® exposure, no significant difference was observed between the two protocols (P = 0.3). Respiratory exchange ratio was higher during the CF routine (1.0 ± 0.6 CVO2/VCO2) compared to HIIT routine (0.9 ± 0.4 CVO2/VCO2), P = 0.04.

CONCLUSIONS: These data suggest that CrossFit® routines have similar metabolic demands compared to HIIT. The CF routine appears to reflect a greater exercise intensity that may lead to higher blood lactate concentration from the high glycogenolytic pathways involvement. The constant variation seen during CF may challenge the energy systems differently than HIIT while creating similar total metabolic demands during exercise.
cardiovascular responses to exercise in male and female adolescents. METHODS: Ten (4 male, 6 female; Age=11.7±1.4 years; VO2peak=27.3±3.68 mL•kg⁻¹•min⁻¹; BMI=28.6±6.6) adolescents, referred from local pediatricians, completed 16 HIT sessions over an 8 week period. Each HIIT session consisted of a 5 min warm up, a 20 minute stimulus, and a 5 min cool down. During the stimulus period, subjects completed twenty 30 sec “on”, 30 sec “off” intervals. During the initial session the “on” workload was set to be equivalent to 90% of maximal workload recorded during the VO2 peak test, while the “off” workload was set to be equivalent to 50% of maximal workload recorded during the VO2 peak test. Each of the 16 HIIT sessions was conducted at the same time of day with the workload adjusted to achieve a relative percent effort (RPE) during the last 5 intervals equivalent to at least 9 out of 10 on the Borg RPE scale. Workload, heart rate, and RPE were recorded at the end of each interval. RESULTS: Maximal workload during HIIT increased in all subjects from the first (152±8) watts to the last (240±18) watts session (p<0.001). In comparison, no differences were seen between the genders at any time point (Male: First Session=155±4 watts, Last Session=255±15 watts; Female: First Session=150±11 watts, Last Session=230±13 watts). Similarly, heart rate (Male: First Session=186±9 bpm, Last Session=185±6 bpm; Female: First Session=184±8 bpm, Last Session=177±7 bpm) and RPE (Male: First Session=9±1, Last Session=10±1; Female: First Session=9±1, Last Session=10±1) were maintained across the HIIT sessions. CONCLUSION: The results of this investigation indicate that HIIT is well tolerated and facilitates significant cardiovascular adaptation in both male and female adolescents.

2215 Board #228 June 1 2:00 PM - 3:30 PM Mechanical Efficiency During Repeated Attempts of Indoor Rock Climbing
Andrea C. Woita1, Jack Young, FACSM1, James W. Navalta, FACSM1, Nathaniel G. Bodell1, Jeffrey Montes1, Elizabeth A. Tanner1, Grace A. MacDonald1, Jacob W. Manning1, Camille Thompson1, Jason Taylor1, University of Nevada, Las Vegas, NV, 2Northern Utah University, Cedar City, UT. (Sponsor: John Young, FACSM) (No relationships reported)

Rock climbing is characterized by repeated short bouts of high-intensity climbs requiring upper body strength and muscular endurance. There is an inverse relationship between work rate and mechanical efficiency and it is hypothesized that mechanical efficiency would decrease from the first to the last climb during a series of repeated climbs. Purpose: To determine mechanical efficiency of repeated rock climbing attempts at a self-selected speed. Methods: Twenty-four experienced climbers volunteered to participate in this study (ages 18-40 years, 20 males, 4 females, at least one year of recreational climbing experience). Participants climbed up and down a vertical route (30 feet) on an indoor climbing wall at a self-selected pace for ten minutes. VO2 was continuously measured during the upward portion of the climb using a portable COSMED device. Work was calculated from height climbed and body mass. Results: Four climbers’ data were discarded due to incomplete data. From the remaining twenty subjects, there was no significant difference in mechanical efficiency from the first climb (M=18.4%, SD=11.3%) to the last climb (17.8%, SD=11.0%); t(20)=0.89, p=0.19. Conclusions: The recreational climbers did not experience a significant decrease in mechanical efficiency. It was thought that fatigue would result in decreased mechanical efficiency due to an increased work rate from continuous climbing action. One possible explanation is the repeated attempts resulted in a learned effect causing the subjects to become more familiar with the route. The familiarity of the route likely led to improved technique and possibly offset the impact of fatigue on mechanical efficiency. Future studies should consider investigating the difference in mechanical efficiency on repeated climbs of varying routes.

D-71 Free Communication/Poster - Modeling Thursday, June 1, 2017, 1:00 PM - 6:00 PM Room: Hall F

2216 Board #229 June 1 2:00 PM - 3:30 PM Comparing Daily Class Schedule and its Influence on Undergraduate Students’ Physical Activity Patterns
Matthew D. Moran, Din A. Kendle, Matthew B. Rhudy, Kristen Gift, Marissa Ruggiero, Carolyn Gray, Praveen Veerabadrappa. The Pennsylvania State University, Reading, PA. (No relationships reported)

Full-time undergraduate students’ daily physical activity patterns may be affected due to Penn State University’s different class schedules -Monday/Wednesday/Friday (MWF) and Tuesday/Thursday (T/Th). A cohort of 834 students (1,084 enrollees, 88.6% female, 1,084 enrollees, 9% male; 25±2.3 years; BMI=25±5.2 kg/m²) from the first week of class were split into quintile groups (Q1 - Q5) based upon their final OFC ranking. Students achieved the recommended 10,000 steps daily goal on M/W/F and did not meet the step goal on T/Th. This difference in steps could be attributed to the mandatory class ‘common hour’ which may allow students to be more physically active than the T/Th schedule. In addition, the shorter class structure on M/W/F (50 min/class) might also provide opportunities for students to be more active than T/Th (75 min/class). These preliminary results may be useful for planning early physical activity interventions on specific days of the week among college students.

2217 Board #230 June 1 2:00 PM - 3:30 PM Comparison of Effectiveness in Online vs. Hybrid Courses in College Wellness Classes
Ruth N. Henry, Frank M. Romeo. Lipscomb University, Nashville, TN. (Sponsor: Kent Johnson, FACSM) Email: ruth.henry@lipscomb.edu (No relationships reported)

Online courses have gained popularity in recent years; research has supported its effectiveness while also pointing out the limitations of online delivery. Hybrid courses have been developed in response to some of the challenges, with course content delivered both online and in a face to face setting. Purpose: The goal of this research was to determine whether 100% online or hybrid online courses are more effective in delivering a college-level wellness course. Methods: 47 students were enrolled in Fitness/Wellness courses; 23 students enrolled in the 100% online section which met in class only for fitness tests and written exams. The other 24 enrolled in the hybrid section, which met once per week for exercise in addition to class meetings for fitness testing and exams. Assignments were identical in both sections. All students were assessed for knowledge via weekly open-book online quizzes (QUIZ) and closed-book exams (EXAM) in the classroom. Fitness tests were performed before and after an 8-week self-instructed, instructor-graded exercise program, and fitness improvement was analyzed. Students also responded to open-ended questions about course delivery preference. Results: There were very few differences between groups in written work or fitness outcomes. Written work between groups was statistically equal; (EXAM online mean = 79.9±9.57; hybrid mean = 81.58±7.75; p=0.49); (QUIZ avg. online mean = 83.7±10.1; hybrid mean = 84.5±10.7; p=0.81). Improvements in fitness parameters were calculated as post-score minus pre-score. Only the 1.5-mile run test yielded a significant difference, with the hybrid group (mean improvement = 2.3±4.2 minutes) improving significantly more than the online group (mean improvement = 0.6±0.99 minutes; p<0.003). Improvement in pushups (Online = 4.45±6.11, Hybrid = 2.67±4.75, p=0.28), sit-ups (Online = 3.4±3.59, Hybrid = 2.77±5.82; p=0.68) and sit-and-reach (Online = 2.47±3.42, Hybrid = 2.05±2.32; p=0.64) were statistically equal between groups. In the open-ended questions, students in both sections cited the value of weekly class meetings and face-to-face time with teacher and classmates, although online students expressed preference for the online format for convenience.

Conclusion: Student outcomes in wellness courses with online and hybrid delivery are similar.

2218 Board #231 June 1 2:00 PM - 3:30 PM Self-reported Measures Of Strength And Sport-specific Skills Distinguish Ranking Among Females In An International Online Fitness Competition
Paul Serafini, Yuri Feito, FACSM, Gerald Mangine. Kennesaw State University, Kennesaw, GA. (Sponsor: Dr. Yuri Feito, FACSM) Email: paul.serafini21@gmail.com (No relationships reported)

PURPOSE: To determine if self-reported performance measures could distinguish ranking amongst female competitors in an international online fitness competition (OFC). METHODS: The top one-thousand five female competitors (28.7±2.9 y; 4.87±6.65 ± 5.80 kg; 163.71±6.60 cm) of the OFC were split into quintile groups (Q1 - Q5) based upon their final OFC ranking. Then, self-reported performance scores for one-repetition maximum (IRM) squat (SQ), deadlift (DL), clean and jerk (CJ), snatch (SN), 400-m sprint, 5,000-m run, and benchmark workouts (Fron, Helen, Grace, Filthy-50, and Fight-gone-bad) were compared between quintiles using separate one-way analysis of variance. RESULTS: Q1 reported greater (p < 0.05) IRM loads for DL (148.3±14.5 kg), SQ (126.1±13.0 kg), CJ (95.69±8.42 kg), and SN (76.5±7.6 kg) compared to all other quintiles (Q2 - Q5). In the 400-m sprint, though Q1 (71.0±9.2 sec) was different than any other quintile, Q2 (67.5±8.8 sec) reported faster (p < 0.05) times than Q3 - Q5 (73.5 - 74.8 sec). For the 5,000-m run, differences were
only observed between Q1 (21.3 ± 1.8 min) and Q4 (22.6 ± 2.2 min, p = 0.008) and between Q1 and Q5 (22.6 ± 1.9 min, p = 0.016). In benchmark workouts, Q1 reported the fastest (p < 0.001) performance compared to all other groups and better (p < 0.005) performances compared to Q3 - Q5 in Grace (1.9 ± 0.5 min) and Fight-gone-bad (388 ± 45 repetitions). Differences between groups for Helen and Fitly 50 varied amongst quintiles. CONCLUSIONS: In female athletes, the most elite OFC competitors (i.e., Q1) possessed the greatest strength and power, and generally performed the best in both benchmark workouts. Previous research has emphasized muscle strength and endurance (i.e., Fran, Grace, and Fitly-50). Though aerobic and anaerobic fitness also appeared to be greater in higher-ranking competitors, distinctions between quintiles were more broad.

Talent identification in rowing typically includes standing height (SH) and body mass (BM), because successful rowers are on average taller and heavier than their opponents. Moreover, successful elite senior rowers are significantly taller and heavier than Juniors, but it remains unclear if those athletes who became elite rowers later, were already taller and heavier as adolescents. PURPOSE: We aimed to retrospectively analyze anthropometric differences of national team junior rowers considering their long-term career progression level and to define minimal anthropometric requirements allowing for later success. METHODS: 706 male German junior rowers (age 17.5±0.7 y) of the years 1991 - 2015 were grouped according to their highest progressive career level, more precisely U19-, U23-, Senior World Championships (WCh), or Olympic Games (O). To analyze differences in SH and BM a one-way ANOVA with Post-Hoc test was calculated. RESULTS: Distribution for highest progressive career level were 46.7% U19- (191.0±4.6 cm, 85.5±6.1 kg) 35.6% U23- (192.3±4.7, 86.5±7.6), 9.6% Senior WCh (192.8±4.9 cm 87.4±6.5 kg) and 10.8% OG (193.7±4.4 cm, 88.2±6.4 kg). Significant small effects in SH (F(3,702) = 9.30, p = .000, η2 = 0.038) and BM (F(3,702) = 4.31, p = .005, η2 = 0.018) among progression levels were found. Rowers competing not higher than U19-WCh were smaller (-0.69 to -1.42%, p < 0.05) and exhibited less BM (-1.88 to -3.05%, p < 0.007) compared to higher progression levels. This effect increased by 0.45 % (R2 = 0.97) for SH and 1.01% for BM (R2 = 0.99) with rising progression level. No significant differences were found between U23, Senior WCh, and OG. Minimal anthropometric requirements within the higher progression levels can therefore be calculated as 188 cm SH and 80.3 kg BM. CONCLUSIONS: This finding suggest that higher SH and BM within a homogenous group of adolescent elite junior rowers are already associated with long-term career progression in international elite rowing. Minimal anthropometric requirements could be established and can be interpreted as thresholds associated with later success. However, anthropometric variables must not be solely or exclusively used for talent identification, because maturation to elite status is inherently multi-dimensional.

| Board #233 | June 1 2:00 PM - 3:30 PM | Bioelectrical Impedance Analysis and Skinfold Prediction of Percent Fat in Male College Athletes |


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(No relationships reported)

Determination of body fat (%fat) in athletes is now a common component of the preparation for competition. Various techniques have been developed to estimate %fat in athletes. However, some question may remain concerning the accuracy of these methods to accurately determine %fat in male college athletes. PURPOSE: To compare various methods of obesity classification in male college athletes. METHODS: 87 NCAA Division II athletes (n = 183) from 6 sports were assessed during the off-season for skinfolds (SKF), BIA, and DEXA. Skinfold sites included biceps, triceps, subscapula, midaxilla, chest, supraillium, abdomen, thigh, and calf. Skinfolds were measured in triplicate and averaged for analysis. Eight SKF equations utilized to estimate %fat in athletes were evaluated. Single-frequency (50 Hz) hand-to-hand BIA (H-BIA) and foot-to-foot BIA (F-BIA) devices used in an athletic setting were also assessed. RESULTS: All prediction methods significantly underestimated DEXA %fat (18.2±5.8%, range = 9.5 to 36.3%) despite high correlations with the criterion (ICC = 0.78 to 0.93). Of the SKF equations, the Durnin-Womersley equation produced the closest estimate (16.2±4.0%, ICC = 0.91). H-BIA (13.6±4.9%) and F-BIA (13.4±5.8%) were comparable in their underestimation of %fat (-4.8±4.4%) with similar correlations with the criterion (ICC = 0.83). Significant negative correlations for the difference between SKF predicted and DEXA %fat (r = -0.71 to -0.97) indicated greater discrepancy between the two methods at higher %fat values. There were smaller but significant negative correlations for the difference between SKF predicted and actual %fat values and body mass (r = -0.22 to -0.56), suggesting greater underestimation of DEXA %fat by SKF at higher body masses. CONCLUSIONS: All prediction techniques produced significantly lower estimates of %fat in male college athletes than when measured by DEXA. Prediction error typically increased at greater actual %fat and body mass values. If DEXA is to be accepted as the new standard for assessing body composition, new prediction equations may need to be developed. Higher %fat values than previous accepted may need to become the new normal standard for college athletes when using DEXA as the criterion.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

THURSDAY, JUNE 1, 2017
3:30 PM
R2 of 83.3%. The addition of these variables increased the strength of the prediction achieved an AT of 18.1 ± 4.56 ml/min/kg, lowest VE/VCO2 ratio of 24.72 ± 2.18 represented a measure of performance fatigability. Data are presented as mean ± SD. the time to fatigue (TTF) during a vigorous bout of treadmill exercise. a significantly (p<0.05) different ID compared to women (16% increase versus 9% in healthy individuals. The ST is an easy to administer, job-related, valid field expedient test of aerobic fitness (specificity) to complete the run in less than 16:30 min (≈8METs). CONCLUSIONS: The ST is an easy to administer, job-related, valid field expedient test of aerobic fitness for predicting a 1.5 mi run graduation standard in a law enforcement setting. This study funded by the Department of Homeland Security

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Funding: Intramural Funds from the National Institutes of Nursing Research

PURPOSE: Develop a simple, field expedient, pre-hire aerobic fitness tool to predict success in effecting a standardized foot pursuit and job-simulation arrest scenario as well as the job-related graduation criteria of 10 METs. METHODS: A Job Task Analysis (JTA) was conducted via survey, on-site observations, and interviews of incumbent federal officers (n=1025) with the objective of establishing an aerobic fitness standard for the essential function of foot pursuit and effecting arrest. Respondents were asked to provide best estimates of distances, heights, and weights associated with critical and arduous tasks. Graduation criteria were based upon previously published research of a 2.6 l.min-1 requirement for a foot pursuit and arrest scenario, nominally determined to be 10 METs. SUBJECTS: Applicants (N=756, including 99 females (13%)) who presented for entrance from October of 2005 through May of 2007 served as subjects for this study. Because they had received no prior physical screening these subjects represent a sample of applicants that was not range restricted on physical ability. A pass-fail, 5-minute step test (ST) (40cm, 24 repetitions.min-1) was administered prior to starting a 13.5-week training program. Subjects embarked on their customary program of instruction (POI) and were tested on 1.5-mile run pre/post training. RESULTS: Students improved their run time by an average of 12%. Individuals who passed the ST had a 98% probability (sensitivity) of completing a 1.5-mile run in less than 16:30 min (p<0.001). Of the 57 applicants (9% of total sample) who could not complete the ST, performance on the 1.5-mile run was generally poor, with 89% (55/62) failing (specificity) to complete the run in less than 16:30 min (8-18 METs). CONCLUSIONS: The ST is an easy to administer, job-related, valid field expedient test of aerobic fitness for predicting a 1.5 mi run graduation standard in a law enforcement setting. This study funded by the Department of Homeland Security

Core strength/endurance (CSE) is believed to be an important component of physical performance in sport and functional tasks. A standard measure of CSE is the side plank (SP) during which the duration it can be held is measured. PURPOSE: To examine the effects of a test of inspiratory muscle performance (IMP) done in the SP position on SP duration and several measures of IMP. METHODS: 28 healthy subjects (15 men, 13 women with a mean: SD: age, height, and weight of 36(±14 and 34(±11 years, 176.0±8.6 and 165.6±1.6 cm, and 80.8±8.3 and 64.5±7.2 kg, respectively) underwent in random order two tests of SP duration (with and without IMP tests) and IMP (at the onset of SP and in sitting) with at least 5 minutes of rest between each of the tests. IMP was measured via the Test of Incremental Respiratory Endurance (TIRE) yielding maximal inspiratory pressure (MIP), sustained maximal inspiratory pressure (SMIP), and inspiratory duration (ID). MIP was measured from residual volume while SMIP and ID were measured from residual volume to total lung capacity. RESULTS: MIP were found to have significantly (p<0.05) greater height and weight compared to women. The SP duration decreased significantly (p<0.05) for the entire cohort when IMP was tested during SP (104.2±41.5 sec to 81.1±33.0 sec), but no significant difference in SP duration between men and women under both test conditions was observed. MIP and SMIP also decreased significantly (p<0.05) for the entire cohort when IMP was tested during SP (117.9±21.8 to 96±18.3 cm H2O and 683±19.1 to 535.6±173.9 PTU) and a significantly (p<0.05) lower MIP and SMIP was observed in the SP position of both men and women with men having significantly (p<0.05) greater values compared to women during both test conditions. Men were observed to have a significantly (p<0.05) different ID compared to women (16% increase versus 9% decrease). CONCLUSIONS: SP duration and IMP decreased significantly when IMP was tested in the SP position with men having significantly greater MIP, SMIP, and ID compared to women. The increase in ID in men suggests that men use a different strategy to optimize CSE which may be due to their significantly greater height, weight, and IMP. CSE and IMP appear related, but further investigation of this relationship is warranted.

Fatigability is represented by a decline in performance in relation to the frequency, intensity and duration of physical activity. The use of anaerobic threshold (AT) as an index of endurance is well accepted in the literature. In patients with cardiovascular disease, ventilatory efficiency is related to exercise capacity, and therefore may have clinical significance as a fatigability measure. However, this has yet to be determined in healthy individuals. PURPOSE: To characterize physiological determinants of the time to fatigue (TTF) during a vigorous bout of treadmill exercise. METHODS: Subjects were 19 healthy participants (13 females, 6 males; age: 26.6±9.1 years; BMI: 24.2±2.7 kg/m2) enrolled in the National Institutes of Nursing Research, Fatigue in Healthy Individuals Protocol. Subjects completed a ramp treadmill cardiopulmonary exercise test (CPET) to volitional exhaustion during the initial visit. The anaerobic threshold and two measures of ventilatory efficiency (lowest VE/VCO2 ratio and VE/ VCO2 slope to AT) were determined from the CPET. A subsequent visit consisted of a constant work rate test at vigorous-intensity performed to exhaustion in which the TTF represented a measure of performance fatigability. Data are presented as mean ± SD. RESULTS: The TTF was 436.12 ±175.9 seconds at 240.05 ±66.48 watts. Subjects achieved an AT of 18.1 ±4.56 ml/min/kg, lowest VE/VCO2 ratio of 24.72 ±2.18 and VE/VCO2 slope of 22.49 ±2.16. Pearson product-moment correlation analysis suggests that both measures of ventilatory efficiency were not significantly correlated to the TTF. The anaerobic threshold was found to be the best predictor of the TTF, with a strong effect size (r= 0.865) suggesting that AT is a reliable predictor of TTF explaining 15% of the variance. CONCLUSIONS: Results from this study suggest that AT remains a better predictor of fatigability compared to measures of ventilatory inefficiency. Further research is needed to determine other objective measures of fatigability.

Funding: Intramural Funds from the National Institutes of Nursing Research

PURPOSE: The National Basketball Association (NBA) conducts an annual combine to assess anthropometric and athletic ability of collegiate and international prospects in preparation for the draft. Additionally, in-game performance variables are tracked by 7226

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ACSM May 30 – June 3, 2017 Denver, Colorado THURSDAY, JUNE 1, 2017
and used by scouting and personnel departments to determine players to draft. The purpose of this study was to determine how well the variables measured of the athletes invited to the 2015 NBA Combine predicted on-court performance during their rookie season, as measured by Player Impact Estimate (PIE) (player’s overall statistical contribution against the total statistics in played games). METHODS: Data from 12 tests (six anthropometric, six performance) recorded during the NBA Combine and data from 7-in-game performance variables recorded during the 2014 collegiate/international season were used for analysis. 64 athletes’ rookie season player contribution was measured in PIE. A multiple linear stepwise regression was calculated to predict on-court contribution based on the 19 variables assessed during the NBA Combine and 2014 season. RESULTS: A significant regression equation was found among three variables (three quarter court sprint, 2014 assist:turnover ratio, 2014 field goal percentage) (F(3,21) = 6.080; p = 0.005; R² = 0.500). The three predictor model was able to account for 30.3% of the variance in PIE. PIE = 37.208 + 9.245(3/ quarter court sprint) + 9.245(2014 assist:turnover ratio) + 0.254(2014 field goal percentage), 95% CIs [-68.19, -6.220]; [−0.455, 18.944], (0.932, 3.143) and (0.210, 22.843), respectively. CONCLUSIONS: The findings of this study suggest that the performance variables could partially predict on-court contribution during the 2015 NBA regular season, though R² prediction was varied. However, of the 19 variables assessed, only three provided significant predictive value. These findings may help teams and scouts to appreciate performance and determine potential on-court contribution of draftees and undrafted free agents.

An athlete’s practice is ideally constructed to prepare them for game-type conditions. Training volume however, can be influenced by several factors including frequency, intensity, time, type, and volume of practice. Differences between basketball practices, scrimmages, and games are already illustrated (Montgomery et al., 2010 & Klusemann et al., 2014). The ability to improve practices to mimic game-type conditions could better prepare the athletes to perform in games. PURPOSE: To compare the physiological demands of practice to a pre-season game. METHODS: Ten Division II men’s basketball players participated in this study (20.7±0.9 yrs, 94.0±13.2 kg, 1.90±0.09 m). All players wore Hexoskin activity monitors (Hexoskin, Morrisville, NC) which measure heart rate (HR) via ECG, g-force (above that of the earth’s gravity) via triaxial accelerometer, and time of day (including time spent wearing the monitor). Monitors were worn at practices for the week leading up to and the week following a pre-season game. A dependent, two-tailed t-test compared the average of twelve days of practice (P) to the pre-season game (G). Coefficient of determination was utilized to compare change in time while wearing the monitor to change in training volume (total g-force). RESULTS: Time spent in practice was significantly greater than the game (P = 144 ± 2; G = 126 ± 2 min; p ≤ 0.05). While average HR did not differ (P = 121 ± 5; G = 121 ± 17 bpm), maximal HR was higher in the game (P = 180 ± 6; G = 189 ± 7 bpm; p ≤ 0.05). Average g-force was higher in practice (P = 0.38 ± 0.05; G = 0.30 ± 0.11 m/s²; p ≤ 0.05). Passive g-force (maximal g-force minus g-force during arm movement) were (P = 3.64 ± 0.42; G = 3.97 ± 0.71 m/s²; p = 0.10). Total g-force (average g-force of the session multiplied by the minutes of the session) differed between the two conditions (P = 55.2 ± 7.7; G = 37.4 ± 13.6 min/m/s²; p ≤ 0.05). A coefficient of determination elucidated an r² = 0.175, indicating that only 17.5% of the change in total g-force was due to differences in average g-force among the three variables (three quarter court sprint, 2014 assist:turnover ratio, 2014 field goal percentage). Angle of peak torque occurred at a significantly shorter muscle length (P<0.01) when compared to Knee Flexion Torque At Long Muscle Lengths

SUCCESSFUL PERFORMANCE IN BASEBALL AND SOFTBALL

Successful performance in baseball and softball requires the ability to perform multiple skills efficiently. The skills most critical to the practice contribute 21% of total torque at 20° with limb mass contributing 16% and contractile torque accounting for only 63% of total torque. Angle of peak torque occurred at a significantly shorter muscle length (P<0.01) when calculated from contractile torque (62°) versus total torque (49°).

Table 1

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<th>Contractile Torque (Nm) (% of Total Torque)</th>
<th>Passive Muscle Torque (Nm) (% of Total Torque)</th>
<th>Limb Mass Torque (Nm) (% of Total Torque)</th>
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<td>INV</td>
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CONCLUSIONS

Currently “gravity correction” functions for isokinetic testing measure passive torque at only one joint angle and therefore cannot account for changing passive muscle tension from short to long muscle lengths. This invalidates isokinetic assessment of hamstring angle of peak torque or weakness at long muscle lengths where passive muscle tension is considerable.

S467

Abstracts were prepared by the authors and printed as submitted.
A recent study looked at the relationship between performance variables and success in the NFL among players who participated in NFL combine events, which features college seniors aspiring to make an NFL roster. To date no studies have looked at a similar relationship among high school seniors entering college, who aspire to make an NCAA Division I football roster. Purpose: The purpose of the study was to identify initial performance variables that predict success among aspiring Division I college football players. Methods: Archival data were analyzed from 310 college football players, which focused on their initial testing as they entered the program, who played during the decade from 1999-2009 at an NCAA top 5 nationally ranked university. Players were categorized by training group with skill players (G1; n=124) including running backs, defensive backs and wide receivers; fullbacks, tight ends and line backers (G2; n=76); and offensive and defensive linemen (G3; n=110). Tests were conducted within a week of each player joining the program included height, body mass (BM), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same examiner over the ten-year period. Success was determined by three criteria: level 1 included players who never made the starting lineup in their college careers, level 2 were players that made the starting lineup but never made it to the NFL, and level 3 were players that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. Results: The best predictors by training group were as follows: Skill players (G1) by 10YD (p = 0.001); Linebackers and related positions (G2) by BIPRM (p=0.026) and 20YS (p=0.044); Linemen (G3) by BM (p=0.32), PC (p=0.043), and 40YD (p=0.043). Conclusions: These results suggest that it may be possible to predict the success of high school recruits entering a NCAA Division I football program by position grouping, by looking at selected performance parameters. Our data suggests that for G1 acceleration is important, G2 upper body strength and lateral speed are paramount, and G3 size combined with speed and explosive hip extension predicts success.
PURPOSE: the purpose of the study was to analyze the effect of plyometric and whole body vibration training methods on vertical jump height in athletes. METHODS: A meta-analysis was performed where the inclusion criteria for the studies were: (a) only athletic population, (b) active control group, (c) only one experimental intervention, (d) statistical data necessary to calculate effect sizes (ES). Hedge’s standardized mean difference ES was calculated for each result; then, ESs pooled using random-effects models. On-overlapping 95% confidence intervals (CI) were considered statistically significant. Heterogeneity was assessed using Q and I², while funnel plots and Egger’s regression test were used to assess small-study effects (potential bias). RESULTS: One hundred and fifteen effect sizes were calculated from 36 studies. Global effect sizes (ES) were statistically different from zero in both training methods. Plyometric training had an ES = 1.046 (CI₉₅% = 0.82 to 1.27, p <0.001) and the control group an ES = 0.032 (CI₉₅% = 0.12 to 0.18, p = 0.73). The ES for the experimental group in the whole body vibration training method was 0.652 (CI₉₅% =0.3 to 1.0, p= 0.001) and the control group ES was 0.038 (CI₉₅% =0.3 to 1.0, p= 0.765). ESs were correlated to age (r = 0.454, p<0.002), number of weeks of training (r=0.309, p<0.039), final number of sessions per week (r=0.348, p<0.019), final duration of sessions (r= 0.619, p=0.014), initial series of exercises (r=0.572, p<0.000), final series of exercises (r= 0.601, p<0.000) and initial number of jumps per session (r = 0.633, p = 0.027) in the plyometric experimental method. No significant associations between ESs and moderator variables were observed in the whole body vibration method. CONCLUSIONS: The overall results showed a statistically significant improvement on the vertical jump height of athletes when plyometrics or whole body vibration were used as training methods.

Running at Lactate threshold (LT) for training is a frequent training method used by elite and healthy athletes. However, LT determination is usually done in the laboratory with an invasive method. PURPOSE: To predict LT by physiological variables utilizing human motion during exercise. METHODS: 12 male athletes (Age: 23±6.1 years, Percentage (%) body fat: 12.4±7.3%, height: 173.4±4.7cm, weight: 68.2±5.8kg, bone mineral content: 2736±252g and lean mass: 56233.7±4751g) completed an incremental discontinuous submaximal to exhaustion protocol on the treadmill. VO₂ resting was measured at every stage and VO₂max max was determined at volitional exhaustion. Human motion, blood lactate, heart rate (HR), VO₂ and Rate of Perceived Exertion (RPE) were constantly measured RESULTS: Among the 32 human motions, 8 human motions (4 on left leg and 4 on right leg) demonstrated strong relationship (correlation r > 0.700) to human bioenergetics during running. The range of human motion on left leg (10 % - 70 %) significantly varies than right leg (5 % - 15 %) due the right leg being dominant. Two human motions had the highest correlation with human bioenergetics 1) the angle between left (thigh & leg) phase 1 and 2) and 2) angle between right (thigh & leg) phase 3 (r = 0.858). The equations derived with human motions (A) VO₂ = (VO₂ -15.81)*10.83m·kg⁻¹·min⁻¹ and (B) VO₂ = (VO₂-15.81)*15.76m·kg⁻¹·min⁻¹ can be used to predict the VO₂ at LT if VO₂max is known. CONCLUSIONS: Results indicated that human motions have significant relationship with HR, VO₂, and blood lactate during running at submaximal intensities. The human motion derived equation can predict VO₂ at LT if VO₂ at exhaustion is known without using a invasive method.

Table 1. Spearman’s correlations (r). Significant p values (< 0.05) are included.

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Table 1. Spearman’s correlations (r). Significant p values (< 0.05) are included.

CONCLUSION: These data suggest that flexibility, body composition, and indicators of athletic ability are not greatly related in this population. Thus, it would be beneficial for NAIA coaches to perform all of these assessments when evaluating an athlete as any single measure is likely to provide unique information.

Administration of bench press 1-repetition maximum (1RM) tests can be time consuming, require trained personnel, and are risky for beginners. Therefore, alternative testing procedures for upper body push strength should be considered. PURPOSE: To quantify strength and determine the relationship between dynamic bench press IRM and angle specific isometric bench press. METHODS: Twelve recreationally trained males (age=24.83±2.89yrs, height=172.3±6.6cm, mass=83.18±8.53kg), capable of bench pressing a minimum of 1.25x their bodyweight, volunteered to participate. On day 1, subjects performed a bench press warm-up and had 5 attempts to reach their IRM using a self-selected grip that remained the same for the entire study. On day 2, subjects performed an isometric bench press warm-up, then completed 2 max effort repetitions at 4 different angles of elbow flexion (60, 90, 120, and 150 degrees) and at 50% of their arm length in randomized order. RESULTS: Pearson correlations were very low and not-significant (P<0.05) between dynamic bench press IRM (115.43±12.68kg) and isometric bench press at all angles (60°=56.60±9.72kg, r= -.04; 90°=65.25±9.7kg, r= -.26; 120°=110.39±20.79kg, r= -.11; 150°=121.46±29.83kg, r= -.24; 50% arm length=57.72±6.09kg, r= -.25). CONCLUSIONS: Traditionally, dynamic movements are the focus of strength testing. The IRM bench press is dynamic while the isometric bench press produces no movement. Thus, muscular length-tension or force-velocity differences between modes may explain the low relationships. Therefore, isometric bench press may not be a proper substitute for a 1RM bench press test.
attainment. Similarly, the Wingate cycle test is a commonly accepted method of anaerobic capacity assessment which stresses anaerobic energy pathways. Based on the energy system demands at the point of VO2 max and during a Wingate protocol it has been shown that peak power obtained from a Wingate cycle test is a good predictor of VO2 max. However, it is unclear whether a non-consecutive testing day protocol produces a more accurate predictive model compared to a same day testing protocol. PURPOSE: to develop and compare the predictive accuracy of the regression models for a non-consecutive day testing protocol and a same day testing protocol. METHODS: Participants (N=23) completed an incremental treadmill VO2 max protocol and 30 second Wingate cycle test. Participants (n=12) completed testing on non-consecutive days (NON) and participants (n=11) completed testing on the same day (SAME). VO2 max (L/min) and peak power (PP) were collected. All data were analyzed using simple linear regression. RESULTS: Linear regression analysis of NON revealed R2=0.888 and prediction equation Y = 1.499 + 0.004X and SAME showed R2=0.861 and prediction equation Y = 1.407 + 0.003X. NON and SAME standard error of estimate percent (SEE %) were 15.23% and 10.98% respectively. CONCLUSION: These results indicate PP obtained the same day of VO2 max testing is a better predictor of cardiovascular performance. SEE % also shows the predictive accuracy of the SAME prediction equation is superior to the NON prediction equation. This may be due to the diminished effect of potential training adaptations that could occur 2-7 days between testing sessions during the NON testing protocol in healthy, active young adults.

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MEDICINE & SCIENCE IN SPORTS & EXERCISE®

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No relationships reported

2240 Board #253 June 1 2:00 PM - 3:30 PM
Allometric Scaling for Endurance Variables in Croatian Army
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(No relationships reported)

Body mass bias is widely spread among physical performance testing and may confound the results often leading to misinterpretation. Endurance testing is a part of physical performance testing in the army and is generally assessed by running distance time. Two such tests, 2-mile run (2MR) and 300 yards run (300YR), are used to assess soldiers’ endurance. VO2 max treadmill test is a measure of aerobic capacity. If expressed as a relative value (ratio of VO2 max and body mass) or RVO2 max it is a good predictor of endurance or long distance running time. Considering that longer distances running time and RVO2 max are measures dependent of body mass, it is important to determine how to allow comparisons between subjects independent of their body mass. One practical solution is to determine body mass allometric exponent for distance running time. PURPOSE: To determine experimental body mass allometric exponent (eAE) for endurance variables and if it corresponds to proposed theoretical body mass allometric exponent (IAE) which equals 0.33. METHODS: 572 healthy male army recruits (mean age 29.4y) underwent endurance assessment comprised of a standard endurance testing battery in Croatian Army: 2-mile run (2MR), 300 yards run (301YR) and incremental VO2 max treadmill test. Their body mass (BM) was also measured. Relative maximal oxygen uptake (RVO2 max) was taken as a measure of endurance since it is a better predictor of long distance running time. A regression technique was applied on the log-transformed data in order to determine the values of the allometric exponent for each particular test. One sample t-test was used to determine statistical differences between average eAE and IAE. RESULTS: Regression analysis yielded BM allometric exponents for 2MR, eAE=0.33 (95%CI=0.23 - 0.43); RVO2 max, eAE=0.47 (95%CI=0.35 - 0.55) or (−0.38); 300YR, eAE=0.22 (95%CI=0.15 - 0.28). Mean eAE=0.34 and compared with IAE=0.33 was not significantly different (p=0.05) when tested by one sample t-test. CONCLUSION: The result derived mean experimental allometric exponents of 0.34 for endurance variables correspond to theoretical one and as such should be used for scaling endurance variables and comparing results of endurance tests recorded as running time. Supported by Grant of Ministry of Defence of the Republic of Croatia

PURPOSE: To determine if measures of strength and skill, obtained from online athlete profiles, could distinguish overall performance in an international online fitness competition (OFC). METHODS: The highest ranking male competitors (n = 1500; 27.18±7.4y; 85.2±7.88 kg; 177.0±6.47 cm) were split into quintile groups (Q1 - Q5). Subsequently, quintile comparisons were made using self-reported performances for a one-repetition maximum (1RM), squat (SQ), deadlift (DL), clean and jerk (CJ), snatch (SN), 400-m sprint, 5,000-m run, and benchmark workouts (Fran, Helen, Grace, Filthy 50, and Flight-gone-bad) via a separate one-way analysis of variance. RESULTS: Greater (p < 0.011) performance scores were reported by Q1 for DL (252.4±20.5 kg), SQ (201±19.1 kg), CJ (148.9±12.1 kg), SN (119.4±10.9 kg) and DL (22.3±0.2 min) compared to all other quintiles. For Grace, Q1 (1.7±0.4 min) reported faster (p < 0.001) completion times than Q3 - Q5, while their performances in the 400-m sprint (59.3±5.9 sec), Helen (7.6±0.6 min) and Flight-gone-bad (430±70 repetitions) were either better than Q3 (62.6±7.3 sec, p=0.022), Q4 (7.9±0.7 min, p=0.007) and Q5 (39±7.3 repetitions, p=0.010) respectively. No specific quintile differences were observed in 5,000-m or Filthy-50 performance. CONCLUSION: This data indicates that the most successful male athletes in this OFC possessed the greatest strength and power. Further, these athletes performed the best in a short duration (< 3 min) sports-specific workout (i.e., Fran) that emphasized these characteristics. Lower ranking athletes should focus on emphasizing strength and power development once sufficient anaerobic, aerobic, and sports-specific proficiency has been attained.

2241 Board #254 June 1 2:00 PM - 3:30 PM
Self reported Performance Measures Of Males Are Predictive Of Overall Performance In The CrossFit Open
Oladeji S. Olowojesiku, Paul Serafini, Gerald Mangine, Yuri Feito, FACSM. Kennesaw State University, Kennesaw, GA. (Sponsor: Yuri Feito, FACSM)
(No relationships reported)

To our knowledge, the relationship between many physiological adaptations due to in-season training and their impact on racing performance remains unclear.

PURPOSE: To investigate multiple physiological variables that contribute to the greatest improvements in 6,000m cross country race performance. METHODS: Nine female collegiate cross country athletes (1.80±0.1m, 59.6±3.9kg) were evaluated twice during their competitive cross country season: pre-season (T1) and mid-season (T2). Subjects completed a graded exercise test to volitional fatigue on a motor driven treadmill. Oxygen consumption was measured by a Parvo TuOne 2400 Metabolic cart. Near-infrared spectroscopy (Portammon, Artinis Inc.) of the vastus lateralis was used to measure tissue saturation index (TSI) for each stage of the graded exercise test.

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test. In this study, the slope of the decline in TSI was determined and used to quantify the muscle oxygenation response. Blood lactate was analyzed at each workload by a handheld lactate analyser (Nova Biomedical). Blood lactate and the rate of lactate accumulation. Efficiency was determined from work output and energy input during running. Changes in these variables along with standardized race performance times were analyzed. RESULTS: VO2max significantly increased (p<0.05) from T1 to T2 (51.6 ± 3.2 ml·kg⁻¹·min⁻¹ to 56.4 ± 4.3 ml·kg⁻¹·min⁻¹) indicating an average gain of 4.9 ± 3.9 ml·kg⁻¹·min⁻¹ (10.1 ± 7.7%). The greatest gains in VO2max and in LT from pre- to mid-season correlated to the greatest improvements in race performance. About 40% of the variance in race performance can be explained by the changes in VO2max whereas improvements in LT explained 32% of the variance in race performance. These data suggest that improvements in VO2max are most important in predicting race performance in collegiate cross country runners.

Heart rate (HR) based methods are commonly used to monitor training stress and are referred to as training load (TL) or training impulse (TRIMP). Edwards TRIMP equation is based on time spent in HR training zones above 50% HRmax, whereas Polar’s TL is measured via their Team2 system using a proprietary equation that incorporates anerobic power and maximal oxygen consumption (VO2max) combined with time spent in HR training zones. PURPOSE: To examine if TL estimates from proprietary Team2 software correlate with Edwards TRIMP in order to assess the training readiness of athletes. Secondly, the Beep test assessed fitness levels both pre- and post-season to determine if training adjustments based on TL influenced post-season fitness. METHODS: Twenty-eight male Division III soccer athletes (19.8 ± 1.8 years) had their heart rates continuously monitored during the fall 2014 season, as well as pre and post-season testing using the Beep test to estimate VO2max. In instances where TL was >300 per match, athletes had reduced intensity during pre-season sessions to aid in improved recovery. Data recorded included time spent in each of five heart rate zones, ranging from 50% to 100% HRmax in 10% increments. RESULTS: When comparing Edwards TRIMP and TL, significant correlation coefficients were found for body anaerobic power (Wingate tests) compared to non-elite wrestlers.

Upper body strength has been found to be greater in more successful wrestlers compared to their less successful counterparts. Additionally, elite high school wrestlers have shown a lower percent body fat (skinfold), and greater upper and lower body anaerobic power (Wingate tests) compared to non-elite wrestlers. PURPOSE: To test the validity of a cEIM device as a predictor of grip strength. METHODS: The author aimed to assess the validity of a cEIM device as a predictor of grip strength. However, the use of such measures for predicting ice hockey performance at the professional level has resulted in equivocal findings and to our knowledge, has not been assessed in collegiate ice hockey players. PURPOSE: The main purpose of this study was to determine if the results of a discontinued graded exercise test and selected anthropometric measures could predict a collegiate ice hockey player’s likelihood of playing professionally in the NHL.

Measurement of physiologic and anthropometric variables can be conducted to assess training progress and to estimate an athlete’s potential to perform at an elite level. However, the use of such measures for predicting ice hockey performance at the professional level has resulted in equivocal findings and to our knowledge, has not been assessed in collegiate ice hockey players. PURPOSE: The main purpose of this study was to determine if the results of a discontinued graded exercise test and selected anthropometric measures could predict a collegiate ice hockey player’s likelihood of playing professionally in the NHL.

RESULTS: Average values for variables of interest were similar in future NHL vs non-NHL players across 36 years: height (182.0±4.9 vs 181.5±6.1 cm), weight

Abstracts were prepared by the authors and printed as submitted.
Hamstring strain injuries are one of the most common sports injuries, especially in sprinting sports (Liu, Garrett, Moorman, & Yu, 2012). Hamstring strength imbalance quantified via hamstring strength asymmetry or by a hamstring to quadriceps ratio is a commonly proposed risk factor for hamstring strains (Liu, et al., 2012; Freckleton & Pizzari, 2012). Knowledge concerning the relationship among hamstring to quadriceps isokinetic ratios, speed, and power in sprinting athletes can assist in the development of training protocols and injury prevention strategies. PURPOSE: The purpose of this study was to identify the relationship between hamstring/quadriceps (H:Q) isokinetic strength ratios and its correlation with lower extremity power and speed field test measures. METHODS: Participants for this study included 30 NCAA Division I Track Athletes who compete in sprinting events. Peak torque (PT) was determined using an isokinetic dynamometer at speeds of 60 and 180 degrees per second in both hamstrings and quadriceps. Power was measured using the standing broad jump test and vertical jump test. Speed was assessed using light gates to measure sprint speed at 5, 10, 20, and 40 meter increments. A correlational approach was used to identify relationship between isokinetic measures with measures of lower extremity power and speed.

RESULTS: Significant correlations (p<0.05) were found between peak torque (PT) values and most field tests (vertical jump, standing broad jump, and 40 meter sprint speed). However, there was no significant correlation (p>0.05) between H:Q ratios and field test measures (vertical jump, standing broad jump, and 40 meter sprint speed). CONCLUSIONS: The results of this study confirm that PT values correlate highly with field test measures used to assess power and speed. Unexpected findings include the lack of significant correlation between H:Q ratios and field test measures. Therefore, future research should focus on examining adjusted H:Q ratio values using body weight and lean mass of participants. Answering these questions could assist sport performance professionals in program development, and sports medicine personnel with injury prevention interventions.

**Methodology**

**Methods**

**Abstract**

**Introduction:** People with spinal cord injury (SCI) present with impaired autonomic control when the lesion is above T6. This could lead to impaired recovery following vigorous physical activity. **Purpose:** To compare VO2 off-kineitcs following a maximal cardiopulmonary exercise test (CPET) in SCI and un-injured healthy individuals. **Methods:** Subjects were 13 patients with SCI who reported inability to perform treadmill (n = 9), VO2peak was determined using a mono-exponential model in which a time constant (τoff) was calculated and amplitude of change in VO2 (AMP) was measured over the recovery period. Student’s t-tests were used to compare SCI vs CON group means and Pearson product moment correlation coefficients were used to assess the relationships amongst VO2peak and the VO2 off-kineitcs variables. **Results:** CON had a significantly higher VO2peak compared to SCI (22.41 ± 5 vs. 14.64 ± 6.36 ml/kg/min, p=0.005). Compared to CON, SCI had significantly longer τoff (83.4 ± 34.7 vs. 54.7 ± 10.2seconds, p=0.021). A significant difference in AMP between the groups was noted with CON (0.85 ± 0.57 vs. 0.57 ± 0.48L/min, p=0.054) however the ratio of AMP/τoff was significantly larger in the group with SCI than in CON (0.0126 ± 0.0108 vs. 0.0243 ± 0.008L/min/sec, p=0.011). VO2peak and τoff were inversely related (r=-0.524, p=0.01). **Conclusions:** Potentially explained by the time taken to replenish muscle ATP stores and lactate clearance, VO2 off-kineitcs is one measure of cardiorespiratory fitness. Despite an observable decline in AMP, the prolonged VO2 off-kineitcs suggests that cardiorespiratory fitness was impaired in these subjects with SCI. Funding: DoD Award #W81XWH-14-1-0613

**Abstract**

**Introduction:** The purpose of this study was to identify the relationship between hamstring/quadriceps (H:Q) isokinetic strength ratios and its correlation with lower extremity power and speed field test measures. **METHODS:** Thirty healthy male college students (24.5±2.4 yrs., 68.5±5.9 kg) performed Romanian deadlift (RDL) without weight as a low intensity hamstring Ecc-Ex. **RESULTS:**: The purpose of this study was to investigate the effect of low intensity Ecc-Ex on APT, muscle strength and flexibility. **METHODS:**: Thirteen healthy male college students (24.5±2.4 yrs., 68.5±5.9 kg) performed Romanian deadlift (RDL) without weight as a low intensity hamstring Ecc-Ex. Before and after RDL, muscle strength and APT during maximum eccentric knee flexion (60°/s) and flexibility were measured on both legs. After the experiment, each leg were divided into two groups based on the change in APT after RDL: the group with increase in APT (16 legs) and decrease in APT (10 legs) after RDL. **RESULTS:** After RDL, muscle flexibility defined by range of motion in straight leg raise test increased significantly in both groups. The group with increase in APT and decrease in APT (10 legs) after RDL. **Variables** of interest were compared before and after RDL. **RESULTS:** After RDL, muscle flexibility defined by range of motion in straight leg raise test increased significantly in both groups. The group with increase in APT, peak torque and power significantly decreased (141.3±37.8 vs. 127.9±26.4 %BW, 106.3±22.8 vs. 89.3±14.4 %BW/deg, p<0.05, respectively) and muscle stiffness (89.3±14.4 vs. 106.3±22.8 %BW/deg, p<0.05, respectively) decreased significantly (0.85±0.22 vs. 0.89±0.22 Nm/deg, p<0.05). In contrast, the group with decrease in APT, there was no significant change in peak torque, power and muscle stiffness.

**Conclusions:**: These results suggest that the low intensity Ecc-Ex induced APT decrease has no harmful impact on the muscle strength and flexibility. Thus, low intensity Ecc-Ex might be a useful method of muscle strain injury prevention.
Electronic stimulation can be used to stimulate contraction of paralyzed muscle, and when coordinated via computer processing, lower body muscles can power a cycle ergometer in a manner which increases whole-body energy expenditure. **Purpose:** When matched for charge input determine if calorie (kcal) expenditure and fuel partitioning measured during and immediately following a bout of functional electrical stimulation (FES) cycling differed when performed on two FES devices. **Method:** Six males with spinal cord injury (SCI; age: 49±17 yr; weight: 76±6 kg; level of injury: C4-T11) completed 30 min of steady-state FES exercise on four separate occasions at a charge-matched moderate stimulation intensity. Two sessions were completed on a commercially available unit (RT300, Therapeutic Restorations, MD) and two on a device that is in pre-production testing (Mycycle, MYOLYN, FL) that employs a different electrical control paradigm. Before, during, and after cycling, energy expenditure and fuel homeostasis were calculated via pulmonary gas exchange (Oxycon, Jeager, Germany). Results: Rate of oxygen consumption ($VO_2$) and cardiac output (CO) during FES were 34±20% and 49±23% of peak values. Respiratory exchange ratio was 0.8±0.2 and overall, there were no significant differences between the two FES devices. However, we found no significant results between groups in other outcome variables. **Conclusions:** Low-load resistance exercise rehabilitation with BFR led to significant increases in knee extension strength. Rehabilitation combined with BFR may be useful for the patients who are in need of fast recovery in muscle function following a total knee replacement surgery.

**Purpose:** To determine the effects of insulin resistance (IR) on sublesional cutaneous microvascular perfusion responses to insulin iontophoresis in persons with SCI. **Method:** Persons with SCI have sublesional microvascular endothelial dysfunction. The presence of IR has a further confounding effect on endothelial-mediated changes to cutaneous perfusion and appears to be an important modifiable risk factor for the optimization of cutaneous perfusion in the lower extremities of persons with SCI. **Results:** Low-load resistance exercise rehabilitation with BFR led to significant increases in knee extensor strength. Rehabilitation combined with BFR may be useful for the patients who are in need of fast recovery in muscle function following a total knee replacement surgery.

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Multiple sclerosis (MS) is a neurological disorder that affects ~400,000 people in the US. Common symptoms include sensory impairment, fatigue, and reduced mobility. Neuromuscular electrical stimulation (NMES) can be used to restore muscle function and improve mobility, but little is known about the relative influence of pulse width on treatment efficacy. Wider pulse durations (1 ms) activate a greater proportion of sensory axons, whereas narrower durations (0.26 ms) selectively activate motor axons. PURPOSE: To compare the effects of narrow- and wide-pulse NMES on the walking endurance of persons with MS. Wide-pulse NMES (WP) was expected to engage the nervous system more effectively and produce greater gains in walking performance than narrow-pulse NMES (NP). METHODS: Twenty-seven persons with MS (52 ± 7.4 yrs) participated in the study. Participants were randomly assigned to two groups: NP group (0.26 ms; 50 Hz; n=11; 54 ± 6.3 yrs), and WP group (1 ms; 100 Hz; n=14; 51.2 ± 8.3 yrs). NMES was applied at a tolerable level for 3 sessions/wk for 6 wks. Current was progressively increased to new tolerance and tapered to limit fatigue at testing. NMES was applied to the dorsiflexors and plantar flexors muscles (10 min each muscle, 4 on and 12 off) for both legs. Walking endurance (6 MWT) and walking speed (25-FWT) were assessed before (0 wk), after (6 wks), and after a 4 wk withdrawal period (10 wks). RESULTS: Both groups (NP & WP) improved walking endurance and walking speed after the intervention (p<0.05). The 6MWT (m) results: NP - before (mean ± SD) = 345 ± 138, after = 387 ± 154, retention = 396 ± 178; WP - before = 409 ± 131, after = 422 ± 155, retention = 450 ± 149. Mixed ANOVA indicated no significant difference between NP and WP groups (P=0.302) in 6MWT. The 25-FWT (s) results (non-parametric test: Friedman test): NP - before (mean ± SE) = 11.9 ± 5.5, after = 9.9 ± 4.4, and retention = 10.5 ± 5.1; WP - no significant differences. Wilcoxon signed rank tests in the changes in walking speed for both groups indicated no statistical difference between the two groups (P values 0.075, 0.173). CONCLUSION: 6 wks of either wide- or narrow-pulse NMES improved walking performance for persons with MS. Wide-pulse NMES didn’t produce greater gain in walking performance than narrow-pulse NMES.
Multiple Sclerosis (MS) is a disease of the central nervous system that has been associated with increased levels of fatigue. Recently, research has shown asymmetry in muscle function and performance in people with MS (PWMS) where one side of the body performs better than the other. Interestingly, and of clinical concern, would be how asymmetry might be associated with generalized fatigue. Purpose: The intent of this study was to correlate isometric knee extensor strength and peak power (PP) asymmetry scores to measures of fatigue in PWMS. Methods: Fourteen volunteers, eight with relapsing-remitting MS and six healthy controls without MS participated in the study. Participants completed a single leg incremental cycling test to determine peak power (PP) of each limb, as well as maximal voluntary isometric contractions of the knee extensors to determine strength (KES). The Modified Fatigue Impact Scale (MFIS), the Fatigue Severity Scale (FSS), and the Short Form Health Survey (SF-36) questionnaires were used to assess feelings of fatigue. A higher score on the MFIS and FSS indicates greater levels of fatigue, whereas a higher score on the SF-36 indicates better feelings of health. KES and PP asymmetry scores were calculated as weaker leg (more affected) / stronger leg; a lower score indicates a greater magnitude of imbalance. Pearson correlations were used to determine relationships between KES and PP asymmetry and all self-reported measures of fatigue. Results: The mean Expanded Disability Status Scale score was 2.6 ± 1.6 in the MS participants, indicating mild to moderate impairment. No significant correlations were observed between KES asymmetry scores and measures of self-reported fatigue. Significant correlations were observed between PP asymmetry scores and the MFIS physical sub-scale (r = -0.554; p = 0.04), the FSS (r = -0.524; p = 0.05), and the SF-36 (physical health subscale; r = 0.666; p = 0.02). Conclusions: Asymmetries in function (as measured by PP) and not strength appear to be significant contributors to self-reported measures of fatigue. This might suggest that assessments using a more dynamic measure such as peak power may be more appropriate compared to static strength. More importantly, preliminary findings suggest PP asymmetry appears to influence generalized fatigue in PWMS.

Multiple sclerosis (MS) is an immune-mediated disease of the central nervous system that results in physiological deconditioning and walking disability. High-intensity interval exercise (HIIE) has induced significant improvements in physiological conditioning in healthy and clinical populations. However, the effects of engaging in HIIE on cardiorespiratory functioning, gait, and walking performance in persons with MS who have mobility disability are relatively unknown. Purpose: To examine the effects of single sessions of recumbent stepping (HIIE) and continuous (CON) exercise on physiological and functional outcomes in persons with MS.

METHODS: 5 participants with mild-to-moderate MS underwent HIIE and CON exercise bouts. The HIIE bout included 10 cycles of 1-min intervals at the wattage associated with 50-60% VO2peak followed by 1-min recovery intervals at 15W, totaling 20 min in length. The CON bout consisted of 20 min at the wattage associated with 50-60% VO2peak. Physiological measures were collected within session, and functional measures were collected pre-, immediately-post, and 10-minutes post-exercise.

RESULTS: We observed significant differences between the CON and HIIE protocols for VO2 (r = 0.46, P = 0.01), power output (r = 0.24, P = 0.01), and RER (r = 0.74, P < 0.01), with the HIIE condition inducing higher values than the CON condition. Heart rate approached a statistically significant difference between conditions (r = -2.61, P = 0.06). There were no significant interaction effects or effects of time or condition on walking speed and gait kinematics (P > 0.05).

CONCLUSIONS: We determined that HIIE exercise taxes the cardiorespiratory system significantly more than CON exercise, yet without deleterious effects on walking and gait in persons with MS. This has important implications for informing an evidence-based exercise prescription in persons with MS who have walking impairments that is appropriate for improving physiological conditioning.
and Performance Oriented Mobility Assessment (POMA). Fine motor control was assessed with the Purdue Pegboard Test. **Results:** The gait assessment of the POMA was significant across all time points (p < 0.028). All other variables were statistically similar (p > 0.05) across all time points. **Conclusion:** Exercising on a traditional land treadmill, aquatic treadmill, or anti-gravity treadmill for 60 min/week for 4 weeks at a moderate intensity did not alter balance, gait or fine motor control in adults with Parkinson’s disease.

**Table:**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-Control</th>
<th>Post-Control</th>
<th>Post-LTM</th>
<th>Post-ATM</th>
<th>Post-AGTM</th>
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</thead>
<tbody>
<tr>
<td>TUG (s)</td>
<td>8.4±1.4</td>
<td>9.3±3.3</td>
<td>8.5±2.6</td>
<td>7.9±2.1</td>
<td>8.8±3.6</td>
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<td>POMA Balance</td>
<td>13.3±3.0</td>
<td>14.3±1.2</td>
<td>13.5±2.3</td>
<td>14.3±2.0</td>
<td>14.0±1.6</td>
</tr>
<tr>
<td>POMA Gait*</td>
<td>10.3±1.6</td>
<td>9.2±3.1</td>
<td>11.7±1.5</td>
<td>10.8±2.3</td>
<td>10.8±0.9</td>
</tr>
<tr>
<td>FMC (left hand)</td>
<td>8.7±3.2</td>
<td>9.1±2.8</td>
<td>9.0±3.4</td>
<td>8.8±2.8</td>
<td>9.0±3.2</td>
</tr>
<tr>
<td>FMC (right hand)</td>
<td>8.4±3.3</td>
<td>8.6±3.0</td>
<td>9.2±2.7</td>
<td>10.1±2.8</td>
<td>9.8±2.6</td>
</tr>
<tr>
<td>FMC (both hands)</td>
<td>6.1±2.4</td>
<td>6.6±2.7</td>
<td>7.3±2.9</td>
<td>6.8±2.2</td>
<td>6.2±1.9</td>
</tr>
</tbody>
</table>

Values are mean ± s.d. * = main effect for time point (p = 0.028); ATM = aquatic treadmill; AGTM = anti-gravity treadmill; LTM = land treadmill; TUG = timed-up-and-go; POMA = performance oriented mobility assessment; FMC = fine motor control.

**D-73**  
**Free Communication/Poster - Oxygen Uptake Kinetics**  
**Thursday, June 1, 2017, 1:00 PM - 6:00 PM**  
**Room: Hall F**

**2262**  
**Board #275**  
**June 1 3:30 PM - 5:00 PM**  
**Oxygen Uptake during Three Varying Duration High-Intensity Functional Training Sessions**  
**Jesse A. Stein, Joshua R. Smith, Carl J. Ade, Ryan M. Broxterman, Brian Sanborn, Thomas J. Barstow, FACSM, Katie M. Heinrich. Kansas State University, Manhattan, KS.**

**Preliminary: To determine oxygen uptake during three varying duration high-intensity functional training (HIFT) sessions. METHODS: Six healthy men with >1 year of HIFT experience were recruited (age: 29.5 ± 5 yrs). Participants completed an incremental exercise test on a treadmill to determine maximal oxygen consumption (\(\dot{VO}_2\max\)), gas exchange threshold (GET), and respiratory compensation point (RCP). Participants completed three HIFT sessions. Session 1 (S1) consisted of 3 rounds of power cleans and ring dips. Session 2 (S2) consisted of 3 rounds of a 400-meter run, 21 kettlebell swings and 12 pull-ups. Session 3 (S3) consisted of as many rounds as possible of 5 pull-ups, 10 push-ups and 15 squats in 20 minutes. Participants were encouraged to complete S1 and S2 as fast as possible, while performing as many repetitions as possible in S3. Pulmonary gas exchange (\(\dot{V}O_2\), \(\dot{V}CO_2\), VE) were measured during each session. **RESULTS:** The mean \(\dot{VO}_2\max\) was 55.9±5.6 mL/kg/min with GET and each session. Possible in S3. Pulmonary gas exchange (\(\dot{VO}_2\), \(\dot{V}CO_2\), VE) were measured during to complete S1 and S2 as fast as possible, while performing as many repetitions as possible in S3. Pulmonary gas exchange (\(\dot{V}O_2\), \(\dot{V}CO_2\), VE) were measured during S1 and S2 as fast as possible, while performing as many repetitions as possible in S3. Pulmonary gas exchange (\(\dot{V}O_2\), \(\dot{V}CO_2\), VE) were measured during.

**2263**  
**Board #276**  
**June 1 3:30 PM - 5:00 PM**  
**Characterization of Ventilatory Off-Kinetics Following Arm and Leg Cycling in Incomplete Spinal Cord Injured Men**  
**Gino S. Panza, Khalid Alwadeai, Jeffrey E. Herrick. George Mason University, Fairfax, VA. (Sponsor: Randall Keyser, FACSM). Email: gpanza@masonlive.gmu.edu**

**Introduction:** The minute ventilation (\(V_{E}\)) off-kinetics phase has been associated with greater muscle oxygen deficiency and slower muscle oxygen adjustments to exercise. Neural mechanisms are implicated in \(V_{E}\) off-kinetics as recovery from exercise may be mediated by breathing frequency. Motor incomplete spinal cord injury (miSCI) is associated with significant cardiopulmonary impairment that may alter the off-kinetic response during arm and leg exercise. **Purpose:** The purpose of this study was to characterize the \(V_{E}\) off-kinetics following both arm and leg exercises in adults with cervical miSCI compared to a group of age matched peers (CON). **Participants:** miSCI: Age: 31 (18.1) years, Height: 185.7 (60.6) cm, Weight: 75.9 (14.4) kg. CON: Age: 32 (4.6) years, Height: 178.3 (6.6) cm, Weight: 92.9 (16.3) kg. **Methods:** Both groups completed arm and leg cycle tests on separate days at an intensity that elicited a \(V_{E}\) equal to 30% of measured maximum voluntary ventilation (MVV). \(V_{E}\) off-kinetics was analyzed over the 5 minutes following the 30% MVV bout using a nonexponential model. Amplitude (\(Amp\)), in liters, was defined as the change from exercise to steady state of asymptote approaching baseline and \(t\) (seconds) as the time taken to reach 63% of the end-recovery amplitude. **Results:** miSCI group: \(t\) (s) and \(Amp\) (L) for arm and leg cycling were as follows: \(67.9 (8.0)\) and \(-20.5 (11.5)\), and \(106.1 (19.5)\) and \(-23.4 (14.5)\). The average arm \(t\) was 33.7 (29.2) faster than leg cycling with a 2.8 (0.4) liter decrease in amplitude. CON group: \(t\) (s) and \(Amp\) (L) for arm and leg cycling were as follows: \(56.7 (5.9)\) and \(-43.4 (4.4)\) and \(90.13 (17.83)\) and \(-49.2 (4.9)\). On average, arm \(t\) was 33.3 (16.5) seconds faster than leg cycling while the \(Amp\) was 5.83 (29.2) liters lower. On average, \(t\) was 11.9 and 11.50 s slower for arm and leg cycling, respectively when compared to CON. Amplitude was also slower with 22.8 and 25.8 liter difference in arm and leg cycling, respectively. **Conclusion:** The miSCI group reported a longer \(t\) following both arm and leg exercise than the CON group suggesting a prolonged recovery phase. A prolonged \(V_{E}\) off-kinetic phase may in part contribute to reduced functional performance in adults with chronic miSCI. Character count w/o spaces: 1907/2000

**2264**  
**Board #277**  
**June 1 3:30 PM - 5:00 PM**  
**Prior Supramaximal Cycling Transiently Increases Submaximal Cycling Energetics in Cyclists and Non-cyclists**  
**Eric Homestead, William C. Byrnes, FACSM. University of Colorado Boulder, Boulder, CO. (Sponsor: William C. Byrnes, FACSM).**

**Purpose:** We sought to examine the effects of supramaximal cycling on the energetics of submaximal cycling at and below the lactate threshold (LT) in cyclists and non-cyclists. **Methods:** On 3 separate days, endurance-trained cyclists (CYCL, n=10) and recreationally active non-cyclists (N-CYCL, n=9) performed 3 sub-LT cycling bouts at 60%, 80%, and 100% LT before (PRE) and after (POST 1, POST 2, and POST 3) supramaximal cycling bouts (3x2 min) at 110% of power at \(V_{O_2\max}\) (SUPRA). POST 1, POST 2 and POST 3 occurred 2, 22, and 52 min after SUPRA. Metabolic variables, core temperature (\(T_c\)), and blood lactate concentration ([lactate]) were measured. \(VO_2\)-power and EE-power linear relationships were developed for each subject from the 3 intensities and compared between conditions (PRE, POST 1, POST 2 and POST 3). **Results:** \(VO_2\)- and power at LT were significantly higher by 51% and 131% in CYCL compared to N-CYCL (p<0.01). CYCL and N-CYCL responded the same across conditions so the estimated marginal means are reported which combines groups. \(VO_2\) was significantly greater during POST 1 compared to PRE, POST 2, and POST 3 regardless of intensity (2.0±0.5 vs. 1.8±0.5, 1.8±0.5, and 1.8±0.5 min⁻¹, p<0.05). \(VO_2\)-power slopes were different between conditions (p<0.05), but not when EE-power slopes were analyzed. The \(VO_2\)-power intercept during POST 1 was significantly greater compared to PRE, POST 2, and POST 3 (0.68±0.25 vs. 0.58±0.20, 0.55±0.19 and 0.53±0.20 L·min⁻¹, p<0.05). The same results were found for EE-power intercepts. \(\dot{V}O_2\), \(HR\), and \(T_c\) were significantly higher during POST 1 compared to PRE (p<0.05). Only \(HR\) and \(T_c\) were higher during POST 2 and POST 3 compared to PRE (p<0.05). [Lactate] increased from PRE to POST 1 and then progressively decreased over time (p<0.05). **Conclusion:** Prior supramaximal cycling increases the energetic cost of submaximal cycling (at and below LT) in endurance-trained cyclists and non-cyclists. Arm and leg recreationally active non-cyclists. For both arm and leg cycling, the EE-power intercept during sub-LT cycling immediately following supramaximal cycling suggests that muscle efficiency was unaltered and that the greater energetic cost is associated with metabolic demands that do not increase with increasing workrate.
PURPOSE: High-altitude or oxygen-limited training has received a lot of attention as a way to increase oxygen utilization capacity. Due to the impracticality involved in traveling to high altitudes, endurance athletes and coaches have employed methods of simulating high-altitude (low-oxygen) conditions as an effective alternative. Some low-oxygen devices may not be available to all due to prohibitive cost or inconvenience. A recent simple alternative is altitude-simulating masks. However, the effectiveness of these masks is in question. This research looks at the effect of masked training on VO2max and hematocrit levels.

METHODS: 14 subjects participated in a 6-week interval-training experiment. Subjects VO2max, hematocrit, and lactate values were measured. Half of the subjects were given a training mask and asked to complete 3 workouts per week in the range of 60%-80% of VO2max. The control group was given the same task of working out 3 times a week without a mask. Hematocrit and VO2max were measured after the 6 weeks of training and analyzed for significant differences.

RESULTS: There was no difference between the pre and post-training VO2max values in the masked and no-mask groups. There was no difference in the percent change in VO2max between the two groups. The no-mask group experienced a 5.9%7 change in hematocrit while the masked group had a decrease in hematocrit of 1.19%< after training. There was a significant difference in how the two groups hematocrit levels responded to training.

CONCLUSIONS: We found no support for the use of training masks helping athletes use oxygen better than using no mask at all. Perhaps training masks may help athletes use oxygen more effectively if they used them for longer than 6 weeks. A training protocol of longer duration would likely yield more conclusive results.

Endurance exercise training increases whole-body maximum O2 uptake (VO2max) by increasing both convective and diffusive O2 conductances within the active muscles. High intensity interval training (HIIT) very effectively increases VO2peak but it is unknown whether HIT enhances muscle O2 diffusive properties.

PURPOSE: We investigated the effect of HIT on deoxygenated hemoglobin and myoglobin (Hb+Mb) concentration (Hib, reflecting fractional O2 extraction) and total Hb+Mb concentration (HbF, reflecting diffusive O2 transport) in quadriceps during ramp- incremental cycling (RJ) using quantitative time-resolved near-infrared spectroscopy (TRS-NIRS).

METHODS: Fifteen men volunteered for exercise training (TR, n = 8) or non-training control (CN, n = 7). TR performed HIT (4 repeats of 30 s all-out sprint cycling and 4 min recovery) 3 times/week for 5 weeks. All subjects performed RJ to exhaustion pre- and post-intervention. VO2 was measured breath-by-breath. Absolute Hib and HbF were measured in the vastus lateralis (VL) and rectus femoris (RF) by TRS-NIRS. Hib and HbF profiles were modeled by a double linear response: y(t) = x · b1 + x · b2 + y(t) · f(x, y, z), where m(t) is the slope of heme chromophore accumulation above and below an inflection point, [H].

RESULTS: VO2peak increased in TR (48.9±4.6 vs. 52.7±5.3 mL kg·min⁻¹, p<0.05) but not in CN (46.1±8.9 vs. 45.2±10.1 mL kg·min⁻¹). The amplitude of Hib from rest to intolerance increased only in TR, in both the VL and RF muscles (29.5±13.5 vs. 34.8±13.7 PM, mean of both sites, p<0.05). In contrast, post-training Hib amplitude was unchanged in both groups and both muscles. Moreover the slopes (m·m) of HB and HbF were unchanged between pre- and post-intervention in either group or muscle.

CONCLUSIONS: Five weeks of HIT increased VO2max and regional (VL and RF) muscle deoxygenation without altering Hib slope or peak HbF - reflecting a gain of O2 flux to active muscle with an unchanged O2 delivery to utilization matching during submaximal exercise and an unchanged diffusive O2 potential. This supports the notion that greater muscle O2 consumption following HIT in young adults occurs by the improvement of O2 extraction capacity without an obligatory [Hb]-induced enhancement of diffusive O2 conductance. Supported by JSPS-15K16476, 24247046, 26560362.
Running economy (RE) is often a good predictor of running performance among athletes with a similar VO2 max. Additionally, economy differences have been seen when comparing elite distance runners to recreational runners. **PURPOSE:** To explore the effect that varied stride frequencies (SF) have on RE in both collegiate and recreationally trained runners. **METHODS:** Four collegiately trained male distance runners and four college-aged recreational runners ran on a treadmill at speeds of 3.9 m/s and 2.7 m/s, respectively, which corresponded with 60 to 65% of their VO2 max. Subjects completed 5 bouts of running for 5 minutes at their preferred stride frequency (PSF), ±10% of their PSF, in a random order. The first three minutes of each trial were used to match the prescribed stride frequency and to reach a steady state, the last 2 minutes were used for data analysis. Subjects were given three minutes between trials to recover from the prior prescribed SF session. PSF was determined prior to data collection and prescribed stride frequencies were defined with a metronome. Subjects were given a familiarization phase prior to data collection to aid in matching the prescribed SF and video was used to verify that prescribed SF was achieved. **RESULTS:** Mean VO2 differences in collegiate trained runners were significant (p < 0.05) in all but one of the trials (±5% of SF) where p = 0.07. There were subjects experienced a small but not statistically significant (p = 0.06) improvement in RE as SF increased. Recreational runners saw mean VO2 differences that were also significant (p < 0.03) when running at a SF that was below their PSF, where some subjects experienced a small but not statistically significant (p = 0.06) improvement in RE as SF increased. **CONCLUSION:** Experienced runners tend to have a PSF that corresponds with what is most economical, whereas lesser trained, recreational runners could potentially see improvements in RE in an increase in SF.
Whole-body high-intensity interval training (WB HIIT), including CrossFit®, has gained wide popularity, partly because HIIT benefits can be achieved in less time than moderate-intensity exercise. Most HIIT research, however, has used bicycle ergometer or treadmill-based exercises that emphasize only the lower body. PURPOSE: To compare heart rate (HR), respiratory exchange ratio (RER), and VO2 following a 10-minute functional, WB HIIT CrossFit® workout and a 20-minute steady-state, moderate-intensity workout. METHODS: Fourteen CrossFit® athletes (11 F/3 M) aged 36.6±9.2y performed 20-minute rowing ergometer exercise at 70%±5 bpm of age-predicted max and a 10-minute WB HIIT workout consisting of as many continuous reps as possible of 10 barbell thrusts (men 75s/65s women 55s) and 10 burpees over the barbell, on separate days. VO2 and RER were measured using indirect calorimetry immediately following each exercise and throughout recovery until VO2 and RER returned to pre-workout levels. Heart rate was continuously monitored. Differences in time to return to baseline for VO2 and RER between the two modalities were determined using dependent t-tests (p<0.05). RESULTS: Participants achieved 96.4±4.4% of age-predicted max HR during the WB HIIT workout, classifying it as a max-effort exercise. Time to return to resting RER values between the two workouts was significantly different (19.1±3.8 mL/kg/min after rowing vs. 32.5±5.4 min after WB HIIT, p<0.001). Peak VO2, levels immediately after exercise also differed (19.5±4.8 mL/kg/min after rowing vs. 32.9±6.0 mL/kg/min after WB HIIT, p<0.001), as did the time for VO2 recovery (8.2±1.6 min after rowing vs. 22.3±7.7 min after WB HIIT, p<0.001). CONCLUSION: RER and VO2 remained elevated over 11 and 14 min longer, respectively, following WB HIIT, despite half the workout time. This is likely due to a longer time to restore ATP-PC stores, recycle lactate, and reduce body temperature. Heart rate remained elevated following the observed recovery period after WB HIIT suggesting a higher EPOC and caloric expenditure compared to moderate-intensity exercise. Our equipment prevented the measurement of VO2 during the workout, so future research should use equipment that would allow for testing VO2 during WB HIIT exercise so that EPOC can be accurately calculated.

While recent research debates the potential benefits and risks of barefoot and simulated barefoot running, the long-term effects on biomechanical and physiological parameters remain unclear. PURPOSE: To investigate the effects of transitioning from traditional cushioned (CF) to minimalist footwear (MF) on running economy (RE) in recreational runners. METHODS: We used a prospective randomized controlled design. Thirty-two habitual shod recreational male runners (mean ± SD age 38.3 ± 8.5 years, length 178 ± 5.1 cm, weight 78.2 ± 11.2 kg, BMI 24.3 ± 2.9 kg/m² and weekly mileage of 53.1 ± 29.8 km) were allocated randomly in either an eight weeks training intervention in minimalist (=intervention) or cushioned running shoes (=control). The intervention consisted of a gradually increased new footwear load (CF or MF) by 5% of weekly mileage per week. Before and after the intervention, VO2max test and seven days apart a submaximal RE test at 70%, 80% and 90% of VO2max in both shoe conditions were conducted. Steady state oxygen consumption during the last of five minutes was captured and used to calculate the relative oxygen consumption per distance and bodyweight. A paired sample t test was used determine differences between pre and post interventional RE values. RESULTS: The oxygen consumption of the intervention group showed a reduction in all tested conditions. The intervention group showed a statistically significant reduction from 224.2 to 217.5 mL·kg⁻¹·min⁻¹ (p=0.0479) for running in MF at 90% of VO2max. Interestingly, the VO2 values were also reduced for the intervention group (training in MF) when running with CF at 80% (from 228.4 to 221.8 mL·kg⁻¹·min⁻¹, p=0.0186) and 90% (from 229.2 to 217.9 mL·kg⁻¹·min⁻¹, p<0.002) of VO2max. For all other stages and the control group (training in CF) no significant differences were observed. Five participants in the control and two participants in the intervention group did not finish the study (respectively one injury per group). CONCLUSION: In this study, transitioning to MF improved the RE for running in MF and in CF. Within the debate of pros and cons of (simulated) barefoot running, this adds evidence for improvements when transitioning gradually in small steps over 8 weeks to MF. Future research should investigate dose-response relationships and effects on running performance.
negatively to triglycerides (TGs) and average size and concentration of very low-density lipoprotein (VLDL) particles and their subclasses of large particles. BMI was negatively correlated to blood measures of CRF, but showed a stronger association with VO2peak than to the Andersen test. Conclusion: Our data showed a strong association between CRF (both the VO2peak-test and the Andersen-test) and lipid protein pattern in prepubertal healthy children, and this adds to the understanding of CRF as a good measure of children’s CV health. Furthermore, the Andersen test showed even stronger associations to its lipid protein pattern compared to the VO2peak-test. This is encouraging as the Andersen-test is a practicable field test that involves only minimal equipment and has a low cost.

2277 Board #290  June 1 3:30 PM - 5:00 PM
The Effect of Continuous versus Intermittent Exercise on VO2 Slow Component and Muscle Activation
Jakob D. Lauver1, Timothy R. Rotarius2, Barry W. Scheuermann1. 1Adrian College, Adrian, MI. 2The University of Toledo, Toledo, OH.

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(No relationships reported)

During heavy exercise intensity exercise (above lactate threshold (LT)), a higher O2 cost than predicted by VO2 work rate relationship for exercise below LT occurs which has been termed, the oxygen uptake (VO2) slow component (VO2SC). Interestingly, a decrease in the overall VO2 response during heavy intensity intermittent versus continuous heavy intensity exercise has been recently reported. How intermittent exercise results in less total work being performed and perhaps muscle activation, which may affect the amplitude of the VO2SC. Purpose: To examine the magnitude of the VO2SC and muscle activation in response to heavy intensity continuous (CON) and intermittent (INT) exercise when the same total work was performed. Methods: Four healthy males (27 ± 3 yrs, ±SD) performed 2 bouts of CON and INT on separate days, each bout lasting 6 min at an intensity of 50% of the difference between peak VO2 and LT (AT50%). In the INT condition, 3 recovery periods (20 W) were inserted every 10 s for the last 3 min of exercise. The work rate (WR) for the INT protocol corresponded to an intensity (greater than AT50%) which resulted in the same total work (i.e. area under the work curve) performed in CON. Pulmonary VO2 was recorded breath-by-breath, while muscle activation (vastus medialis (VM), vastus lateralis (VL)) was assessed by surface electromyography (EMG). Results: The phase II tVO2 (CON: 24.6 ± 10.8 s; INT: 25.0 ± 4.5 s) and VO2SC, as measured by AVO2~60 (CON: 534 ± 159 mL/min; INT: 402 ± 117 mL/min) were similar (p=0.05) between CON and INT. The change in EMG, as measured by AEMG~60 for VM (CON: 1.95 ± 3.51 mV; INT: -4.16 ± 13.95 mV) and VL (CON: 4.45 ± 3.31mV; INT: -2.05 ± 13.78 mV) was similar (p=0.05) between CON and INT. However, since end exercise VO2 was similar (CON: 3258 ± 684 mL/min; INT: 3239 ± 682 mL/min, p=0.05) and absolute exercise WR was lower (p=0.02) for CON (203 ±56 W) than INT (262 ± 80 W), the VO2/WR relationship was higher (p<0.05) for CON (16.0 ± 2.0 mL/kg/min/W) compared to INT (12.3 ± 1.3 mL/kg/min/W). Conclusion: While considerably different absolute WRs were necessary to achieve the same total work performed, the similar VO2SC and muscle activation, but lower VO2/WR relationship for INT versus CON suggests that brief periods of recovery significantly alter the O2 cost of heavy intensity exercise.

2278 Board #291  June 1 3:30 PM - 5:00 PM
Muscle Deoxygenation during Incremental Exercise is Delayed in Children Compared to Young Adults
Abraham S. Chiu1, Harry B. Rossiter, FACSM2, Ida E. Clark1, Andrew M. Jones, FACSM1, Stephen J. Bailey1, Brett S. Kirby2, Brad W. Wilkins2, Lee J. Wylie1, Anni Vanhatalo, FACSM1. 1University of California Irvine, Irvine, CA. 2Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA. (Sponsor: Harry B Rossiter, FACSM)

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The mechanisms regulating O2 delivery and utilization during endurance exercise differ with maturation and are incompletely understood. This is important to understand the development of cardiovascular and neuromuscular diseases that originate early in life. Time-resolved near-infrared spectroscopy (TRS-NIRS) provides a quantitative non-invasive measurement of deoxy-hemoglobin + myoglobin concentration ([HHb]) at the muscle, an indicator of muscle deoxygenation during exercise. Purpose: To compare [HHb] dynamics during incremental ramp exercise in healthy early pubertal children and young adults. METHODS: 23 early pubertal children (16 yrs, 7-11 years) and 15 young adults (7 yrs, 21-35 years) underwent an incremental ramp exercise test on a cycle ergometer. Pulmonary gas exchange was measured breath-by-breath (Vmax, Carefusion). Fastus lateralis [HHb] was quantified by TRS-NIRS (TRS-21, Hamamatsu Photonics). RESULTS: Peak VO2 was not different between children and adults normalized to body mass (46.7±8.1 vs. 48.9±7.7 mL/kg/min). Absolute [HHb] was not different between children and adults during unloaded pedaling (23.5±5.5 vs 26.8±10.0 μM, p=0.20) but adults had a higher peak exercise [HHb] (32.0±8.2 vs 44.7±22.6 μM, p=0.01). Two way RM-ANOVA of relative HHb dynamics revealed an effect of age (F(1,36) = 6.895, p=0.013) and interaction with % peak power (p=0.001, Figure). Post-hoc, relative HHb was lower at 60% peak power in children vs adults (57% vs 68±13%, p=0.0006), while VO2 did not differ (33.5±4.9% vs 30.6±6.2%, p=0.12). CONCLUSION: Muscle deoxygenation is both attenuated and delayed during incremental exercise in children compared to adults, despite similar relative VO2. This is consistent with a closer matching of muscle microvascular O2 delivery to utilization over a greater range of aerobic power in children. The mechanisms contributing to this improved regulation of muscle blood flow during exercise in children warrant further study.

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Effects of Bodyweight Exercise on Excess Post-exercise Oxygen Consumption and Metabolic Expenditure
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Introduction: Body weight exercises (BWE; push-ups, squats, lunges) are popular modes of exercise, yet little is known regarding their effects on caloric expenditure. Classic hypertrophy training results in up to four-hour excess post-exercise oxygen consumption (EPOC) and elevated 24-hour resting metabolic rate (RMR). The purpose of this study was to determine if BWE 1) alters the length and amount of EPOC and 2) increases 24-hour RMR. METHODS: Four healthy adult volunteers (3 males, 1 female; age 22.2±2.7 yrs, height 168±11cm, mass 74.7±18±kg, body fat 27.8±4.7%) consumed standard diets and underwent two RMR measures [pre- (morning) and post- (following morning) BWE]. Three hours following pre-RMR, participants completed a BWE bout [4 sets of push-ups (~9 reps), squats (~14 reps), and lunges (~14 reps)], followed by a 4 hour EPOC test. To standardize the work done participants performed 1-repetition maximum tests for bench-press and leg-press (to determine number of repetitions for BWE). Results: It was found that a bout of BWE elevated relative VO2 (rVO2; mL/kg/ min) and energy expenditure post-exercise. When comparing pre-RMR to EPOC there was a significant difference at minute 15 in both rVO2 (p<0.02) and caloric expenditure (p<0.05). Yet, there was no significant difference in both rVO2 and caloric expenditure when pre-RMR and post-RMR were compared. Conclusions: As expected, we found that EPOC occurs after BWE, but is only elevated up to 30 minutes after exercise. This shows that BWE is an efficient and practical way to elevate metabolic rate, leading to increased caloric expenditure while potentially saving time and money. More participants are needed to fully understand the physiological implications of BWE related to caloric expenditure in healthy adults.
Critical power (CP) is a fundamental parameter in defining high-intensity exercise tolerance, however its physiological determinants are unclear. CP has been shown to be causally related to CP priming exercise would be expected to increase CP in the supine position that was absent in the upright position. Specifically, priming exercise resulted in a concomitant shortening of VO2 kinetics and increased CP in the supine position that was absent in the upright position. To determine the impact of priming exercise on VO2 and CP in the supine and upright body positions. METHODS: 16 healthy men were assigned to either upright or supine groups, and completed an incremental ramp test to determine VO2 max and the gas exchange threshold. This was followed by 8 visits whereby CP, pulmonary VO2, and muscle deoxyhaemoglobin ([HHb]) via near infrared spectroscopy) kinetics were determined via constant load exercise tests to exhaustion in two conditions: 1) without priming exercise (CON) and 2) following a bout of priming exercise at ~30%Δ. RESULTS: During supine exercise, priming exercise shortened τ (CON: 53 ± 17 vs. PRI: 31 ± 9; P < 0.001) and increased CP (CON: 177 ± 31 vs. PRI: 185 ± 30; P = 0.006) compared to control. However, priming exercise had no effect on τ (CON 35 ± 8 vs. PRI 37 ± 11; P = 0.82) or CP (CON: 235 ± 42 vs. PRI: 232 ± 34 W; P = 0.57) during upright exercise. Priming exercise also resulted in a slowing of [HHb] kinetics during supine (CON: 8 ± 4 vs. PRI: 11 ± 4; P = 0.003) but not upright (CON: 10 ± 5 vs. PRI: 14 ± 10; P = 0.10) position. CONCLUSIONS: The present study provides the first experimental evidence that VO2 kinetics are an important determinant of CP. Specifically, priming exercise resulted in a concomitant speeding of VO2 kinetics and increased CP in the supine position that was absent in the upright position. This was associated with a slowing of [HHb] kinetics in the supine position, suggesting that this effect might be mediated by increased O2 availability.

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**Prediction of Oxygen Uptake from Pedometer Output across Different Activities**

Pedometers may be used to estimate participation in physical activity (PA) of moderate-to-vigorous intensity. Step rate thresholds for moderate-to-vigorous PA vary by height but have been developed in research employing primarily locomotion activities. Whether pedometer output can accurately predict the energy cost across different locomotion, occupational, and household activities, and during sedentary behavior has not been thoroughly studied. **PURPOSE:** We examined if step rate and height predict the rate of oxygen uptake (VO₂) across different types of activities and sedentary behavior. Following development of a prediction model, we also evaluated its accuracy. **METHODS:** Participants were 36 healthy young adults (21 ± 4 yrs; 16 men). They completed 8 activities (representing minimal sitting; b) walking at 2.5 mph; c) walk at 3.5 mph and 5% grade; d) jog at 5 mph; e) moving a box 2.5 yards; f) doing dishes; g) ascending and descending a 20-step staircase; and h) vacuuming. We measured VO₂ with a portable open-circuit spirometer and step rate with a pedometer (NL-1000, New Lifestyles) worn on the right hip, both wrists, and both ankles. Acceleration data for y-axis and VM were converted to 5-s epochs. Mean counts (5 to 25-s) were used for analysis of each speed condition. Repeated measures ANOVAs was used to examine effect of speed on y-axis and VM activity counts for each wear location. Pair-wise comparisons with Bonferroni adjustments were performed to determine where differences occurred. A plateau was defined as no significant increase in counts with an increase in speed when running. Correlation analysis was used to assess the association between counts and speed. **RESULTS:** Hip y-axis and VM counts increased significantly up to 10 km/hr and significantly decreased at speeds above 16 km/hr. For the wrists and ankles, significant increases in counts were seen for y-axis across all running speeds and VM across all speeds. The table shows counts/5-s for y-axis and VM at each location and speed. **CONCLUSION:** Pedometer-determined step rate and its square are significant predictors of VO₂ across different activities and sedentary behaviors in healthy young adults. Height does not contribute to VO₂ prediction. Accuracy of prediction across activities is low to moderate.

**Results**

<table>
<thead>
<tr>
<th>Speed (km/hr)</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip y-axis</td>
<td>94</td>
<td>268</td>
<td>417</td>
<td>662</td>
<td>728</td>
<td>735*</td>
<td>707*</td>
<td>664*</td>
<td>684*</td>
<td>544*</td>
</tr>
<tr>
<td>VM</td>
<td>185</td>
<td>328</td>
<td>484</td>
<td>698</td>
<td>769</td>
<td>783*</td>
<td>761*</td>
<td>731*</td>
<td>690*</td>
<td>658*</td>
</tr>
<tr>
<td>Wrist Left</td>
<td>196</td>
<td>315</td>
<td>414*</td>
<td>1166</td>
<td>1388</td>
<td>1631</td>
<td>1888</td>
<td>2110</td>
<td>2439</td>
<td>2740</td>
</tr>
<tr>
<td>Right y-axis</td>
<td>199</td>
<td>293</td>
<td>395*</td>
<td>1253</td>
<td>1535</td>
<td>1791</td>
<td>2045</td>
<td>2260</td>
<td>2618</td>
<td>2996</td>
</tr>
<tr>
<td>Left VM</td>
<td>279</td>
<td>445</td>
<td>692</td>
<td>1604</td>
<td>1813</td>
<td>2066</td>
<td>2317</td>
<td>2524</td>
<td>2867</td>
<td>3197</td>
</tr>
<tr>
<td>Right VM</td>
<td>289</td>
<td>433</td>
<td>720</td>
<td>1702</td>
<td>1982</td>
<td>2262</td>
<td>2505</td>
<td>2711</td>
<td>3087</td>
<td>3383</td>
</tr>
<tr>
<td>Ankle Left y-axis</td>
<td>93</td>
<td>559</td>
<td>603</td>
<td>392*</td>
<td>618</td>
<td>861</td>
<td>1062</td>
<td>1259</td>
<td>1432</td>
<td>1673</td>
</tr>
<tr>
<td>Right y-axis</td>
<td>469</td>
<td>637</td>
<td>699</td>
<td>472*</td>
<td>687</td>
<td>943</td>
<td>1162</td>
<td>1332</td>
<td>1451</td>
<td>1649</td>
</tr>
<tr>
<td>Left VM</td>
<td>550</td>
<td>1037</td>
<td>867</td>
<td>1959</td>
<td>2444</td>
<td>2941</td>
<td>3108</td>
<td>3673</td>
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<td>4242</td>
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<tr>
<td>Right VM</td>
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<td>3089</td>
<td>3510</td>
<td>3986</td>
<td>4071</td>
<td>4419</td>
</tr>
</tbody>
</table>

**Conclusion:** When the ActiGraph is worn on the wrist or ankle y-axis and VM do not plateau as is seen with the hip location. The wrist and ankle wear locations result in a stronger linear relationship between speed and counts than the hip does.

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**Device Settings Impact on StepWatch Accuracy during Running**

**PURPOSE:** The StepWatch 3 ankle-mounted pedometer has been used to capture free-living ambulatory activity in published research, however, this device does not accurately count running steps. It is unclear from published literature if device setting impacts the accuracy of counting running steps. **METHODS:** To examine the step count accuracy of the StepWatch 3 at various running speeds by altering device settings. **RESULTS:** Thirty participants aged 21-32 participated in the study. Participants completed all devices were above 0.8 (p<.001) indicating good or excellent discrimination ability of zero cadence. Vivosoft and wrist-worn ActiGraph provided the highest (93%) and lowest (75%) accuracy, respectively. **CONCLUSION:** Agreement with zero cadence, both research- and consumer-grade activity monitors provided valid capacity for discriminating seated activities from common daily living activities. Based on this preliminary analysis it appears that accumulated time spent at zero cadence obtained by activity monitors can be used as a proxy indicator of time spent sitting. Supported by NIH/NIA grant 5R01AG049024-03 – CADENCE-Adults study.
4-minute trials of treadmill ambulation at 6 different speeds ranging from 2.24 to 3.35 m·s⁻¹ while wearing one device on the lateral aspect of each ankle, directly above each malleolus for a total of 2 devices overall. Each device was programmed using either the “default” setting or “Quick Step” setting. A counterbalanced design was used to minimize order effect. Direct observation was used as the criterion of step count (total steps/trial). One-way repeated measures ANOVAs were used to determine differences between step count estimates from devices/settings at the ankle compared to criterion. ANCOVAs were used to determine the impact of stride length and cadence on device determined step counts. Mean absolute percent error (MAPE) was also determined for all running speeds. RESULTS: StepWatch determined steps were significantly different from criterion for all speeds regardless of device setting (p < .05), with the exception of device “Quick Step” setting at 2.24 m·s⁻¹ (p = .18) and MAPE was ≤ 3% (19). MAPE values for the default setting were ≥ 24.4% for all treadmill speeds. The remaining MAPE values for the “Quick Step” setting were ≥ 4.9% for treadmill speeds beginning at 2.46 m·s⁻¹. When stride length was considered, StepWatch determined steps were not statistically different from criterion for all speeds regardless of device setting. CONCLUSION: StepWatch default and “Quick Step” settings do not accurately report steps at ambulatory speeds ≥ 2.24 m·s⁻¹, with the exception of device “Quick Step” setting at 2.24 m·s⁻¹. After accounting for stride length, device output accurately reported steps regardless of device setting and treadmill ambulation speed. Further research is needed to explore the advanced setting features of the StepWatch with a goal of improving accuracy.

The time-stamped sampling nature of accelerometer-based wearable technologies allows minute-by-minute study of step accumulation, and specifically cadence (steps/min). PURPOSE: Considering cadence has been strongly correlated with overall intensity defined using metabolic equivalents or METs (e.g., 3 METs=moderate intensity and 6 METs=vigorous intensity), the purpose of this study was to identify objectively observed, manually counted cadence criterion cut points that can inform heuristic (i.e., reasonably acceptable or guiding) values associated with 3 and 6 METs. METHODS: Ten men and 10 women representing each 5-year age-group category between 21-40 years (21-25, 26-30, 31-35, 36-40) for a total of 80 adults (mean age 29.75±6.7 years; BMI 24.76±3.4 kg/m²) participated in a lab-based study of videotaped movement. Data were collected during a series of 5-min treadmill bouts (starting at 0.5 and increasing up to 6 mph in 0.5 mph increments) as tolerated, until running occurred, or until reaching 75% of maximum heart rate or a rating of perceived exertion (RPE) > 13. MET level was calculated by dividing steady state VO₂ by resting (seated) energy expenditure (both expressed in ml/kg/min). RESULTS: Two distinct areas of linearity emerged from the cadence versus METs data and a bilinear or ‘hockey stick’ model was subsequently applied to ascertain 3 and 6 MET cut points. Cadence accounted for 78% of the variance (least-squares bilinear regression model) in intensity with the bilinear break point apparent at 103 steps/min. The cadence cut point (95% Prediction Intervals; broader than more conventional Confidence Intervals) for 3 METs was 104.2 (34.8-113.7) steps/min and at 103 steps/min. The cadence cut point (95% Prediction Intervals; broader than more conventional Confidence Intervals) for 3 METs was 104.2 (34.8-113.7) steps/min and 103 steps/min. CONCLUSIONS: Heuristic values are practical, guiding, rounded quantities which may be imprecise but serve effectively to convey generalized and reasonably accurate information. We confirmed previous speculation that, despite individual variability, 100 steps/min can serve as a reasonable heuristic value indicative of moderate intensity in this age group. Further, 130 steps/min appears to be a similarly useful indicator of vigorous intensity ambulatory movement.

Physical activity (PA) assessment is critical for understanding PA levels. Self-report tools are useful but can be inaccurate. PURPOSE: To determine: 1) reliability/validity of the 7-item Modified International Physical Activity Questionnaire (MIPAQ) compared to objective measurement in African Americans and, 2) the effect of a 10-minute bout of moderate-intensity PA prior to survey administration on response accuracy. METHODS: Participants (N=91; 55 male, 33 female; aged 46.5 ± 12.6 years) were randomized to: 1) complete the MIPAQ only or 2) complete the MIPAQ after a 10-minute PA bout. Following the survey, participants were a pedometer and accelerometer for seven days. Upon return, a random sample of participants completed the MIPAQ a second time for test-retest reliability, computed by Chronbach’s alpha. Spearman’s rank-order correlations compared objective and self-report PA measures. RESULTS: Walking PA (r=.3, p<.01) and Total PA (r=.28, p<.01) were correlated with the accelerometer PA. Among those who performed a pre-MIPAQ PA bout, Walking PA and Total PA were significantly correlated with the accelerometer (r=.43 and .31, respectively) and pedometer (r=.33 and .37, respectively). Associations remained significant in overweight participants. Chronbach’s alphas ranged from .83-.94, indicating high survey reliability. CONCLUSIONS: The MIPAQ is a valid and reliable measure of PA in African Americans. Adding a brief period of activity prior to survey completion may increase reporting accuracy. Research supported by Award Number R01HL094580.
Advancements in physical activity measurement now afford researchers the capacity to measure proximity between accelerometers using Bluetooth low energy hardware. However, further research is needed to interpret the available proximity data to estimate distances from devices, which provide radio propagation measurements between accelerometers. Purpose: To estimate metered distances in indoor and outdoor environments from accelerometer-derived proximity data, and 2) compare the predictive accuracy of machine learning models in estimating distance. Methods: The study was two-phased: 1) calibration and 2) simulation. During calibration, received signal strength indicator (RSSI) data were collected from stationary accelerometers within indoor and outdoor environments at metered intervals (1m to 10m) in a major urban center. Observations of distances between devices (i.e., “ground truth”) were recorded by the researchers, and approximately N = 2,000 observations were recorded in each respective environment. Calibration results were used to simulate free-living proximity data as a Markov chain for indoor (1m to 20m) and outdoor (1m to 50m) ranges. Using N = 10,000 simulated indoor and outdoor proximity data cases, respectively, distance was estimated under measurement conditions wherein 1) calibration data are available and 2) calibration data are unavailable and are therefore estimated from Bluetooth low energy hardware. Competitive machine learning models were used to predict distances for both conditions, and cross-validated Root Mean Squared Error was calculated and reported in meters (ranges). Results: The regression tree model (RT) had the lowest error for indoor 1.65m and outdoor 1.35m calibration data. Using measured calibration data, RT had the lowest error for simulated indoor (2.9m to 3.8m) and outdoor data (7.5m to 11.8m). With estimated calibration data, RT showed errors of 4.0m and 11.1m for simulated indoor and outdoor data, respectively. Conclusions: A regression tree model estimated distances from simulated indoor and outdoor accelerometer-derived proximity data with the lowest error; however, error in the outdoor range was large. Researchers collecting proximity data via accelerometry can estimate metered distances from radio signals propagated between accelerometers.

Physical activity decreases the risk of chronic disease, while sedentary behavior increases this risk. Questionnaires are an easy, inexpensive way to quantify sedentary behavior. However, there tends to be error with self-report. Purpose: To compare time in sedentary behaviors assessed via activity monitor (objective) with sedentary time assessed by self-report (subjective). Methods: Office staff and administrators with a sedentary job description at a University were recruited. The activPAL3 activity monitor was placed on the participants’ (n=44) thigh and worn continuously for seven days. Participants completed the Occupational Sitting Questionnaire (OSPAQ) and Paffenbarger Physical Activity Questionnaire (PPAQ) for the timeframe that the activPAL3 was worn. Data were expressed in total time (hrs/day) spent sedentary over a typical work week. A Pearson Product Correlation was utilized to examine the relationship between the subjective sedentary time at work (OSPAQ) and over a 24hr period (PPAQ) and objective (activPAL3) sedentary time. The agreement between the subjective and objective assessments was evaluated using a Bland-Altman analysis. Differences between objective and subjective scores for each individual were calculated and the mean error was determined. Results: Participants were predominantly Caucasian (95%), middle-aged (48 y ± 10), and had an average BMI (30.5 ± 8.2). A positive, weak correlation between sedentary time assessed subjectively from the OSPAQ (r = .10; p = .518) and objectively by the activPAL3 activity monitor was found. The mean error of the sedentary time estimated during the workday was approximately one hour (1.07 ± 1.02) and approximately four hours (3.52 ± 2.31) for the entire day, with most participants underestimating sedentary time. The Bland Altman analysis found no systematic bias in the OSPAQ (p = .743), while a trend of proportional underestimation bias in the PPAQ (p = .001) was found relative to the activPAL3 measures. Conclusion: Self-reported sedentary time subjectively assessed by the OSPAQ and PPAQ was weakly correlated to sedentary time objectively assessed by the activPAL3 activity monitor over a 24 hour period and while at work. The lack of a relation demonstrated substantial error in self-reported assessment.

The intensity of physical activity (PA) can be monitored with pedometers. Step-rate cut-offs for PA intensity are developed from the relationship between oxygen uptake (VO2) and step-rate. This is based on the assumption that the relationship between VO2 and step-rate across different activities is stable within people, but this has not been evaluated. Purpose: To examine if the relationship between VO2 and step-rate, and the cut-offs for moderate- and vigorous-intensity PA based on step-rate are reliable within people. Methods: Thirty six healthy persons (21 ± 4 yrs; 16 women and 20 men) completed two sessions with identical procedures within 7 days. VO2 was measured with open-circuit spirometry and step-rate with a pedometer (NL-1000, New Lifestyles) placed on the non-dominant hip during sitting and seven activities: walking at 2 intensities, jogging, ascending and descending a staircase, washing dishes, vacuuming, and moving a box. Using individual linear regressions of VO2 against step rate for each participant, we determined 5 variables: the slope, intercept, and R2 of the relationship between VO2 and step-rate, and the cut-offs for moderate- and vigorous-intensity activity defined as step-rate at 3 and 6 metabolic equivalent units, respectively. We evaluated differences in these variables between sessions with paired t-tests, Intra-class Correlation Coefficients (ICCs; 2-way random model with absolute agreement), and Bland-Altman plots. Results: There were no significant mean differences between sessions in any of the dependent variables (p > .05). All ICCs were significant (p < .0023). ICCs > .993 were reported for the intercept (0.80), but moderate-to-low (r2, the moderate- and vigorous-intensity cut-offs (0.76, 0.58, 0.57, and 0.50, respectively). Bland-Altman plots showed nearly-zero mean error. The plots also showed that the variation in the difference between sessions was relatively small for the moderate-intensity cut-off (95% CI -24 to 24 steps min-1), but wider for the vigorous-intensity cut-off (95% CI -48 to 48 steps min-1). Conclusion: The relationship between VO2 and step-rate, and the cut-offs for moderate- and vigorous-intensity PA are moderately reliable within people. Calibration procedures should advance for better prediction of PA intensity from pedometer data.
and objective instruments, objective measures may estimate TEE more accurately than
the subjective instruments. AEE from CHAMPS performed the worst estimate on TEE
and was least likely to be related to the objective instruments.

2295 Board #308 June 1:00 PM - 3:30 PM
Improved Count Based Metrics For Estimation Of Energy Expenditure With Waist Worn Actigraph
Andrew S. Kaplan, Samuel R. LaMunion, David R. Bassett, Jr., FACSM, Scott E. Crouter, FACSM, University of Tennessee-Knoxville, Knoxville, TN.

Previous studies report that walking cadence (steps/min) is strongly correlated with
and intermittent activities can have a 2-3 fold higher energy cost than walking and
However, this relationship varies depending on the type of activity being performed
Ten men and 10 women representing
METHODS: Twenty-nine participants completed ten lifestyle activities ranging from sedentary behaviors to vigorous intensities for seven minutes each. Participants wore an Actigraph GT9X on the right hip. A Cosmed K4b2 was used as the criterion measure of EE. Acceleration data was converted to 5-s epochs. Oxygen consumption data from the Cosmed was averaged over 30-s and converted to metabolic equivalents (METs) for each activity (1 MET = 3.5 ml/kg/min). Mean counts and 75th percentile of the 5-s counts for y-axis and vector magnitude (VM) were calculated using the middle 4-min from each activity bout. The relationship between activity counts and METs was summarized using R² values.
RESULTS: Across all activities, the y-axis mean counts and METs had a R² of 0.789, which was improved to a R² = 0.835 when using the 75th percentile of the y-axis counts. For the VM mean and 75th percentile count metrics, the R² was 0.871 and 0.875, respectively.
CONCLUSIONS: The relationship between EE and y-axis counts can be improved using the 75th percentile of the counts. However, both VM count metrics had a stronger relationship to EE than their y-axis counterparts. This new count metric may provide an alternative for those utilizing data collected with older single axis accelerometers.

2296 Board #309 June 1:00 PM - 3:30 PM
The Relationship Between Walking Cadence and Percentage of Maximum Heart Rate
Elroy J. Aguiar, Scott W. Ducharme, Ho Han, Jongil Lim, Christopher Moore, Michael A. Busa, John R. Sirard, Stuart R. Chipkin, John Staudenmayer, Catrine Tudor-Locke, FACSM, University of Massachusetts Amherst, Amherst, MA.
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Previous studies report that walking cadence (steps/min) is strongly correlated with
PURPOSE: The aims of this study were: 1) to investigate the relationship between cadence and percentage of maximum heart rate (%HRmax), an often used proxy-measure of intensity; and 2) to specifically identify cadence cut points associated with ACSM defined %HRmax thresholds for moderate and vigorous intensity.
METHODS: Ten men and 10 women representing each 5-year age-group category between 21-40 years (total n=80; mean ± SD age 29.8 ± 6.7 years; BMI 24.8 ± 3.4 kg/m²) were recruited. Participants completed a treadmill walking test comprised of 5-min bouts at incrementally faster speeds from 0.5 to 6 mph, with a 2-min rest between bouts. The test was terminated at the completion of the 5-min bout during which the participant began to run, achieved >75% HRmax, or reported a Borg rating of perceived exertion >13. Cadence was visually observed (steps per bout / 5 min) and heart rate (HR) was measured using a chest-worn monitor during all bouts (average of final 2-min). HRmax was estimated using the standard equation: 220 - age. Based on the data, a bilinear regression model of the variance in %HRmax was explained by cadence (i.e., R²=0.54, least-squares linear regression model) with the bilinear break point at 103 steps/min. Cadence cut points (95% prediction intervals) for 64% and 77% of estimated HRmax were 128.6 (106.9 - 149.9) and 146.3 (124.6 - 164.6) steps/min, respectively.
CONCLUSION: Cadence explained over half of the variance in %HRmax, with ~110 steps/min and ~145 steps/min representing a reasonable heuristic (i.e., guiding) values for moderate and vigorous intensity, respectively. Further analysis is warranted investigating the cadences associated with moderate and vigorous intensity defined by percentage of HR reserve. This may account for some of the inter-individual variability in resting HR and HR response, thereby strengthening the relationship observed.
Supported by NIH/NIA Grant 5R01AG049024-03 - CADENCE-Adults study

2297 Board #310 June 1:00 PM - 3:30 PM
Identifying Physical Activity Type Using Wrist Models Constructed for High-frequency Accelerometer Data
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Accelerometer-based measurements have played an important role in assessing physical activity (PA). Hip-worn accelerometer data is the most validated based on current literature, but wrist-worn accelerometer has greater user acceptability. There is an emerging focus to understand the data from wrist-worn accelerometers to assess PA but data is still lacking.
PURPOSE: To investigate the capability of the wrist-worn accelerometer to identify sedentary behavior, levels of activity intensities, and locomotion.
METHODS: This study evaluated 25 adults (n = 14 females, mean age = 33.8 years, mean BMI = 26.4 ± 3.4 kg/m²) who performed 34 simulated tasks of sedentary (e.g., computer work) and locomotion (e.g., self-paced walk). Data were collected using a 100 Hz tri-axial wrist-worn accelerometer. Energy expenditure was measured in parallel using a portable caloriometry system. Constructed features included time and frequency domain variables, such as vector magnitude (VM) and its angle with the vertical axis, dominant frequency (DF), ratios of power by DF and dominant frequency (DF and DF/DF), and VM and its angle with the vertical axis (< 7 degrees). ActiGraph's proprietary step-counting algorithm.
RESULTS: The time and frequency features were capable of estimating METs (rMSE > 1.2 METs), activity intensity (accuracy > 80%), sedentary behavior (accuracy > 95%), and locomotion (accuracy > 92%). All features were found significantly different (p < 0.05) between groups of tasks. However, sedentary and locomotion tasks could be distinguished using as few as two features. With little variation in VM (< 0.06 m/s²) and the angle between VM and the vertical axis (< 7 degrees), sedentary tasks were distinguished versus other tasks (accuracy > 92%). Locomotion tasks could also be distinguished (accuracy = 90%) by examining DF (< 1.6 Hz) and its fraction of power (< 0.05).
CONCLUSION: Time and frequency domain features defined for wrist accelerometer data can detect sedentary activity with 94% accuracy. Further, locomotion within activity can be identified with 92% accuracy. Future work will require evaluations during free-living conditions to confirm the accuracy.
Supported by NIH/NIA (R01AG042525) and UF Claude D. Pepper Center (1P30AG028740).

2298 Board #311 June 1:00 PM - 3:30 PM
Development and Validation of Universal Step Detection Threshold for Raw Accelerometer Data
Jongil Lim, Ho Han, Elroy J. Aguiar, Michael A. Busa, Scott Ducharme, Christopher Moore, Stuart R. Chipkin, John Staudenmayer, Catrine Tudor-Locke, FACSM, University of Massachusetts Amherst, Amherst, MA.

PURPOSE: To develop a universal and computationally inexpensive algorithm for accurately detecting steps from GENEAqc raw acceleration data relative to the criterion measure of directly observed steps and improve on the accuracy of ActiGraph’s proprietary step-counting algorithm.
METHODS: A total of 80 young adults (mean age = 29.8 ± 6.7 years, BMI = 24.7 ± 3.4 kg/m²) performed 5-min bouts of 7-lab based simulated activities of daily living and treadmill walking (beginning at 0.5 and increasing up to 6 mph in 0.5 mph increments). GENEAqc and ActiGraph GT9X accelerometers were worn concurrently on the right anterior-axillary line. For Actigraphy, step counts detected in 1-s epochs using the manufacturer’s default and proprietary algorithm were summed over the duration of each 5-min bout of activity. Raw accelerometer data from the GENEAq’s x-axis (which captures vertical motion) was filtered using a band-pass filter (cut-off frequency of 0.25 and 2.5 Hz) and de-trended to the mean. All peaks greater than zero gravity were identified with 92% accuracy. Future work will require evaluations during free-living conditions to confirm the threshold.
Supported by NIH/NIA (R01AG042525) and UF Claude D. Pepper Center (1P30AG028740).
2299  
**Board #312**  
**June 1 2:00 PM - 3:30 PM**  
**Self-Reported Fitness and Objectively Measured Physical Activity among Older Adults**  
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(No relationships reported)

**PURPOSE:** To study the relationship between self-reported fitness and objectively measured physical activity and sedentary behavior among elderly.  

**METHODS:** The study is based on the older Finnish Twin Cohort. All same-sex twin pairs born 1940-1944 with both co-twins alive were invited to participate in the study. They first participated in a telephone interview followed by an objective activity monitoring (a hip-worn triaxial accelerometer, Hookie AM20) and activity related questionnaire. By end of 2015, altogether 406 individuals (mean age 74 years, 209 male and 197 female) had used accelerometer for at least four days and had answered a following question on perceived fitness (How do you think about your current physical fitness in your opinion; 1) Very good 2) Fairly good 3) Satisfactory 4) Fairly poor 5) Very poor. Groups four and five were combined for the analyses. In this study twins were studied as individuals. Analysis was done using linear regression and Sidak post-hoc test was used to analyse differences between fitness groups.  

**RESULTS:** According to preliminary data, self-reported fitness explained moderately different objectively measured activities as R-squared for daily steps was 29% (p<0.001), for overall daily MET 29% (p<0.001) and sitting down 32% (p<0.001). Better self-reported fitness was associated with more steps taken a day (8 545 steps (most fit) vs. 3.168 steps (poor fitness), p<0.005), more light (1.5-3 MET: 3.3/day vs. 2.1 hours/day, p<0.05), moderate (3-6 MET; 0.93/day vs 0.28 hours/day, p<0.05) and vigorous (>6 METs; 3.6 min/day vs. 0.005 min/day, p<0.05) activity compared to subjects who reported poor fitness when the model was adjusted with accelerometer wear time, age, BMI and movement restricting injury. Better self-reported fitness was also associated with less sitting (7.3/hour (most fit) vs. 8.1 hour/day (poor fitness), p<0.05). **CONCLUSION:** These preliminary results show that self-reported fitness is associated with objectively measured daily activity profile among elderly. Most differences were seen in variables describing activity, although some differences were seen even in sitting down. Among elderly subjects who perceive themselves as having poor fitness, it would be important to find factors associated with low mobility and try to find ways to improve them.

2300  
**Board #313**  
**June 1 2:00 PM - 3:30 PM**  
**Validation of a Biometric Smart Shirt for Assessment of Physical Activity**  
Joe R. Mittryk, Monroe I. Molesky, Alexander H.K. Montoye, Alma College, Alma, MI.  
(No relationships reported)

Smart shirts are embedded with sensors to collect physiologic data (e.g., heart rate and breathing rate/volume) and an accelerometer to assess kilocalories (kcals) and steps. However, little is known about measurement accuracy of smart shirts. **PURPOSE:** The purpose of this study was to validate a smart shirt for assessment of physiologic and physical activity variables.  

**METHODS:** Participants (n=32) aged 18-51 years wore a smart shirt and performed 15 total activities, 12 in the laboratory and 3 on a 200-m indoor track. Lab activities were performed for 5 min each and included lying, sitting, standing, walking at various speeds (3.0, 3.5, 4.0 miles/hr) and inclines (0%, 5%, 10%), jogging, and cycling. Track activities included self-paced walking (200 m, 2 speeds) and jogging (400 m). Steps, kcals, heart rate, and breathing rate and volume from the smart shirt were compared to criterion measures (metabolic analyzer for kcals and breathing rate/volume, pedometer for steps, and pulse oximeter for heart rate). Percent (%) errors were calculated between smart shirt estimates and criterion-measured variables. A threshold of 10% was used for low (<10%) vs. high (>10%) predictive error. Paired samples T-tests were conducted to determine significant differences between smart shirt estimates and criterion measurements with p<0.05 used to denote statistical significance.  

**RESULTS:** Estimates made by the smart shirt had high % error (shown as mean [standard error]) for kcals (29.8% [3.1]), breathing rate (19.4% [4.3]), and breathing volume (33.6% [3.8]). The smart shirt had low % error for steps (9.4% [0.7]) and heart rate (2.7% [0.9]). For all activities, kcals and breathing rate and volume performed poorly (>10% error), whereas heart rate had <10% error for all activities. Step predictions were significantly underestimated for slow walking speeds (16.7-3.6%, p<0.05), and kcals were significantly overestimated during all activities (5.6-94.7%, p<0.05). **CONCLUSIONS:** The smart shirt performed well estimating and heart rate, but performed poorly estimating kcals, breathing rate and breathing volume. Further research should further examine accuracy of this smart shirt during sport-specific activities as well as in free-living protocols. This study was supported by the Alma College CORE Research Grant.

2301  
**Board #314**  
**June 1 2:00 PM - 3:30 PM**  
**The Reasoned Action Approach Better Predicts Self-Report Measures of Active Play than Accelerometer Measures**  
Elizabeth A. Moordadian, Andrea K. Chomistek, Jeanne D. Johnston, Susan E. Middleton, Georgia C. Frey, FACSM. Indiana University, Bloomington, IN. (Sponsor: Georgia Frey, FACSM)  
(No relationships reported)

The Reasoned Action Approach (RAA) has been successfully used to identify factors that predict a child’s intention to be physically active, however, the predictive ability of intention to physical activity (PA) behavior has been weak. **PURPOSE:** To determine if subjective (i.e. self-report) vs objective (accelerometry) measures impact the predictive ability of intention to engage in physical activity behavior in children ages 9-12 years. **METHODS:** 210 5th and 6th grade students completed a 17-item RAA survey assessing after-school active play. Extensive piloting was performed to ensure the instrument was developmentally appropriate for the target population. The survey was administered on Monday inquiring about after-school active play that same week. On Friday, self-reported (SR) behavior was assessed by two questions during a face-to-face, semi-structured interview. Accelerometry (AC) was used as an objective measure of after-school active students. Students were an AC on the hip during waking hours, for the school week. Minutes spent in moderate-vigorous PA during the hours of 3:00-8:00 PM were determined using ActiLife software and the Evenson (2008) cutpoints. The strength of relationship between Intention and SR, and between Intention and AC, was measured via Pearson correlations. Multivariate linear regression was used to determine the predictive ability of Intention for the number of days the behavior was performed as determined by SR and AC. **RESULTS:** 100 participants met the AC wear inclusion criteria (female=60%; fifth grade = 48%, age = 11.25 ±0.8y. height = 149.5 ±8.14 cm, weight = 45.3 ± 13.44 kg). Intention was significantly correlated to both SR (r=0.67; p<0.01) and AC (r=0.26; p<0.01). SR was better predicted by intention than AC (F=83.84; p<0.01 vs. F=7.57, p<0.01), explaining 46.1% and 7.2% of the variance, respectively. **CONCLUSION:** SR should be used to measure PA when using the RAA, due to the higher predictive ability, compared to AC. The stronger relationship between intention and SR is likely due to the higher correspondence between the measures. The developmental appropriateness of the measures may have also contributed to the higher predictive ability seen in this study, compared to other studies.

2302  
**Board #315**  
**June 1 2:00 PM - 3:30 PM**  
**Performance Of Actigraph's Wear-Time Sensors For Wear/non-wear Time Classification**  
Diego J. Arguello1, Kristie Andersen1, Alvin Morton2, Dinesh John1, 1Northeastern University, Boston, MA. 2University of Tennessee Knoxville, Knoxville, TN.  
(No relationships reported)

**PURPOSE:** To evaluate the performance of the wear-time sensor in Actigraph’s wGT3X-BT and GT9X monitors under controlled laboratory and uncontrolled free-living settings.  

**METHODS:** The lab protocol tested the accuracy of a wrist worn GT3X in capturing wear-on and off ‘instances’ (round minute) against direct observation as criterion. Participants (N = 26; mean ± SD; age= 23.2 ± 3.8 years, BMI= 23.2 ± 3.7 kg/m²) were removed an Actigraph GT3X on 4-5 occasions during a 3-hour physical activity protocol. In the free-living setting we tested the accuracy of the wrist-worn wGT3X-BT and GT9X in classifying wear (i.e. sensitivity) and non-wear time (i.e. specificity) over a 2-day period. The criterion for the free-living condition was determined using an independent temperature sensor and self-report. Sensor-based free-living measures of wear-time were also compared to the commonly used Troiano 2007 and Choi 2011 wear/non-wear algorithms, which are based solely on motion signals.  

**RESULTS:** In the lab protocol the GT9X wear sensor detected 83.95% of wear-on and wear-off ‘instances,’ and had significant delays (4.7 ± 11.6 min) in detecting the minute when the monitor was taken off. Sensitivity and specificity of the GT9X in the free-living protocol was 93% and 49%, respectively. In the lab protocol, the sensitivity and specificity of the wGT3X-BT and GT9X was 82% and 95%, and 72% and 95%, respectively. The wear sensors from both devices had inferior sensitivity but superior specificity to Troiano 2007 and Choi 2011 wear/non-wear algorithms.
CONCLUSIONS: ActiGraph wear-time sensors yielded inferior wear detection performance and superior non-wear detection performance over Troiano 2007 and Choi 2011 algorithms. Motion-based algorithms may have inferior non-wear detection capabilities because of a reliance on pre-determined durations of inactivity (i.e. 20-60 min) to classify non-wear. This strategy may not distinguish between the lack of motion that occurs during both monitor wear and non-wear. Conversely, ActiGraph wear sensors are capable of making this distinction. The inferior wear detection performance of the ActiGraph wear-sensor may stem from the sensor’s exclusive reliance in detecting skin conductance. For example, a loose strap may inaccuracy yield a higher rate of non-wear.

Machine learning has been used to accurately recognise physical activity patterns; however, classifiers for targeting bone loading exercises have not been developed. PURPOSE: The purpose of this study was to determine the accuracy of machine learning models for classifying the intensity of exercises necessary for bone adaption in older adults. METHODS: Triaxial accelerometer data was collected from forty-four older participants (60-70 yrs) wearing a GCDC X16-1C accelerometer on their hip during three aerobics classes consisting of impact aerobic exercises performed at high and low intensities. Multi-class support vector machine (M-SVM) classifiers were trained in parallel for activity type detections where one classifier trained with low intensity activity samples and the other with high intensity samples. In a multi-view scoring manner, the classification confidence of these two learners was utilised for predicting the activity intensity. The leave-one-out cross-validation technique was used for assessment purpose. RESULTS: Overall recognition accuracy of the M-SVM classifier for detecting exercise intensity was 73%. For each aerobics class, the M-SVM classifier accurately recognised exercise intensity by 82%, 73% and 65%. CONCLUSIONS: Machine learning techniques such as M-SVM accurately recognised the intensity of bone promoting exercises from triaxial accelerometer data in community-dwelling older adults. First results of the developed classifier demonstrate significant potential of machine learning models for the evaluation of exercise adherence and performance in older adults.
2307 Board #320 June 1 2:00 PM - 3:30 PM
Accuracy Of Behavioral Assessment With A Wearable Camera in Semi-structured And Free Living Conditions in Older Adults.
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([No relationships reported])

PURPOSE: To examine the congruency of wearable cameras (WC) and direct observation (DO) to identify posture, activity category, and type during semi-structured (Semi) and free-living (Free) conditions in older adults.

METHODS: 818 6, 6 female, volunteered. 6 underwent testing for VO₂Max, body composition, & 1-RM for Chest Press (CP) & Leg Press (LP). RI were 33, 50, & 75. All tests were recorded. Videos were analyzed by DO. An independent sample of 1499 observations across both conditions for observations. Time spent in each attribute was tested with the Wilcoxon signed-rank test.

RESULTS: Posture had a 96.4% (Kappa=0.93; SE=0.10; p<0.0001) and 93.1% (Kappa=0.89; SE=0.07; p<0.0001) agreement between the WC and DO across both conditions for observations. Time spent in posture, activity category, and type during Semi and Free conditions, respectively. For activity category, there was 76.7% (Kappa=0.42; SE=0.10; p=0.001) and 94.6% (Kappa=0.92; SE=0.08; p<0.0001) agreement between the WC and DO during the Semi and Free conditions, respectively. For activity type, obtained from Free only, there was 100% (Kappa=1.0; SE=0.20; p<0.0001) agreement across measures. WC total time spent in seconds was not significantly different to that obtained from the DO for posture during Semi (186±147 vs. 199±50, p=0.9342) or Free conditions (1341±414 vs. 1400±418, z=0.3170). For activity category, time spent across each measurement type did not significantly differ for Semi (WC = 162±38 vs. DO = 171±44, z=0.7348) or Free Conditions (WC = 1082±322 vs. DO = 1256±342, z=0.4806). For activity type, time estimates for Free only were not statistically different to that obtained from the DO for posture during Semi (186±47 vs. 171±9.0, p<0.0001) and Free conditions (1341±414 vs. 1400±418, z=0.3170).

CONCLUSIONS: Results from this study suggest that there is high congruency between wearable cameras and direct observation for behavioral observations and time spent in posture, activity category and type.

2308 Board #321 June 1 2:00 PM - 3:30 PM
Metabolic Cost Of Resistance Exercise
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([No relationships reported])

PURPOSE: Determine if the Total O₂ cost (TO₂) of RE differs during & following RE as a function of RE type & relative intensity (RI) & Determine if TO₂, during & following RE, differs across 3 RI, when the volume of Work is held constant.

METHODS: 28 male, 21±0.5 years, 171±1.90 cm, 71±1.65 kg (n=7;16±5.0 kg) were fitted with five wrist activity monitors (XT and VS on the left wrist, PL, MF, and LT on the right wrist). CP and LP were performed to the point of muscular fatigue, estimated at 75% of 1-RM for CP and LP.

RESULTS: Age=21.5±0.5, Height=166.5±6.2, Mass=65.4±11.7, BMI=23.5±3.7, BodyFat%=20.7±5.7, FatMass=13.8±7.5, LeanMass=51.5±7.7, VO₂max=46 ±8.4, RERmax=1.13±0.03, and HRmax=200±6.2. TO₂ cost was measured as the O₂ used in each attribute was tested with the Wilcoxon signed-rank test.

Body composition was measured with BodPod.

RESULTS: Age=21.5±0.5, Height=166.5±6.2, Mass=65±4±11.7, BMI=23.5±3.7, BodyFat%=20.7±5.7, FatMass=13.8±7.5, LeanMass=51.5±7.7, VO₂max=46 ±8.4, RERmax=1.13±0.03, and HRmax=200±6.2. TO₂ cost was measured as the O₂ used during exercise & through 10min Post RE Rest; RE & Post RE Rest were repeated for RE type (LP & CP) & RI. RE & RI were counterbalanced. Metabolic measures & HR were recorded using a Cosmed K4b².

CONCLUSIONS: Results suggest TO₂ cost is related to RE type, muscle mass activated, O₂ deficit incurred during RE, & O₂ debt repaid during recovery. Further, the O₂ debt during recovery from LP75 & LP50 is greater when compared to LP35 even though Work was held constant. This suggests factors other than the O₂ deficit contribute to the O₂ debt.

2309 Board #322 June 1 2:00 PM - 3:30 PM
A Comparison Between Actual Energy Expenditure Measurements And A System Dynamics Model Output
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([No relationships reported])

PORTABLE METABOLIC UNITS AFFORD A PRACTICAL UTILITY FOR FIELD MEASUREMENTS OF ENERGY EXPENDITURE (EE). THIS METHODOLOGY HAS PROVEN USEFUL TO ASSESS EE RELATED TO TERRAIN, INTENSITY, AND DURATION DURING A SINGLE EVENT. SIMILARLY, SYSTEM DYNAMICS (SD) MODELING HAS BEEN USED TO DESCRIBE THE RELATIONSHIP BETWEEN EXERCISE AND OBESITY AS IT RELATES TO EE. HOWEVER, THERE IS LITERATURE OF THAT REPORT SD TO PREDICT EE IN FREE-LIVING ADULTS.

PURPOSE: TO COMPARE ACTUAL EE FROM A PORTABLE METABOLIC UNIT TO PREDICTED EE FROM A SYSTEM DYNAMICS MODEL.

METHODS: SEVEN SUBJECTS (4 MALES, 3 FEMALES; 24.4 ± 1.71) WALKED SELECTED ROUTES OF VARIOUS TERRAIN PACED BY A METRONOME AT 2.7 MPH. EE WAS MEASURED USING A COSMED K4b² METABOLIC UNIT WITH EACH SUBJECT COMPLETING FOUR TRIALS PER ROUTE. AN INTEGRATED GPS RECEIVER記錄ED LATITUDE AND LONGITUDE COORDINATES OF EACH ROUTE. THE MODELING SOFTWARE STELLA WAS USED TO DESIGN THE SD MODEL WHICH INCORPORATES SUBJECTS’ WEIGHT, WALKING PACING, ROUTE ELEVATION PROFILE AND DISTANCE. PONDL'S ET AL (1977) PREDICTION EQUATION FOR EE WAS RUN IN THE MODEL TO COMPARE WITH THE REAL-TIME K4b² DATA.

RESULTS: IN SIMULATION MODELING PARAMETERS (STOCKS AND FLOWS) ARE ADJUSTED TO INCREASE ACCURACY. MODEL PARAMETERS WERE ADJUSTED TO PROVIDE AGREEMENT FOR EE TO WITHIN ±1% OF THE ACTUAL EE AS MEASURED BY THE COSMED K4b² UNIT. A PAIRED T-TEST COMPARING THE ACTUAL VS THE SD MODEL PREDICTIONS OF TOTAL EE WERE NOT SIGNIFICANTLY DIFFERENT (P = 0.9342).

CONCLUSION: IT APPEARS THAT SD MODELING CAN BE AN EFFECTIVE TOOL TO PREDICT EE OF INDIVIDUALS WALKING ON VARIOUS TERRAIN. ONCE USER PARAMETERS HAVE BEEN ENTERED, SIMULATION MODELING CAN PROVIDE FEEDBACK ON EE WITH SUITABLE ACCURACY OF A SELECTED ROUTE. COMPARED TO A SINGLE EVENT MEASUREMENT, SD ALLOW USERS TO COMPARE EE OF MULTIPLE DEFINED ROUTES SIMULTANEOUSLY. FEEDBACK HAS BEEN IDENTIFIED AS A CRITICAL COMPONENT OF ADHERENCE AND MAINTENANCE FOR PHYSICAL ACTIVITY. IN THIS CASE OF SD MODELING, ACCURATE FEEDBACK AND ROUTE SELECTION MAY ENCOURAGE USERS TO ENGAGE IN REGULAR PHYSICAL ACTIVITY.

Funded by James Madison University Office of Public Safety.

2310 Board #323 June 1 2:00 PM - 3:30 PM
Accuracy Of Wrist-worn Activity Monitors During Walking And Swimming
Email: eunhye.kwon@tamusa.edu

([No relationships reported])

Wrist-worn activity monitor has been growing at a rapid pace with many manufacturers. PURPOSE: To assess the accuracy of wrist-worn activity monitors during walking and swimming. METHODS: Twenty-seven participants (age=48±12.5 yrs, h=171±1.90 cm, w=71±15.0 kg) were fitted with five wrist activity monitors (XT and VS on the left wrist, PL, MF, and LT on the right wrist). After walking for 200m at a self-selected pace and swimming freestyle for 200m at a self-selected pace, monitor counts and actual step counts from a hand tally (AC) were recorded. Repeated measures ANOVA was used to determine significant differences between monitors. Percent error was calculated as ([monitor counts-actual counts]/actual counts) × 100.

RESULTS: All monitors registered counts significantly lower (p<.05) than AC during the walk (26±8.04, 29.4±17.8, 20.8±33.8, 37.0±65.0, and 28.5±34.6 counts for XT, VS, MF, LT, and PL, respectively). Percent error was lowest in MF while walking, followed by XT, PL, VS, and LT (7.2±1.2, 8.9±1.2, 9.0±1.2, 9.5±1.5, and 11.9±2.08 percent, respectively). LT and PL counts were significantly higher (p<.05) than AC during the swim (378±93.4 and 198±214.5 counts, respectively) while XT, VS, and MF were not significantly different than AC (21.8±139.4, 15.4±112.3, and 44.7±120.1 counts, respectively).

CONCLUSIONS: While four out of five activity monitors registered less than 10% error during the walk, the differences in counts compared to AC was significant. It is noted in some participants the step counts were extreme compared to the AC, thus the unusually high standard deviations. This was especially evident in the swim. The ability of a monitor to register a count is determined by the manufacturer and while different monitors have different construction, those who wear them do not always move in the same way, particularly in walking and swimming gait. These variables should be considered when using wrist-worn monitors to track different modalities of activity.
Falls are a significant concern for an aging population, with 14% of falls thought to occur during the transition from sitting to standing. **PURPOSE:** To determine the effect of chair rising speed on stabilization time in young and older adults. **METHODS:** Twenty healthy older (71.8±2.7 yrs; mean±SD) and 20 young adults (22.5±2.7 yrs) were first assessed for functionality using the Short Physical Performance Battery (SPPB). Then, each performed 4 simple repetitions each of comfortable pace (CSTS) and maximal fast pace sit-to-stand (FSTS) in a randomized block design while on a force platform. The stabilization phase was defined as the period from when the vertical ground reaction force returned to bodyweight after knee extension until center of pressure (COP) variability was within 2 standard deviations of their quiet stance. The anterior-posterior (A-P) and mediolateral (M-L) COP variables were assessed independently. **RESULTS:** The older adults had higher scores on the SPPB (11.3±0.8 vs 12.0±0.2; p<0.002). The stabilization phase was significantly longer in the A-P direction during FSTS (3.13±1.01 vs 2.70±0.88 s; p<0.039), with no differences between groups or within the M-L direction. However, the older adults did have significantly greater movement of the COP during the first 2s of stabilization, regardless of pace (A-P Path Length: 5.17±1.47 vs 3.96±1.17 s; p<0.002; M-L Path Length: 3.35±0.94 vs 2.57±0.64 % standing height, p<0.001). Furthermore, this A-P Path Length was significantly correlated between the CSTS and FSTS amongst the older adults, but not for the young (r=0.598, p=0.01 vs r=0.438, p=0.05). **CONCLUSION:** Although a healthy and high functioning group of older adults were examined, differences between groups existed during the FSTS, most notably at the beginning of the stabilization phase. It also appears that performance during CSTS and FSTS are more closely coupled in the older adults than the younger adults. This coupling suggests that older adults might dynamically control slow and fast STS similarly with a singular strategy while younger adults may have multiple strategies. This reduced flexibility of response may be adding to the increased risk of falls in older adults during the FSTS task.

**RESULTS:**}

Prolonged standing (PS) substantially increases the risk of experiencing low back pain. However, the specific factors involved, and sex related differences are not fully understood. One factor may be bilateral asymmetries in posture. **PURPOSE:** The goal of this study was to examine the effect of prolonged standing on weight-bearing and ground reaction force control within healthy young adults during quiet stance. **METHODS:** Twenty-four subjects (12 male, 12 female) voluntarily participated in the study (age = 22.3 ± 2.4 years, height = 1.70 ± 0.09 m, mass = 69.89 ± 11.31 kg, BMI = 24.1 ± 2.5 kg/m² [mean ± SD]). Subjects performed two 60 sec quiet standing trials separated by one 30 min free standing trial while ground reaction forces under each foot were measured. Forces were normalized to percent body weight (%BW). Sway, maximum velocity (maxV), and path length (PL) were calculated from the center of pressure (CoP) for both the dominant (D) and non-dominant (ND) foot, as well as net combined values. All CoPs were calculated in both the anterior-posterior (AP) and medial-lateral (ML) directions, and were normalized to standing height (%Ht). Weight-bearing (WBAs) and CoP asymmetries (CoPAs) were calculated by subtracting the ND limb from their D limb. **RESULTS:** There were no differences in WBAs or CoPAs between the pre- and post-PS trials, nor between the men and the women (p>0.05). In both of the quiet stance trials, there were no significant differences between the D and ND limbs for WBAs, but the ND limb generally had a greater contribution to CoP movements than the D limb. There was an increase in the net CoP variables after PS exposure (p<0.003). Significant negative correlations were found between WBAs and some CoPAs during the pre-PS trial (r=-0.18, r=-0.660) and the level of these significant correlations changed during the post-PS trial (p<0.024.

**CONCLUSION:** While these results suggest that 30 min of PS does not have an effect on WBAs and CoPAs during quiet stance, there appears to be an effect on net CoP movements, as well as sex related differences in the correlations between WBAs and CoPAs. These findings suggest that fatigue is potentially occurring.
Parkinson patients are at a high risk of falling due to the neurological disorder. Standing balance is an important indicator of postural control capacity among people with falling risks. During standing, respiratory activity, as the internal perturbation, may alter the motion of center of gravity. Therefore, in Parkinson patients, different respiratory activities could influence balance outcomes related to Center of Pressure (COP). PURPOSE: this study was to examine the effects of different breathing patterns on balance performance in patients with Parkinson. METHODS: ten Parkinson patient (PG) and ten age-matched health individuals (CG) were recruited. Each participant randomly performed 3 trials of balance test under three respiratory conditions (neutral, thoracic, and abdominal breathing patterns) with eyes closed. 95% sway area (A95% in cm²), average velocity (Vaverage in cm/s) and standard deviation at ML (SDML) and AP (SDAP) directions were recorded for each trial. Two-way MANOVA was performed to examine the effects of group and respiratory activity on the association among COP-related measures listed above. Post Hoc Tukey’s test was applied when necessary.

RESULTS: Significant differences were observed between groups on all measures (P <.05). Compared to control group, Parkinson group exhibited greater A95% (PG:10.16 ± 9.89 cm², CG: 7.52 ± 7.07 cm²), higher Vaverage (PG: 3.18 ± 1.24 cm/s, CG: 2.56 ± 0.92 cm/s), more SDML (PG: .58 ± 0.30, CG: .54 ± .28) and SDAP (PG: .84 ± .31, CG: .68 ± .24). No other significant difference was observed. CONCLUSIONS: Parkinson’s group showed a worse balance performance as expected. However, the effect of respiration on traditional COP related measures was not observed. This may because that traditional measures could not detect the alteration of COP induced by the internal perturbation of respiratory activity. Instead of using traditional measures, future studies should adopt the nonlinear dynamic analysis to assess the complexity of COP motion potentially altered by respiratory activity.

Loss of balance resulting in falls is a serious health issue for older persons with type 2 diabetes (T2D). One intervention shown to produce benefits for these individuals is various types of exercise training. However, motivation is commonly cited as a barrier to consistent physical activity participation in unsupervised conditions. Interactive video games, such as the Nintendo Wii system, have been viewed as an innovative tool for engaging individuals in activity at home. PURPOSE: To assess the differences between supervised and unsupervised (using the Nintendo Wii) exercise training aimed at improving balance, reaction time, lower limb strength, and falls risk in older adults with T2D. METHODS: 47 older adults with T2D participated in 12 weeks of training: 32 (mean age 66.7 ± 5 yr) completed supervised training (ST) while 15 (mean age 67.7 ± 5 yr) completed unsupervised Wii training. ST sessions (40 min each, 3 times a week) consisted of lower limb stretches followed by leg, abdominal, and lower back exercises. The Wii training group completed three 40-min sessions on the Wii balance board per week. The Wii-based exercises were self-selected to emphasize balance and postural control. Prior to and following training, assessments of lower limb strength (i.e., isometric knee extension and flexion), falls risk (using the Physiological Profile Assessment), balance, postural coordination, vision, proprioception and reaction time were performed. RESULTS: Following training, participants in both the ST and Wii groups showed a significant decline in overall falls risk (ST, 0.59 ± 0.12 to 0.22 ± 0.14; Wii, 0.33 ± 0.13 to 0.17 ± 0.11; p < 0.05). Falls risk reductions were driven by significant improvements in knee extension (ST; 31.5 kg to 36.4 kg; Wii; 31.1 to 34.3 kg), knee flexion (ST; 16.9 to 19.3 kg; Wii; 17.0 to 18.3 kg), faster reaction times (ST; 278 to 247 ms; Wii; 244 to 225 ms) and improved postural coordination (ST, 13.4 to 9.1 errors; Wii, 9.7 to 6.5 errors). CONCLUSION: Both ST and unsupervised Wii exercise training interventions led to a reduction in falls risk in older adults with T2D, accompanied by increases in leg strength, faster reaction times, and improved balance coordination. Thus, both supervised and unsupervised exercise may lead to improvements in falls risk in older adults with T2D.
Limited range of motion (ROM) is often considered detrimental to both athletic performance and everyday function similar to balance. PURPOSE: The purpose of this study was to determine a relationship between hip range of motion and BESTest scores. METHODS: 20 college age women (19.55 ± 3.45 years) with no prior lower extremity injuries or previous concussions volunteered for this study. Using standard goniometer measuring techniques, participants passive range of motion for flexion (FL), extension (EX), internal rotation (IR) and external rotation (ER) was established. A linear regression was performed to determine a correlation. Overall BESTest scores were compared to each aspect of hip muscle ultradrange. RESULTS: Although there was no significant correlation between any specific aspect of ROM and overall BESTest scores (P>0.05), both right and left internal rotation showed a statistically significant moderate correlation (R=0.92 (P<0.05) and, R=0.51 (P<0.05) respectively) to stability in gait. DISCUSSION: Despite no correlation between overall BESTest score and range of motion, internal rotation was shown to have a statistically significant moderate correlation to a single aspect of the BESTest, stability in gait. We determined that range of motion does not pose as a limiting factor to balance as measured by the BESTest.

Lateral ankle sprains are common orthopedic injuries and often result in chronic ankle instability (CAI). Studies have shown that the CAI population typically has decreased ankle proprioception and possibly a greater reliance on visual feedback when compared to healthy controls. However, little is known about how the postural control characteristics change in those with and without CAI when visual external feedback is manipulated. Purpose: To compare postural control characteristics of persons with CAI, Copers and healthy adults when performing a single leg balance test with and without external feedback. Method: The definition for CAI used for this study includes persons who have experienced recurrent ankle sprains, in addition to self-reported “feelings of instability” and “giving way,” and a score on the Identification of Functional Ankle Instability (IDFAI) of 11 or greater. 18 participants with CAI, 15 Copers, and 18 healthy controls (mean age of all groups: 22 years) performed the Athletic Single Leg Test on the Biodex Balance System (BBS) at Level 4, which involved a high degree of platform instability. All participants completed 2 trials without and with feedback in that order. Center of pressure position was recorded and the two trial mean was used for further analysis. Overall stability index (OSI) defined as the mean distance of the center of pressure from the center of the platform was obtained from the system. Sway area was calculated using custom Matlab script. Separate 3 (Group) x 2 (Feedback) mixed ANOVAs were run using overall stability index (OSI), and sway area as dependent variables. Results: Significant feedback main effect showed participants had significantly lower (better) OSI value with feedback (1.4±0.1) compared to without feedback (2.6±0.2; P<0.001) but sway area with feedback (6.5±2.3 cm²) was similar to without feedback (10.9±4.2 cm²). There was no significant group main effect or interaction observed for either of the variables. Conclusion: Results suggest that external visual feedback may not play a significant role in helping persons with CAI improve their postural control.

The legalization of marijuana in a number of states has resulted in increased accessibility to the drug. However, little is known about the influence of marijuana on everyday tasks, such as quiet standing. PURPOSE: To determine whether marijuana influences postural steadiness during quiet standing. METHODS: All participants were physically active, defined by at least 150 minutes of moderate-intensity exercise per week, and were either marijuana users (MU; n = 10, mass = 81.4 ± 20.0 kg; ht = 1.75 ± 0.08 m; age = 25 ± 5 yrs) or non-marijuana users (NU; n = 15, mass = 73.5 ± 13.5 kg; ht = 1.80 ± 0.08 m; age = 25 ± 5 yrs). MU were consuming marijuana products at least once a week for the past 6 months and NU had not used any form of marijuana in the past 12 months. Participants were asked to stand quietly with each foot on a separate force plate for 30 seconds under four conditions: rigid surface eyes closed, compliant surface eyes open, and compliant surface eyes closed. Center of pressure (COP) under each foot (100 Hz) was evaluated to determine 95% confidence, mean velocity and mean frequency of the mediolateral (ML) and anteroposterior (AP) components of the COP trajectories. 2-factor (group, condition) MANOVA was used to identify main effects (P<0.05). Results: There was no interaction between group and standing condition. However, after a group effect was observed, (left leg: A* = 843, F=2.706, DF=6,87, p=0.019; right leg: A* = 822, F=3.129, DF=6,87, p=0.008). Mean velocity in the AP direction for the right leg was greater among MU (p=0.044, 19% difference), respectively) and approached significance for the left leg (p=0.054, 18% difference). Mean frequency in the AP (p=0.006, 24% difference) and ML direction (p=0.001, 27% difference) for the left leg was greater among NU. Similarly, mean frequency in the AP and ML direction for the right leg was also higher among NU (p=0.068, 16% difference, p=0.024, 20% difference, respectively). Conclusion: These data suggest a suppressed central nervous system drive to modulate posture in marijuana users. This is consistent with anecdotal evidence that marijuana has calming effects on the body.
Abdominal wall muscle function is thought to be an important factor affecting balance. PURPOSE: The purpose of this study was to determine if an acute fatigue stimulus to the abdominal muscle groups affects balance in healthy college-age individuals. METHODS: A randomized pre-post test-counterbalanced crossover design was utilized. Twenty healthy college-age students (age = 20.5±1.1 years; body mass = 71.3±14.5 kg; height = 168.8±10.4 cm; n = 10 males; n = 10 females) completed the trial and underwent two sets of seven different core muscle exercises to volitional fatigue after an aerobic full-body warm-up. The seven exercises were: Front plank, right side plank, left side plank, double leg raise, Russian twist, partial curl ups, and spine extension. Fatigue was determined as the point in which the participant could no longer maintain proper biomechanical form. Static single leg balance was assessed on each foot using a computerized balance assessment system (CBAS) and dynamic balance was assessed using the Star Excursion Balance Test (SEBT). Averages between the left and right side were calculated for both balance assessments and used during the statistical analysis. RESULTS: 2 X 2 repeated measures analysis of variance tests were calculated to assess for balance differences between the control group and the exercise group. Cohen’s d effect sizes were calculated on pre and post measurements within each group. A statistically significant time-group interaction was noted on the CBAS mean scores (control pre vs post: 2.99±1.48 vs 2.53±0.81 degrees; exercise pre vs post: 2.91±1.13 vs 2.31±1.22 degrees; p = 0.021). However, the effect size of the exercise group pre vs post measure was small (Cohen’s d=0.34). No statistically significant differences occurred on the SEBT (control pre vs post: 670.5±85.6 vs 673.3±95.4 cm; exercise pre vs post: 664.9±78.6 vs 664.9±74.6 cm; p = 0.687). CONCLUSIONS: The abdominal wall muscle exercise protocol induced a statistically significant decrease in static balance but the size of the effect was small. Dynamic balance was not affected by the exercise protocol. Considering the small effect size and the statistical disagreement between the two assessments, it is possible that acute abdominal wall muscle fatigue may not functionally affect balance, but more research is needed.

**Abstract**

Physical health practitioners often recommend special attention and care for postural misalignment. The postural adaptation of forward head posture (FHP) has been assumed to compromise the structural integrity of the body causing or leading to pain. There has been limited studies examining the direct correlation between the degree of forward head posture and neck and low back pain. PURPOSE: To determine if there is a correlation between FHP angle and neck and low back pain. METHODS: Thirty nine male and thirty seven female subjects completed this study. Forward head posture was measured with a craniovertebral angle (CVA) utilizing the Head Posture Signal Curvature Instrument (HPSIc). The Northwick Neck Pain Questionnaire (NPQ) and the Oswestry Low Back Pain Questionnaire (ODQ) were used to assess pain in the neck and back, respectively. RESULTS: There was no correlation between CVA measurement and total score of NPQ and no correlation (r = -0.03) was found between CVA and ODQ. However, a moderate correlation (r = 0.54) was found between the subjects’ NPQ total score and the ODQ score. CONCLUSION: No correlation was found from increased forward head posture and neck and low back pain.

Previous studies have shown that ankle proprioceptive ability is significantly correlated with sports performance. It is unknown if ankle proprioceptive ability is related to postural sway and mobility in healthy individuals (HI) and Parkinson’s Disease patients (PD) and, if there is a relationship, how the groups may differ. PURPOSE: To examine ankle proprioception, postural sway, and mobility performance in PD and HI. METHODS: PD (n=27) and HI (n=27) volunteers were matched for age (mean 62 years old), weight (mean 62 kg), and height (mean 161cm). Ankle proprioception was measured while standing, using the active movement extent discrimination apparatus (AMEDA). Bipedal postural sway was assessed via the Biodex Balance System, with eyes open and close in anterior-posterior and medio-lateral directions (EOAP, EOML, ECAP, and ECLM, respectively). Mobility measures included the 30 seconds sit-to-stand (STS) and timed-up-and-go (TUG) tests. RESULTS: Compared to HI, PD showed significantly worse ankle proprioception, STS and TUG (p<0.03). Consistent with previous literature, there were no differences observed in any postural sway measures. Previous ankle proprioceptive discrimination scores were not significantly correlated with STS, TUG, or any postural sway measures in either PD or HI. However, both STS and TUG scores were significantly correlated with ECML in PD (r = 0.548, p<0.01) and r=0.494, p<0.01, respectively, but not in HI. CONCLUSIONS: Our findings support the sensory-reweighting theory, suggesting that PD and elderly HI may use other sensory input, not ankle proprioception, to achieve optimal postural control. Given that PD’s mobility is significantly correlated with ECLM, specific exercise should be designed to address medio-lateral control in PD to promote mobility.

**Impact Of An Exercise Intervention On Human Balance Center Of Pressure Sway Parameters In Previously Sedentary, Overweight Adults**

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**Purpose:** Previous research suggests that a loss in excess body weight could potentially lead to a substantial improvement in overall balance in previously obese and overweight individuals (Maffulli et al., 2005). However, very few studies have evaluated balance performance before and after weight loss due strictly to exercise. The purpose of this study was to evaluate if an exercise intervention aimed at weight loss could lead improvement in standing balance.

**Methods:** Fifteen overweight, but otherwise healthy adults (9 females, 6 males) (age: 23.5 years; height: 1.70 m, starting body mass: 92.8 kg) participated in this study. Balance performance was assessed with a sensory organization test (SOT) prior to and after a 10-week exercise intervention. Center of pressure (COP) sway velocities and root mean square (RMS) sway were analyzed using a repeated-measures ANOVA and potential relationships with changes in body mass was evaluated employing a Pearson correlation.

**Results:** Results from the SOT COP sway parameters revealed significant differences in the eyes closed (EC) for anterior-posterior sway velocity (AP VEL) (p = 0.006), referenced (EORSV) conditions for AP VEL (p = 0.048). Post hoc pairwise comparisons for both variables revealed significantly lower postural sway in post-intervention evaluation versus pre-intervention. In addition, there was a significant correlation between degree of weight change and the following variables: EORSV medial-lateral (ML) VEL (p = 0.002), EORSV ML RMS sway (p = 0.011), eyes open sway-referenced platform (EORSRP) ML RMS sway (p = 0.029), EORSRP AP RMS sway (p = 0.049), eyes closed sway-referenced platform (ECSRSP) ML VEL (p = 0.003), ECSRSP RMS sway (p = 0.036).

**Conclusions:** The results of the current study suggest that improved balance performance can result from an exercise intervention without any directed balance exercises. This could especially be true in situations where the somatosensory system plays a greater role in maintaining balance.
Ankle sprains occur at a high rate and often develop into chronic ankle instability (CAI). Impaired postural control may be a contributing factor to CAI. Effective rehabilitation programs and preventative measures for CAI are needed.

**PURPOSE:** To evaluate the effect of a 6-week ankle and hip rehabilitation program on center of pressure (COP) total area and 95% ellipse area during single-leg static balance among groups of strength, balance with, and control.

**METHODS:** 14 CAI subjects in a strength group (22±1 yrs, 173±9 cm, 73±12 kg, 82±8% FAAM ADL, 58±13% FAAM Sports, 3.0±0.8 MAII, 3.7±1.5 ankle sprains) completed a series of ankle and hip strength exercises (isometric, concentric, and eccentric contraction with therapist). 15 CAI subjects in a strength and balance group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and balance exercises (theraband, wobble board, ankle disk, etc.). 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). The rehabilitation intervention was administered 3 times/week for 6 weeks under supervision. Subjects performed 2 trials of single-leg stance on a force plate (1000 Hz) for 30 sec. 3 x 2 (group x time) mixed model ANCOVA analyses (covariate: pre-intervention value) with repeated measures were used to detect group x time differences in the COP total distance and 95% ellipse area.

**RESULTS:** Results are shown in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Strength (n=14)</th>
<th>Strength and balance (n=15)</th>
<th>Control (n=14)</th>
<th>F Value</th>
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<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
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<tr>
<td>COP total distance (m)</td>
<td>18.0(4.2)</td>
<td>18.7(3.1)</td>
<td>18.8(3.7)</td>
<td>15.7(5.9)*</td>
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<tr>
<td>COP 95% ellipse area (cm²)</td>
<td>8.5(3.5)</td>
<td>8.0(3.0)</td>
<td>8.6(3.6)</td>
<td>5.9(1.9)</td>
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</table>

Values are mean (SD)

*Changes in COP total distance (m) are significantly different than the strength and control groups (P < 0.05)

CONCLUSION:

CAI patients in the strength and balance group improved postural control. Strength training alone did not have a significant impact on postural control. This may be due to the lack of proprioceptive activation during training. More data are needed to understand if this intervention may be used as a rehabilitation tool to reduce the risk of CAI.
Baseline assessments are vital in the evaluation of concussion and are recommended for any person competing in organized athletics. Following a head injury, the same assessments are administered and results are directly compared to baseline scores. Previous literature has suggested re-baseline assessments be administered to all athletes who have sustained a concussion, as the longitudinal effects of a single concussion are not well understood. However, the clinical utility of re-baseline concussion assessments has not been well investigated. Limited literature exists examining clinical change when evaluating postural control and cognition from baseline to re-baseline assessment following a concussion. PURPOSE: The purpose of this study was to examine the differences in clinical postural control and cognition with the Balance Error Scoring System (BESS) and the Standard Assessment for Concussion (SAC) in athletes who had previously sustained a concussion. METHODS: 34 NCAA athletes and cheerleaders (males = 13, females = 21) participated in this study. All athletes had previously been diagnosed with a concussion during the 2014-15 and 2015-16 athletic seasons. Pre-season concussion baselines (PBE) were administered before the first athletic season for each athlete and all athletes completed BESS and SAC evaluations. The same administrations were administered following full recovery from concussion (POST). A medical doctor confirmed the diagnosis and recovery of concussion. The SAC is a verbal assessment evaluating orientation, memory recall, and concentration. The BESS is a subjective evaluation used to identify balance impairments. One-way ANOVAs evaluated the scores on SAC and BESS between each time point. RESULTS: From PRE to POST no significant differences were observed with the BESS (PRE = 15.5 ± 7.34 errors, POST = 16.62 ± 8.04 errors; p = .468, Δ-2.12±8.69) and SAC (PRE = 26.79 ± 1.59 units, POST = 27.24 ± 2.24 units; p = .234, Δ 0.44±12.12). CONCLUSIONS: From PRE to POST assessment, scores on the SAC and BESS did not change significantly. This could suggest that re-baseline of the SAC and BESS has limited clinical utility. Future studies should include more sensitive assessments to adequately detect postural changes from baseline to re-baseline.

**D-76 Free Communication/Poster - Protein Metabolism and Exercise**

**Thursday, June 1, 2017, 1:00 PM - 6:00 PM**  
**Room: Hall F**

**Board #344**  
**June 1 3:30 PM - 5:00 PM**

**Effect Of Different Protein Ratio Beverages On Blood Glucose Regulation**

Chi Yang1, Chang Hong Guo2, Chi Hong Lu1, Chun Tai Chen1.  
1University of Taipei, Taipei, Taiwan. 2Shih Hsin University, Taipei, Taiwan.  
No relationships reported

**Results:** 
Whyn protein and essential amino acids are the most popular supplementation in sports nutrition. It has been recommended that protein plus carbohydrate in a certain ratio 1:3 or 1:4 improve the muscle glycogen synthesis and promote recovery. These benefits from protein and carbohydrate complex are compelling compared to supplementation of protein or carbohydrate alone. However different protein ratio on blood glucose regulation remains unclear.

**Purposes:** In this study we investigated a single supplement different protein beverage in different ratio on blood glucose regulation.

**Methods:** We used crossover study design. Twelve heathy college baseball players (21±0 y). Thereafter the subjects were divided into four groups: protein0% (PRO0), protein12% (PRO12), protein36% (PRO36) and protein75% (PRO75). Fasting blood was collected. After drinking protein supplement, blood glucose and insulin were measured every 30 min for 2 h. The data were analysis by one-way ANOVA with repeated measures.

**Results:** 
PRO0 on glucose area under the curve (GAUC) was significantly higher than other groups (4241±446 vs. 2538±275, 1782±234, 196±287, P<0.05) and PRO75 GAUC was significantly lower than other groups (196±287 vs. 4241±446, 2538±275, 1783±234, P<0.05). After supplement 30 min PRO75 glucose blood was significantly lower than other groups (176±2 vs. 176±5, 178±6, 146±fm/g/dL, P<0.05). After supplement 60 and 120 min PRO12 was significantly higher compare with PRO36 (123±3 vs. 107±4mg/dL, P<0.05 and 118±3 vs. 108±1mg/dL, P<0.05). PRO36 on insulin area under the curve (IAUC) was significantly higher compare with PRO36 ($2927±336 vs. 1178±158, P<0.05). After supplement 30 min PRO36 produced higher insulin concentration compare with other groups (56±7 vs. 31±5, 35±7, 14±2en/L, P<0.05).**

**Conclusion:** High protein ratio did not have better glucose and insulin response. However PRO36 may increase insulin level faster than other groups, but did not secrete more insulin.

**2332 Board #345**  
**June 1 3:30 PM - 5:00 PM**

**Relationship Between Autophagy and Heat Shock Response in Peripheral Blood Mononuclear Cells Following Resistance Exercise**

Trisha A. VanDusseldorp1, Kurt A. Escobar1, Kelly E. Johnson2, Roger A. Vaughan2, James J. McCormick3, Terence Morari4, Matthew Stratton5, Nathan Cole6, Karol Dokladny7, Chad M. Kerksick, FACSM4, Len Kravitz8, Christine M. Mermier4  
1Kennesaw State University, Kennesaw, GA. 2University of New Mexico, Albuquerque, NM. 3High Point University, High Point, NC. 4Lindenwood University, St. Charles, MO. (Sponsor: Chad Kerksick, FACSM) Email: tvanduss@kennesaw.edu  
No relationships reported

Autophagy and protein degradation occur during the proximal hours (hr) post-exercise (PE) and are then followed by a gradual transition to protein synthesis. Previous works suggest that this biphasic relationship is mediated in-part by the heat shock response which may influence autophagy activity and may be influenced by the presence of amino acids. PURPOSE: To determine the effect of acute resistance exercise and branched-chain amino acid (BCAA) supplementation on autophagy and the heat shock response. METHODS: Twenty males (22±3.5 y, 86±15±6kg; 175±4±6cm) were randomly assigned to complete 8 days of 0.22 kg/d BCAA or placebo (PL) supplementation. On day 5 participants performed a bout of eccentric resistance exercise. Peripheral blood mononuclear cells (PBMC) were isolated post-exercise, immediately post-exercise (IPE), and 2, 4, 24, 48, and 72hr. PBMC expression of autophagy markers (LC3I & II, & p62) and HSP70 were measured using Western blot. All autophagy and heat shock markers were assessed in relation to a standard baseline (1.0RQ). Red cell lysate was collected pre-exercise, IPE, and 1, 2, 4, 24, and 72hr to assess glutathione total glutathione ratio (GSSG/GSH). RESULTS: No group differences (p>0.05) were detected for protein expression of autophagy markers, HSP70, or GSSG/GSH ratio at any time-point. When combining groups, LC3I decreased significantly (p<0.01) at 2 (0.51±0.33RQ) and 4 (0.41±0.36RQ) hr PE; p62 decreased significantly (p<0.001) at IP (0.56±0.33RQ), 2 (0.24±0.23RQ), and 4 (0.33±0.31RQ) hr PE and significantly increased (p<0.01) at 24 (1.43±0.44RQ) hr PE. HSP70 increased significantly (p<0.001) increased at 48 (1.39±0.06RQ) and 72 (4.71±3.84RQ) hr PE. GSSG/GSH ratio significantly (p<0.05) increased from baseline (0.1±0.04RQ) at 1 (0.39±0.05RQ), 2 (0.69±0.22RQ), and 4 (0.39±0.17RQ) hr post-exercise. Conclusion: These data support previous work that the heat shock response may exert regulatory control of autophagy in-part through HSP70. HSP70 may assist in transitioning the cell from an initial degradation from protein turnover during exercise onwards following exercise towards protein synthesis in the latter phases of the post-exercise period. Initial autophagy upregulation may be influenced by oxidative stress.

**2333 Board #346**  
**June 1 3:30 PM - 5:00 PM**

**Matrix Metalloproteinases and Tissue Inhibitors of Metalloproteinases Following High Fat Diet and Acute Exercise**

Yunsuk Koh1, Yonghyeon Jo1, Eric K. O’Neal2, Angela Hollingsworth2, Lauren G. Killen3, Ashton F. Waddell2, Alexander J. Heatherly2, Daniel G. Murray1.  
1University of North Alabama, Florence, AL. 2University of Memphis, Memphis, TN. 3University of Alabama, Birmingham, Birmingham, AL. (No relationships reported)

Matrix metalloproteinases (MMPs) play a major role in apoptosis, angiogenesis, and inflammation by degrading extracellular matrix proteins. Specific endogenous proteases, tissue inhibitors of MMPs (TIMPs), are known to inhibit MMPs. PURPOSE: The current study examined the effects of a high fat diet and an acute bout of exercise on MMPs and TIMPs in runners. METHODS: Eight middle-aged, aerobically trained male runners (VO_max = 48.5 ± 4.5 mL/kg/min, age = 39.5 ± 9.9 years) participated in the study. As a crossover design, participants maintained their habitual high carbohydrate diet (HC, 60-70% of carbohydrate) in the beginning of the study and shifted to a high fat diet (HFLC, ~70% of total calories from fat) diet with < 50 g of carbohydrate per day for 3 weeks during the second phase. At the end of each phase, participants performed a 50-min acute bout of treadmill exercise at varying race paces in an environmental chamber (29°C with 60% relative humidity) followed by an outdoor 5-km time trial (average = 23 min). Overnight fasting serum samples were collected at pre- and 24-h post-exercise during both HC and HFLC phases to analyze MMPs (MMP-1, -9, and -10) and TIMPs (TIMP-1, -2, -3, and -4). Data were analyzed using a two-way repeated measures ANOVA with Bonferroni post hoc analyses.

**Results:**

HC compared to HFLC, there were no significant differences in MMP-9 and TIMP-4 (p>0.05). MMP-1 and TIMP-3 were significantly higher in HC than HFLC (p<0.05).

**Conclusion:** High fat diet and acute exercise may alter MMPs and TIMPs, which could affect tissue damage and repair processes in runners.
analyzed using a 2 X 2 (phases: HC and HFLC X time: pre- and 24-h post-exercise) analysis of variance with the Sidak’s multiple comparisons when necessary (p < 0.05).

RESULTS: There was no significant differences in MMPs or TIMPs between HC and HFLC phases. Furthermore, an acute bout of exercise in the heat did not alter MMPs or TIMPs. There were, however, significant positive correlations between TIMP-2 and MMP-2 (r (14) = 0.51, p = 0.01) and TIMP-2 and MMP-9 (r (14) = 0.49, p = 0.01). Additionally, a significant negative correlation was found between TIMP-4 and MMP-4 (r (14) = -0.57, p = 0.02). CONCLUSION: A 3-week high fat diet and an acute intense exercise in the heat did not negatively affect serum MMPs and TIMPs in healthy, trained male runners. It seems that MMP-4 activity may be inhibited by TIMP-4, whereas both MMP-2 and -9, interestingly, may be upregulated by TIMP-2. Future studies examining the effects of a long-term high fat diet on metabolic pathways of circulating or tissue MMPs and TIMPs in active individuals along with a variety of populations are highly recommended.

2334 Board #347
June 1 3:30 PM - 5:00 PM
Whey Hydrolysate Supplementation Following Resistance Exercise Elicits Similar Anabolic Responses in Both Young and Older Adults
Bradley Lambert1, Teru Kato2, Paul Reidy3, Ted Graber4, Paul Brand, Tokyo, Japan. 3University of Utah, Salt Lake City, UT. 4University of Texas Medical Branch, Galveston, TX.

Skeletal muscle sensitivity to dietary protein and exercise typically declines during aging. However, previous data presented by our group indicates that whey protein hydrolysate (WH, di- and tri-peptide mixture) may be able to stimulate muscle anabolism at lower dosages than observed with intact whey protein in older adults. Leucine and other BCAA concentrations were measured in serum, vastus lateralis muscle (at rest and at 0–2 hours and 2–4 hours post-ingestion), and mixed-muscle anabolism in young and older adults.

METHODS: Twenty healthy recreationally active adults (YOUNG: M=8, F=2; OLD: M=7, F=3; 25±4y, 25±4 kg/m2) were studied pre- and post-ingestion (PI) of 10 g of WH 1 hour after a high-intensity exercise (8x 10–15% 1RM, leg ext). We measured mixed-muscle protein fractional synthetic rate (FSR) and plasma BCAA concentrations by stable isotopic methods. Western-blotting was used to assess anabolic signaling and the presence of peptide transporters in muscle. Muscle biopsies from the vastus lateralis were collected at rest and during the early (0–2 h) and late (2–4 h) PI periods. Mixed muscle FSR and anabolic signaling was analyzed using a 2(group) X 3(time) mixed model ANOVA repeated across time.

RESULTS:

<table>
<thead>
<tr>
<th>Groups</th>
<th>Basal</th>
<th>(0-2h) Post Ingestion</th>
<th>(2-4h) Post Ingestion</th>
<th>Entire Post Ingestion Period (0-4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YOUNG (n=10)</td>
<td>0.058±0.003</td>
<td>0.075±0.003</td>
<td>0.100±0.009</td>
<td>0.087±0.005</td>
</tr>
<tr>
<td>OLD (n=10)</td>
<td>0.067±0.005</td>
<td>0.106±0.012</td>
<td>0.091±0.014</td>
<td>0.086±0.005</td>
</tr>
</tbody>
</table>

Plasma BCAA Concentrations (% From Basal, umol/L)

<table>
<thead>
<tr>
<th>Time Post Ingestion</th>
<th>Leucine</th>
<th>Isoleucine</th>
<th>Valine</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 min</td>
<td>259 ± 29†</td>
<td>206 ± 24†</td>
<td>120 ± 20†</td>
</tr>
<tr>
<td>40 min</td>
<td>206 ± 24†</td>
<td>112 ± 20†</td>
<td>68 ± 9†</td>
</tr>
<tr>
<td>60 min</td>
<td>206 ± 24†</td>
<td>112 ± 20†</td>
<td>68 ± 9†</td>
</tr>
<tr>
<td>80 min</td>
<td>206 ± 24†</td>
<td>112 ± 20†</td>
<td>68 ± 9†</td>
</tr>
<tr>
<td>100 min</td>
<td>206 ± 24†</td>
<td>112 ± 20†</td>
<td>68 ± 9†</td>
</tr>
<tr>
<td>180 min</td>
<td>206 ± 24†</td>
<td>112 ± 20†</td>
<td>68 ± 9†</td>
</tr>
</tbody>
</table>

CONCLUSION: Compared with rest, increases in p-mTOR (Young: +2.0 fold, Old: +2.5 fold) and p-4E-BP1 (Young: +1.5 fold, Old: +1.4 fold) were observed in both groups at 4h PI (p <0.05). Increases in p-S6K1 were observed in both groups at 2h PI but to a greater extent in the OLD group (p <0.05). Peptide transporter-1 (PEPT1) expression was found in muscle samples from both groups. CONCLUSION: WH provided after REX enhances muscle anabolism in older adults at a dose previously shown to be ineffective with intact whey protein. Future studies will be required to determine if WH may aid in the long-term preservation of muscle in this population.
MEDECINE & SCIENCE IN SPORTS & EXERCISE®

D-77  Free Communication/Poster - Renal Physiology

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2337 Board #350  June 1 3:30 PM - 5:00 PM
Hydration and Renal Responses During Pre-Season High School American Football
Cory L. Butts1, Aaron R. Caldwell1, Richard A. Perry, Jr.1, Kathleen M. Heath1, J.D. Adams1, Matthew S. Gano2, FACSM®, Lisa T. Jansen1, Hyun-Gyu Suh1, Lesley W. Vandermark1, M. Kyle Smoot3, Brendan P. McDermott1,4, 1University of Arkansas, Fayetteville, AR. 2University of Kentucky, Lexington, KY.

Email: clbutts@uark.edu


American football athletes often report to practices and games in a hyohydrated state, potentially increasing the risk for performance and thermoregulatory impairments. However, the renal responses to proactive dehydration with environmental and workload stressors, have not been elucidated in this population. PURPOSE: To observe the hydration status and renal function of high school American football players during pre-season practices. METHODS: High school American football players (n = 31 males, age 16 ± 1y, ht 1.79 ± 0.07m, mass 88.4 ± 19.9kg, body fat 19.9 ± 9.4%) participated in this observational study. Body mass (BM), blood, and urine samples were obtained 2-3 days prior to the start of pre-season practices (Base) and at Days 4 (D4), 7 (D7), and 10 (D10). D4 and D7 samples were collected prior to practice while D10 samples were obtained post-practice. Serum osmolality (Sosm), urine specific gravity (USG), and urine color (Ucolor) were measured at each time point. Renal stress was assessed by measuring plasma neutrophil gelatinase-associated lipocalin (pNGAL) via enzyme linked immunosorbent assay. Wet bulb globe temperatures (WBGT) were also recorded for each practice. RESULTS: BM did not change significantly from Base (91.6 ± 22.9 kg) through D10 (90.2 ± 23.2 kg; p = 0.26). Sosm at Base (292 ± 4 mOsm/kg) was significantly lower than D10 (295 ± 4 mOsm/kg; p = 0.05). Further, Sosm >290 mOsm/kg was present in 67-73% of players reporting to practices on D4 and D7, and 80% finishing practice on D10. Ucolor (USG at Base (1.023 ± 0.007) and D10 (1.027 ± 0.005)) was greater than D4 (1.018 ± 0.009, all p < 0.05). However, renal stress assessed via pNGAL was not elevated throughout practice. Thus, despite suboptimal hydration and environmental stress, these American football players experienced minimal renal injury as measured via pNGAL.

Supported by AMISSM-ACSM Grant

2338 Board #351  June 1 3:30 PM - 5:00 PM
Low Estimated Glomerular Filtration Rate (eGFR) is Associated with Skeletal Muscle Function Deficit in Elderly Persons
Jae Seung Chang, Tae Ho Kim, In Deok Kong. Yonsei Institute of Sports Science & Exercise Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea, Republic of.

(No relationships reported)

Physical performance is closely associated with chronic diseases and dysfunction of numerous organ systems. Old persons with chronic renal failure have shown the potential decline in physical performance, especially in the end-stage. However, it is unclear whether the subclinical kidney dysfunction is associated with skeletal muscle function deficit in the elderly population. PURPOSE: To determine the association between renal function and skeletal muscle function deficit in old persons without nephropathy. METHODS: Eight hundred fifty-four Korean elderly (female, 75.3%) aged 65 to 89 years were included in this cross-sectional study. All participants were interviewed face-to-face and received measure of anthropometry, body composition and serum biomarkers of metabolic diseases. eGFR was calculated using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation based on serum creatinine concentration. The following physical performance tests were performed: handgrip strength (absolute and relative values), timed up-and-go (TUG), chair stand, 2 min stationary walking, figure-eight walk and sit-and-reach. Skeletal muscle function deficit was defined as a combination of weakness and slowness based on the relative handgrip strength (men <13.2, women <0.792) and practice sub-optimally hydrated. However, renal stress assessed via pNGAL was not significantly lower after pNGAL (p=0.048).

Purpose. Exercise-induced redistribution of blood results in a decreased renal perfusion and changes in glomerular permeability and filtration ratio. These alterations may lead to a deterioration of renal function or even acute, but transient, renal failure. Kidney Injury Molecule-1 (KIM1) and Neutrophil gelatinase-associated lipocalin (NGAL) are new urinary biomarkers to detect kidney injury in an early stage. Therefore, the purpose of this study was to examine the effects of an acute bout of endurance exercise on urinary KIM1 and NGAL levels. METHODS. A total of 60 subjects (56±10 years) participated in an annual walking event and walked 30-50 km at a self-selected pace. Heart rate was recorded every 5 km. Baseline and post-exercise blood and urine samples were taken to assess fluid balance and kidney injury and body mass was measured to determine the relative body mass loss. Urinary KIM1 and NGAL levels were corrected for variations in urine volume and for urinary concentration changes using urinary cystatin C. RESULTS. Subjects completed the exercise bout at 71±9% of their predicted maximal heart rate. At baseline, kidney function, measured as estimated glomerular filtration rate (eGFR) was 98.3±11.6 mL/min, whereas 49% of the subjects had a slightly decreased kidney function (eGFR=90 mL/min). Post-exercise body mass loss was 0.9±1.2% and 20% of the subjects were dehydrated after exercise (relative body mass loss >2%). We observed a significant increase in post-exercise urinary NGAL levels (3.0±1.5 ng/100g cystatin C) compared to baseline (2.3±1.3 ng/100g cystatin C, p=0.025). Moreover, 65% of subjects demonstrated elevated NGAL levels after exercise. In contrary, corrected urinary KIM1 levels did not change after exercise (0.70±0.45 versus 0.74±0.49 ng/100g cystatin C, p=0.63). At baseline, 2 subjects were detected with proteinuria, whereas 8 subjects had post-exercise proteinuria (p=0.048).

Conclusion. The increased levels of cystatin C corrected NGAL and proteinuria after an acute bout of endurance exercise suggest that an acute bout of endurance exercise may cause transient kidney injury.

2340 Board #353  June 1 3:30 PM - 5:00 PM
Changes in Glomerular Filtration Rate after Maximal and Submaximal Exercise in Olders
Marina M. Trejo1, Francisco J. Diaz2, Carlos Korshaus2, Maciste Macias2, Antonio Riveria3, Magdalena Najera3, Citalli Arce1, Arturo Figueroa-Galvez, FACSM®, 1Universidad Autonoma de Baja California, Baja California, Mexico. 2Universidad de Guanajuato, Guanajuato, Mexico. 3Florida State University, Florida, FL. (Sponsor: Figueroa Galvez Arturo, FACSM)
Email: fisiol.ug@gmail.com

(No relationships reported)

Purpose: Sustained exercise may decrease Glomerular Filtration Rate (GFR) in older adults. However, kidney function in older adults has not been investigated utilizing the new creatinine-cystatin C equation for GFR during exercise. The
purpose of this study was to analyze the effect of maximal and submaximal bicycle exercise utilizing the equation for GFR of creatinine-cystatin C in older adults (≥65 years). METHODS: Twenty healthy subjects (13 men and 7 women; 70 ± 4 years) participated in the study. Subjects performed 3 bicycle exercise tests one week apart: one maximal (MAXCAP-B), and two 20-minute submaximal at 80% (SUBMAX-B80) and 60% (SUBMAX-B60) of heart rate reserve (HRR), respectively. Blood samples were obtained before and after the test in the seated position to measure the plasma concentration of creatinine and cystatin C. GFR was estimated according to the equation ofCreatinine-Cystatin C Equation (CKD-EPI 2012).

**RESULTS:** MAXCAP-B produced a significant reduction in GFR (87.3±18.3 ml/ min to 80.9±18.8 ml/min, P < 0.05). SUBMAX-B80(80.6±14.03 ml/min to 82.7±16.9 ml/min) and SUBMAX-B60 (84.7±15.0 ml/min to 80.3±12.7 ml/min) produced no significant reduction in GFR. **CONCLUSIONS:** Although maximal exercise produced a decrease in GFR, the changes were minimal. Intense and moderate exercise did not alter significantly GFR when the equation of creatinine-cystatin C was used. Kidney function after intense and moderate exercise in older adults was preserved, indicating safe incorporation of exercise at these intensities.

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**D-78 Clinical Poster Reception**

**Thursday, June 1, 2017, 5:45 PM - 6:45 PM**

**Room:** Hotel-Mineral B

**2341 Board #1**

**June 1 5:45 PM - 6:45 PM**

**Back Injury - Cheerleading**

Michael Stiller, Michelle A. Miller. The Ohio State University, Columbus, OH.

(No relationships reported)

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

**PHYSICAL EXAMINATION:** Examination revealed that she was afibrile with normal vital signs. There was no tenderness on palpation over the spinous processes or the paraspinal musculature. Her neurologic exam was significant for decreased sensation appearing central disc protrusion at T8-9 that abuts the adjacent spinal cord. Her gait was ataxic with significant loss of balance. Her reflexes were 3/4 and the Achilles were 2/4 bilaterally. She demonstrated a wide-based gait with significant loss of balance.

**DIFFERENTIAL DIAGNOSIS:**

1. Spondylolysis/spondylolisthesis
2. Vertebral fracture
3. Intervertebral disc herniation
4. Transverse myelitis
5. Psychogenic

**TESTS AND RESULTS:**

ESR and CRP normal

T-spine MRI:
1. Mild age related change/disc degeneration at T7-8 and T8-9 with a small acute appearing central disc protrusion at T8-9 that abuts the adjacent spinal cord.
2. No findings to indicate transverse myelitis.

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

**TREATMENT AND OUTCOMES:**

1. Neurosurgery consult with no surgical intervention taken. Patient admitted for continued monitoring, PT, and OT.
2. Notable lower limb strength improvement seen over the first three days, however, acute inpatient rehabilitation was needed to assure ability for safe ambulation with impaired lower limb sensation.
3. After 12 days of inpatient rehab, lower body sensation was still impaired, but patient demonstrated improved lower limb strength and was ambulating with proper technique multiple times around the unit without assistance.
4. Patient discharged with outpatient therapy and a follow-up with neurosurgery in one month with repeat spine MRI.
5. Patient instructed to not return to cheerleading until follow-up.
THURSDAY, JUNE 1, 2017

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2344 Board #4
June 1 5:45 PM - 6:45 PM

Proximal Muscle Weakness in 10-year-old Female Gymnast
Peter Waller, David Lessman, Philip Skiba. Advocate Lutheran General Hospital, Park Ridge, IL.

(No relationships reported)

History:
A 10-year-old gymnast initially presented with three weeks of right hamstring pain, and was started on a home exercise program. After 4 weeks without improvement, the patient was started on a program of formal physical therapy. After ten weeks of therapy, the patient began to develop core muscle weakness and right anterior hip pain, and reported an inability to walk more than a mile without limping. She went on to develop similar pain with stair climbing, as well as activities of daily living. Shortly thereafter, the patient began to complain of quadriceps weakness and thoracic back pain.

Physical Examination:

Differential Diagnosis:
1. Juvenile Dermatomyositis
2. Polymyositis
3. Viral myositis
4. Lupus Erythematosus

Tests and Results:
Labs: CPK: 524 H, AST: 75 H, ALT: 32 H, ESR: 18 wnl, Aldolase 11 H, CRP < 0.3 wnl, LDH Total 317 H
X-Ray: 3V of bilateral hips-No acute fractures, subluxation, or dislocations.
MRI Pelvis: Diffuse intramuscular edema, predominantly involving gluteal muscles.
Consistent with myositis.

Final Working Diagnosis: Juvenile Dermatomyositis

Treatment and Outcomes:
1. Patient admitted to outside hospital, and patient started on daily prednisone, weekly methotrexate, and hydroxychloroquine.
2. Patient started on IV methylprednisolone weekly, and monthly IVIG infusion by Dr. Abraham.
3. Evaluation at NIH Myositis Clinic. Recommended increasing IVIG dosing and pulse doses of IM steroids with every IVIG infusion.
4. Lupus Erythematosus

Differential Diagnosis:
1. Juvenile Dermatomyositis
2. Polymyositis
3. Viral myositis
4. Lupus Erythematosus

2345 Board #5
June 1 5:45 PM - 6:45 PM

Cardiovascular Injury-Marathon Running
Stephen Scharf, Beth Stepanczuk. University of Pittsburgh Medical Center, Pittsburgh, PA.

(No relationships reported)

History:
A 48-year-old female competitive marathon runner with no significant past medical history developed right sided neck pain while running a race. The patient completed the race at her typical pace, finishing top five in her age group. After the race, she complained of neck pain on palpation. Around thirty minutes post-race she began to have sudden onset dizziness, causing her to fall to the ground. While on the ground, she soon developed severe vertigo, nausea, and emesis. EMS was immediately called and she was transported to the hospital. During transport the patient had loss of consciousness.

Physical Examination: Examination in the emergency room found the patient to be hemodynamically stable. She was noted to be lethargic but arousable, unable to stand due to vertigo, and had continued nausea and emesis. The rest of her physical exam was benign.

DIFFERENTIAL DIAGNOSIS:
Cardiac arrest
Carotid artery dissection
Exercise associated hypotension
Hemorrhagic stroke
Hypoglycemia
Infectious stroke
Vertebral artery dissection

2346 Board #6
June 1 5:45 PM - 6:45 PM

Sternoclavicular Injury - Rugby Union (15-players-a-side)
Victor Lopez Jr, (Sponsor: Robert C. Cantu, MD, FACSM), Richard Ma2, Douglas E. James3, Michael S. Wilinski4, Answorth A. Allen5. 1Rugby Research and Injury Prevention Group, Inc. Hospital for Special Surgery, New York, NY. 2Missouri Orthopaedic Institute & Thompson Laboratory for Regenerative Orthopaedics, Columbia, MO. 3State University of New York Medical Center (Downstate), Brooklyn, NY. 4Lake Erie College of Osteopathic Medicine, Bradenton, FL. 5Hospital for Special Surgery, New York, NY.


HISTORY: A 19-year-old men’s college Rugby-15s winger collapsed during match play. The player had no impact with another player, dizziness and no loss of consciousness. A medical history revealed the player had sustained a right clavicular injury in a previous match 25 days prior to this incident. Where he complained of right shoulder pain, after impacting the ground with a multi-player tackle. The player had presented to an Urgent Care facility after that injury and provisionally diagnosed with shoulder sprain - vs. pectoralis strain, placed in arm-sling and sent home on oral analgesics. Right shoulder radiographs at Urgent Care visit were read as normal. PHYSICAL EXAM: Exam in ED revealed slurred speech, and complaints of localized pain and tenderness on right medial clavicle. Right sternoclavicular joint pain on palpation. Limited upper extremity range of motion secondary to pain, no facial droop, decreased left sided upper and lower extremity sensation, reflexes and strength.


ACSM May 30 – June 3, 2017
Denver, Colorado
Board #7
June 1 5:45 PM - 6:45 PM
Exercise Vital Sign and Health Care Utilization
Alex Mroszczyk-McDonald, Sponsor: Robert Sallis, FACSM. Kaiser Permanente Southern California, Fontana, CA.

Background: It is well established that >150 minutes of weekly physical activity significantly improves health and Kaiser Permanente Southern California (KPSC) has pioneered the use of an Exercise Vital Sign (EVS) to record Physical Activity (PA). However, there is less data on exercise and impact on healthcare utilization.

Purpose: To evaluate the correlation of EVS and healthcare utilization, in our SCP5 patient population. Specifically, do those patients who report consistent exercise for >150 minutes per week have reduce utilization of the health care system.

Methods: KPSC Electronic Health Record data was abstracted to determine 3 cohorts of adults (18-65yrs) (N=2,534,895) who were Consistently Sedentary (CS) (EVS=0min/wk consistently), Insufficiently Active (IA) (EVS=1-149min/wk), or Consistently Active (CA) (EVS=150min/wk consistently), meeting the World Health Organization recommendations. Each cohort had at least 3 encounters and self reported EVS that were consistent. Each cohort was then compared to their health care utilization over a 1, 3 and 5 year period. Because KPSC is a closed system we were able to accurately capture utilization of pharmacy, hospital, radiology, laboratory and outpatient departments. Data was adjusted for age, gender and ethnicity.

Results: Compared to CS patients, CA patients have consistently lower use of the KPSC health care system. This relationships held true across the 1, 3 and 5 year analysis. Of note patients who were CA were 75% less likely to be hospitalized (OR 0.23-0.26), 43% less likely to use the ER (OR 0.55-0.58) and 45% less Urgent Care services (OR 0.54-0.56), 25% less laboratory blood draws (OR 0.73-0.74), and 27% less pharmaceuticals fills (OR 0.71-0.74). Other factors that were associated with lower health system utilization were female gender, caucasian ethnicity and ethnicity. Conclusion: Based on EVS data, and analysis of health utilization we conclude that CA individuals have significantly lower utilization of the health care system than those who are CS.

Board #9
June 1 5:45 PM - 6:45 PM
Sex Differences in Competition Volume, Club Sport Participation, Specialization, and Injury Among High School Athletes
Eric G. Post, David R. Bell, Stephanie M. Trigsted, Dan A. Schaef er, Madeline M. Miller, Adam Y. Pfaller, Scott B. Hetzel, M. Alison Brooks, Timothy A. McGuine. University of Wisconsin-Madison, Madison, WI.

During the 2014 season, 2% of female athletes were at risk for greater risk due to certain injuries, such as ACL injuries or overuse knee injuries. One theory for this increased risk is the increasing trend towards intense, year-round sport participation and specialization. However, it is unknown whether characteristics of sport participation, including competition volume, club sport participation, specialization, or history of lower extremity injury (LEI) differ between female and male athletes.

PURPOSE: To compare level of competition volume, club sport participation, sport specialization, and previous lower LEI between males and females in high school athletes.

METHODS: 1525 high school athletes (780 female, age=16.1±1.1 years old, grades 9-12) from 29 high schools were recruited to complete a pre-season questionnaire regarding their sport participation patterns and previous injury history.

Sport competition volume in the previous 12 months was classified as high (>60 competitions), moderate (30-60 competitions), or low (<30 competitions). Sport specialization status was classified as low, moderate, or high using a widely utilized 3-point specialization scale. Chi-square tests were used to investigate associations of competition volume, club sport participation, specialization, and LEI by sex (a-priori p<0.05).

RESULTS: Females were more likely than males to participate in high competition volume (23.2% vs 11.0%, χ2=84.7, p<0.001), participate on a club team (61.2% vs 37.2%, χ2=88.3, p<0.001), and specialize (16.4% vs 10.4%, χ2=19.7, p<0.001). A total of 487 subjects (31.5%) reported sustaining a total of 599 previous time-loss LEI. Female athletes were more likely to report a previous LEI than males when considering all sports (36.5% vs. 27.0%, χ2=15.9, p<0.001) and when the sample was restricted to sex-equivalent sports (37.3% vs. 28.2%, χ2=9.0, p<0.003). CONCLUSIONS: Female athletes were more likely to participate in sports at high volumes, on club teams in addition to their high school teams, be highly specialized, and report previous LEI. Female high school athletes may be at greater risk of injury due to these differences in sport participation patterns.

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CONCLUSIONS: Elite para-sport athletes have high prevalence of Triad components, regardless of sex or sport type. Awareness of the Triad in athletes is low. While consequences of the Triad in a para-athlete population are poorly understood, screening tools and education to increase awareness are required to optimize overall health of this population.

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

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