D-07 Thematic Poster - **Body Composition and Health**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 101

1719 **Chair:** Peter W. Grandjean, FACSM. *Baylor University, Waco, TX.*
(No relationships reported)

1720 Board #1 June 1 1:00 PM - 3:00 PM

Age Related Decline in VO2max and Lean Body Mass in Masters Athletes

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Improving physical performance of athletes is an important goal to success in sports achievements. Aging influences both body composition and results in a decline in maximal oxygen consumption (VO_2max). This decline results from several factors, including increased body fat and reduced maximal cardiac output. Sex differences in age-related decline in VO_2max 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 VO_2max 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. VO_2max 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 VO_2max (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*=0.00) (61.7+9.1 kg and 44.2+6.9, respectively). For males, there was no significant correlation between age and VO_2max (r = -0.31, P =0.32), age and LBM (r = -0.23, P=0.47), or VO_2max and LBM (r = 0.04, P=0.89). For females, there was a significant negative correlation between age and VO_2max (r = -0.603, P=0.02); but no significant correlations were found between age and LBM (r = -0.244, P=0.40) and VO_2max and LBM (r = 0.121, P=0.68). There was not a significant age-related decline in VO_2max in males and females (r^2 = 0.09, r^2 = 0.36, respectively) or in LBM (r^2 = 0.05, r^2 = 0.06, respectively). **CONCLUSION:** Although there were declines in VO_2max 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

1721 Board #2 June 1 1:00 PM - 3:00 PM

Development And Validation Of Body Fat Prediction Equation In 20-69 Adults

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PURPOSE: Skinfold thickness is commonly measured in clinical and field settings for the assessment of body fat percentage (BF%) because this method is low cost. A study was conducted to develop prediction equation for total body fat using surface anthropometric measures in adults aged 20-69 years old.
METHODS: Data from 1225 healthy, yellow adults were used. The cohort was then divided into validation and cross-validation groups. Prediction equation was developed by using regression analyses in 1141 Chinese adults aged 20-69 years old. These adults were recruited from a larger randomly sampled population-based study. The independent variables included sex, age, height, mass, body mass index, chest girth, waist girth, hip girth, and skinfold thickness at nine sites. The dependent variable was total body fat percentage and was measured using dual-energy X-ray absorptiometry (DXA). Multiple linear regression was used to determine the best prediction equation for fat percentage. A total of 84 additional samples were included to verify the validity of the equation. Tests for accuracy included R^2 and Bland-Altman plots.
RESULTS: Using multiple linear regression analyses, the best equation for predicting FM (R^2 = 0.758) included sex, age, height, body weight, body mass index, chest girth, hip girth, subscapular skinfold, triceps skinfold, biceps skinfold, chest skinfold, axillary line section skinfold, abdominal skinfold, front thigh skin fold, and medial calf skinfold as independent variables. After cross-validation, the new predication equation (PE) was found to be valid in 20, 40, and 60 years old men and women (P<0.05). Bland-Altman plots showed limited agreement between body fat percentage (BF%) calculated with the prediction equation (PE) and BF% measured with dual-energy X-ray absorptiometry (DXA) in adults aged 20-29, 40-49, and 60-69 years old.
CONCLUSIONS: A prediction equation was developed, and this was able to predict total body fat of adults aged 20-69 years old using surface anthropometric measurements with high predictive accuracy.

1722 Board #3 June 1 1:00 PM - 3:00 PM

Analysis Of Visceral Fat Tissue Via Dual-energy X-ray Absorptiometry And Magnetic Resonance Imaging

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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 this 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 4748.44 cm^3±1366.59cm^3 and 2693.10±920.07 cm^3, 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 2226.16 cm^3, 3548.73 cm^3 and 903.583 cm^3, respectively. ***Conclusion:*** Large differences in means were expected due to the MRI imaging a larger anatomical region (L5 to T9) 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.

1723 Board #4 June 1 1:00 PM - 3:00 PM

Is Unhealthy Fat Mass Disguised By A Healthy BMI In Females With Eating Disorders?

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The chaotic eating behavior, with or without periods with restrictive eating and compensatory behavior, in bulimia nervosa (BN) and binge eating disorder (BED) can cause 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 iDXA, GE Healthcare, enCORE Software, Version 14.10.022) by performing a whole-body scan. Android gynoid 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.

1724 Board #5 June 1 1:00 PM - 3:00 PM

Bias Between DXA And BIA Varies Based On Quantity Of Fat Mass And Fat-free Mass

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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 bias was present for body composition estimates. Mean differences for DXA and BIA were present in females and males 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.

1725 Board #6 June 1 1:00 PM - 3:00 PM

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

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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-/anti-inflammatory cytokines. **METHODS**: Forty-one inactive obese Hispanic females (mean BMI = 34.5 kg/m^2, aged 21-39years), were divided into one of three groups : high intensity training group (HT: running at 70% VO_{2max}, n=14), low intensity training group (LT: walking at 50% VO_{2max}, n=14), and control group (CON, n=13). Exercise volume was similar for both training groups [initial energy expenditure (EE): 13.5 METs·h/w] and EE was increased by 4.5 METs·h/w every four weeks in both training groups. Two-way repeated measures ANCOVA and Tukey post hoc tests were used for data analysis. **RESULTS**: 12 weeks of aerobic exercise resulted in significantly lower levels of TNF-α in both HT (4.46±.98 pg/mL, Mean±SD → 3.66±.80, P=.006) and LT (4.35±.79 → 4.05±.77, P=.027). A significant decrease in CRP was observed in HT (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 adiponectin 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.

1726 Board #7 June 1 1:00 PM - 3:00 PM

Influence of Menopause and Fat Mass Distribution on Lipids and Lipoproteins in Normal-Weight Obese Women

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Normal-weight obesity (NWO), defined as a normal body mass index (BMI), but possessing a high body fat percentage (BF), has been associated with increased risk for cardiovascular disease (CVD) comparable to women with obesity. Following menopause, fat redistribution and increased risk for dyslipidemia are common; however, the effect of menopausal-related shifts in fat distribution and lipids and lipoproteins in NWO women remains to be determined.
PURPOSE: To determine the influence of menopausal status on changes in regional abdominal and hip fat masses and lipids and lipoproteins in NWO women.
METHODS: Sedentary, non-smoking women (n=214), not taking medications for the treatment of dyslipidemia, were grouped based on two categories: 1) menstrual status: premenopausal (PRE) or postmenopausal (POST) and 2) BF status: non-obese (BMI <25 kg/m^2 and BF <36%), NWO (BMI <25 kg/m^2 and BF >36%), or obese (BMI >25 kg/m^2 and BF >36%). Fasting (12 hr) serum samples were analyzed for lipid and lipoprotein-cholesterol concentrations. Percent BF and abdominal and hip regional fat masses were quantified by DXA. A 2x3 ANOVA was used to identify differences between groups. Statistical significance was set at $P<0.05$.
RESULTS: Independent of menopausal status, both abdominal and hip fat mass in NWO was 27-39% (P<0.001) greater than non-obese women, but 37-43% (P<0.001) less than obese women. Cholesterol was greater in non-obese (186±33 vs. 212±28 mg/dL, P=0.001), NWO (196±35 vs. 219±26 mg/dL, P=0.028), and obese (201±34 vs. 223±25 mg/dL, P=0.005) POST women when compared to PRE women. LDL-C was not different between non-obese PRE and POST women; however, LDL-C was greater in POST women who are NWO (111±36 vs. 131±25 mg/dL, P=0.034) and obese (121±30 vs. 138±23 mg/dL, P=0.017) when compared to PRE women. In contrast, HDL-C was lower in only non-obese POST women (62±13 vs. 75±14 mg/dL, P<0.001) when compared to non-obese PRE women. In POST women, only HDL-C was significantly lower (62±15 vs. 75±14 mg/dL, P=0.010) in NWO than non-obese women.
CONCLUSIONS: Based on these findings, menopausal status was not associated with a change in fat distribution; however, the age-related changes in lipids and lipoproteins appear to be due to a change in menopausal status, not shifts in fat distribution.

1727 Board #8 June 1 1:00 PM - 3:00 PM

Measurement of Subcutaneous Adipose Tissue in Pre-School Children using Ultrasound

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Studies analyzing the weight status of children, especially in overweight and obese children, often use skinfold measurements as part of a standard anthropometric assessment. This commonly used method to assess body fat has inherent shortcomings in accuracy and reliability. In the HAPPY CHILD study (Healthy eating, Active Play-Promoting a healthy lifestyle in Young CHILDren), we used ultrasound to measure subcutaneous adipose tissue (SAT) in pre-school children. In taking these measurements, we applied a recently introduced protocol developed by the International Olympic Committee (IOC) Working Group on Body Composition, Health and Performance (under the auspices of the IOC Medical Commission). **PURPOSE:** To determine if the above-mentioned protocol for ultrasound measurements of SAT is a feasible method to assess body fat in pre-school children, aged 3-5 years. **METHODS:** Ultrasound measurements of SAT were taken at eight body sites from 112 children in ten kindergartens. Site marking was performed in reference to a child's body height. The sum of SAT (D) from these eight sites is reported as: D_{Incl} (including embedded structures) and D_{Excl} (excluding embedded structures). Fat patterning profiles were established, and boys were compared to girls. **RESULTS:** Fat patterning profiles of 59 boys and 53 girls with an average age of 4.05 years ± 0.72 were established. A comparison of SAT thickness using the Mann-Whitney U test showed a significant difference between girls and boys in the sum of SAT: D_{Incl} in girls was 52.91 mm ± 19.03 (D_{Excl}: 47.46 mm ± 18.05) vs. 46.9 mm ± 18.48 (D_{Excl}: 41.27 mm ± 17.27) in boys (D_{Incl}: p = 0.036; D_{Excl}: p = 0.024). Both groups had the highest SAT values at the

lateral thigh and the lowest values at the erector spinae. **CONCLUSION:** The applied protocol for ultrasound measurements of SAT is a feasible method to assess body fat in pre-school children. The results show that the girls have a higher amount of SAT than the boys. Adjustments in calculation of measurement sites may be necessary in some cases, depending on the length of a child's limbs.

D-08 Thematic Poster - **Bone Quality in Special Populations**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 505

1728 **Chair:** Lisa Ferguson-Stegall. *Hamline University, Saint Paul, MN.*
(No relationships reported)

1729 Board #1 June 1 1:00 PM - 3:00 PM

Sclerostin And Biomarkers Of Bone Health, Energy And Vitamin D Status In Elite Male Athletes

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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 (P1NP), 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 with Bonferroni correction. Analysis of covariance was used to control for potential confounders when making comparisons and Pearson correlations analysed variables for relationships.**RESULTS:** Serum sclerostin levels were not significantly different between males and females (0.45±0.10ng/mL versus 0.41±0.12 ng/mL unpaired 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 for age and weight. No other significant associations were observed for sclerostin and any other biomarkers. **CONCLUSIONS:** Serum sclerostin levels in elite distance runners were not influenced by sex, but were significantly associated with biomarkers of bone resorption and may be related to energy availability in elite male distance runners. Further research is needed to explore the clinical implications of measuring sclerostin in elite distance runners.

1730 Board #2 June 1 1:00 PM - 3:00 PM

A 1-Year Longitudinal Study of the Bone Mineral Density of Division I College Distance Runners

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PURPOSE: The purpose of this investigation was to examine the changes in bone mineral density (BMD) in a Division I cross-country team over a 1-year period. **METHODS**: Fourteen men (66.8 ± 4.6 kg; 178.7 ± 5.0 cm; 20.4 ± 1.0 yrs; 20.9 ± 1.1 BMI) and nine women (52.1 ± 5.9 kg; 161.8 ± 6.9 cm; 20.2 ± 1.0 yrs; 20.3 ± 1.1 BMI) collegiate distance runners volunteered for bone scans using dual-energy x-ray absorptiometry (DXA). Initial scans were conducted at the beginning of the cross-country season, a second scan at the beginning of the spring track season and a third scan was conducted at the beginning of the following cross-country season. Scan sites included the lumbar spine, proximal femur, and non-dominant forearm. A repeated measured analysis of covariance was utilized to determine any differences between BMD at the three time points. Lean body mass was the co-variant during the statistical analysis. A *p*-value of 0.05 was used for significance. **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 (p = 0.025) decrease in total hip BMD between scans 1 and 2 and a significant increase (p = 0.004) 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. **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 measureable changes at other bone sites. Even though whole body lean mass increased in this group over the one year training period, BMD was maintained. 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.

1731 Board #3 June 1 1:00 PM - 3:00 PM

Bone Metabolic Response to 216 km Ultra-Marathon Running

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Physical exercise is a known source of increased bone turnover. Playing sports is recommended for preventing osteoporosis. The positive effects on bone mass of short-duration, high-impact exercise is well accepted. Bone mass can be considered as net product of bone formation and bone resorption. However, although weight-bearing in nature, endurance running has been shown to increase bone resorption but not formation in some populations potentially increasing the risk of stress fractures. Ultra-endurance running puts enormous strain on the whole human body including the bones. **PURPOSE**: To assess changes in biochemical markers of bone metabolism after given sub-sections of an acute, weight-bearing ultra-endurance race. **METHODS**: Venous blood samples were obtained from five highly-trained male ultra-endurance athletes (mean±SD: age 53.8±10.4 yrs, height 175.8±11.1 cm, body mass 75.9±8.4 kg) before the start of the race (km0), after completion of one (km42), two (km84) and three (km126) marathon distances and after finishing the race (km216) for the analysis of bone formation marker bone alkaline phosphatase (BAP), bone resorption markers tartrate-resistant acid phosphatase (TRAP-5b) and beta-crosslaps (CTX) as well as calcium (Ca) and phosphate (Phos). Furthermore, Vitamin D (VitD) concentration was measured at km0. **RESULTS**: Normal levels of VitD were observed in all athletes. Both markers of bone resorption and Phos only demonstrated small fluctuations throughout the race with no significant time effect (p>0.05). However, BAP and Ca revealed a significant time effect (p<0.05). BAP was higher at km42 (12.5±4.7 µg/l) and km84 (13.2±4.5 µg/l) compared to km216 (11.0±3.3 µg/l; both p<0.05). At km216, also Ca (2.4±0.2 mmol/l) was lower (all p<0.05) than corresponding values at km42, km84 and km126 (2.6±0.3, 2.6±0.2, 2.5±0.2 mmol/l), respectively. **CONCLUSIONS**: The unchanged CTX and TRAP-5b with concentrations well within the clinical reference range indicate that this acute, weight-bearing, one-stage ultra-endurance foot race did not cause an increased bone resorption while the results of the bone formation marker BAP suggests no particularly beneficial effect. Considering all results together it can be concluded that this type of exercise seems to have no acute detrimental effect on bone mineralization.

1732 Board #4 June 1 1:00 PM - 3:00 PM

Seasonal Differences In Bone Characteristics In Elite Team Sport Players

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The size and structure of bone is influenced by habitual mechanical loading. In elite team sport players, it remains unclear whether bone structural properties change during a playing season and if sport specific bone adaptations occur. Purpose: To compare bone characteristics between different team sports and determine whether seasonal

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/cm^2), bone area (BA) (cm^2) and bone mineral content (BMC) (g). Peripheral quantitative computed tomography (pQCT) was used to assess tibial cross sectional area (mm^2), cortical thickness (CT) (mm), periosteal circumference (PC) (mm) and strength strain index (SSI) (mm^3) 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 ± 173.8 vs 2846.9 ± 177.0 g; P=0.013) and SSI was lower (38%) at mid-season compared with before pre-season (2546.7 ± 551.6 vs 2769.1 ± 307.2 mm^3; 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 mm^3; 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.

1733 Board #5 June 1 1:00 PM - 3:00 PM

Total and Regional BMD Comparison of Collegiate Male and Female Athletes

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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 to 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 18-25 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/cm^2, 0.948 g/cm^2, and 1.529 g/cm^2) was significantly higher than women's endurance running (1.187 g/cm^2, 0.828 g/cm^2, and 1.351 g/cm^2) in total BMD, arms, and legs. Also, men's endurance running (1.529 g/cm^2) had significantly higher BMD in the legs than women's soccer (1.427 g/cm^2) and women's swimming (1.293 g/cm^2). Women's swimming (0.912 g/cm^2) was found to have higher arm BMD than women's endurance running (.828 g/cm^2). Women's soccer (1.427 g/cm^2 and 1.356 g/cm^2) had a higher BMD in the legs and pelvis than the women's swimming (1.293 g/cm^2 and 1.228 g/cm^2) and higher pelvis than the women's endurance runners (1.221 g/cm^2). 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 that 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.

1734 Board #6 June 1 1:00 PM - 3:00 PM

Changes in Tibial Bone Density and Microarchitecture in Response to British Army Infantry Training

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British Army infantry training is characterised by prolonged periods of weight-bearing exercise and dynamic high impact activities. Due to the high mechanical loading, early structural adaptations along the tibial diaphysis have been reported following military training. Less is known about microstructural adaptations to mechanical loading in young adult men. **PURPOSE:** To examine training-induced adaptations in bone density and trabecular (Tb) microarchitecture at the distal tibia using *in vivo* high-resolution peripheral quantitative computed tomography (HR-pQCT) in response to British Army infantry training. **METHODS:** Tibial bone density and Tb microarchitecture were measured using HR-pQCT (Xtreme CT, Scanco Medical, Switzerland) in 30 healthy male British Army infantry recruits (21 ± 2 years, 1.76 ± 0.05 m, 76.2 ± 9.2 kg). HR-pQCT scans were performed at the distal tibia of the dominant leg in week 1 (baseline) and in week 13 (follow-up) of initial military infantry training. **RESULTS:** Significant increases in cortical area (141 ± 27 *vs* 146 ± 29 mm^2, P = 0.013), cortical thickness (1.22 ± 0.26 *vs* 1.28 ± 0.29 mm, P < 0.001), total bone density (339 ± 40 *vs* 347 ± 45 mg HA/cm^3, P = 0.014), total Tb bone density (228 ± 23 vs 232 ± 23, mg HA/cm^3, P = 0.004), Tb density in the subendocortical [outer] region (293 ± 27 *vs* 297 ± 28 mg HA/cm^3, P = 0.009) and Tb density in the central region (184 ± 23 *vs* 187 ± 22, P = 0.005) were observed between weeks one and week 13. Conversely, compared to week one, there were reductions in Tb area at week 13 (727 ± 128 *vs* 721 ± 131 mm^2, respectively, P = 0.017). **CONCLUSION:** Changes in bone density and Tb microarchitecture likely contribute to improved bone strength of the human tibia in response to periods of increased mechanical loading. High compressive stresses of military training likely contribute to these early tibial adaptations. This work was funded by UK MOD (Army).

1735 Board #7 June 1 1:00 PM - 3:00 PM

Pre And Postpartum Body Composition: A Case Study In Pregnancy, Lactation, And Physical Activity

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(No relationships reported)

Women who experience typical healthy pregnancies undergo significant changes in body composition, especially fat mass and bone mineral density. These changes have short and long term implications for health and wellbeing but are challenging to study, especially in combination with other factors that influence body composition. **PURPOSE**: The purpose of this case study is to examine the body composition changes of a woman in her early 30s from pre-pregnancy to one year postpartum. **METHODS**: Dual-energy x-ray absorptiometry scans were performed four times, six months prior to conception and 10 days, 120 days, and 375 days after delivery. At each scan the participant was asked about lactation status, physical activity, and supplementation. Percent change was calculated for each variable of interest to describe changes over the examination period. **RESULTS**: Compared to pre-pregnancy, considerable increases in fat mass (40.97%) and body fat percentage (29.4%BF increased to 36.0%BF) was seen 10 days postpartum. Four months later both were still elevated but were found to be lower 12 months after delivery than pre-pregnancy. Bone mineral density and bone mineral content decreased slightly (0.49% and 1.62%, respectively) from pre to 10 days postpartum and decreased considerably more at 120 days (4.68% and 6.10%) and 375 days (9.20% and 9.87%). Site-specific estimates indicate that larger decreases were seen in the trunk (12.1%), spine (13.5%), and pelvis (12.4%). Fortunately, the participant had a young-adult t-score of 2.0 prior to pregnancy and remained above average even after 12 months of lactation. At each appointment, the participant reported being physically active throughout the day but did not exercise consistently over any of the study period. **CONCLUSIONS**: For this individual 12 months of lactation and a generally active lifestyle, but not formal exercise, was sufficient to return body fat and lean mass to pre-pregnancy levels. Total bone mineral density and bone mass remain considerably lower than pre-pregnancy and should be tracked and intervention taken if weaning does not improve levels.

D-09 Thematic Poster - **Heat Exposure/Cooling Methods**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 403

1736 **Chair:** Craig Crandall, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.*
(No relationships reported)

1737 Board #1 June 1 1:00 PM - 3:00 PM

The Effect Of Drink Temperature On Sweating Response And Performance During Exercise In The Heat

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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 (34.5 ± 0.6 °C & 22 ± 1% RH) for 60-minutes at 55% of pre-determined maximal power output (P_{max}) and then completed a test to exhaustion at 80% P_{max}. Thermal (rectal temperature T_{rec}, 8-site skin temperature T_{msk}) and local sweat rate responses (absorbent sweat pad & galvanic skin conductance GSC) were recorded. TTE duration indicated the performance effect. Comparisons were made using ANOVA. Data are displayed as mean [SD] **RESULTS:** Participant's TTE performance was significantly worse in the CONTROL (170 [132] s) condition (p<0.05) than the COLD (371 [272] s) and HOT drink (367 [301] s) conditions which did not differ. Throughout the fixed intensity exercise period, local sweat responses at the bicep and upper back were not different (p>0.05) between any of the test conditions (e.g. grand mean [SD] Bicep GSC CONTROL 15.2 [8.0] µS, HOT 17.3 [8.0] µS & COLD 14.0 [6.0] µS). Temperature responses were higher (p<0.05) in the CONTROL than both drink conditions at the core (T_{rec}, CONTROL 38.3 [0.5] °C, COLD 38.0 [0.5] °C, HOT 38.1 [0.5] °C) but not the skin (CONTROL 34.5 [0.2] °C, COLD 34.5 [0.3] °C, HOT 34.6 [0.3] °C) **CONCLUSION:** Drink temperature did not influence performance, temperature responses or regional sweat responses during high-intensity exercise in hot, dry conditions. Consumption of fluid, irrespective of its temperature, provided a benefit to exercise performance in the heat in contrast to not drinking.
Supported by European Hydration Institute Grant.

1738 Board #2 June 1 1:00 PM - 3:00 PM

Voluntary Intake of Ice Slurry Beverages and Exercise Performance During Heat Stress

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(No relationships reported)

Previous investigators reported that voluntary intake of cold fluid is greater than warm fluid due to more favorable palatability, resulting in better maintenance of hydration status and improved exercise performance. It remains unclear whether ingestion of ice slurry beverages compared to cold fluid during exercise yields superior results. **PURPOSE:** The purpose of this study was to compare voluntary intake of ice slurry beverages to cold fluid and examine its effect on exercise performance in a hot environment. **METHODS:** Eight participants (mean ± SD; age = 24 ± 4 y, height = 175.2 ± 7.8 cm, mass = 79.6 ± 11.2 kg, body fat = 13.0 ± 5.2%) completed a pretest in 22 °C to determine a maximal workload (W_{max}). Then in 2 separate counterbalanced trials they cycled at 50%W_{max} in 35 °C for 60 min followed by a 15-min time trial to complete as much work as possible. Subjects ingested cold fluid (11.1 ± 2.4 °C) or ice slurry (-1.3 ± 0.3 °C) beverages ad libitum during each 60-min trial. **RESULTS:** Subjects ingested significantly more cold fluid than ice slurry (cold fluid: 1,074.7 ± 442.1 g, ice slurry: 526.9 ± 214.1 g; P = 0.001) but still avoided 2% body mass loss in both conditions. However, 15-min time trial performance was not different between conditions (cold fluid: 119.5 ± 34.8 kJ, ice slurry: 114.6 ± 20.9 kJ; P = 0.59). **CONCLUSION:** Participants had similar cycling performances despite ingesting half as much ice slurry as cold fluid, suggesting ice slurry beverages might be an efficient means of exercise hydration.

1739 Board #3 June 1 1:00 PM - 3:00 PM

Effect Of L (-) Menthol On Exercise At A Fixed-RPE In The Heat

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Cooling strategies can be beneficial for athletes during exercise in the heat by lowering thermal discomfort through reductions in core and/or skin temperatures. 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; $\dot{V}O_{2max}$ 57.5 ± 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 (T_{amb} 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, $\dot{V}O_2$ 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, $\dot{V}O_2$ 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.

1740 Board #4 June 1 1:00 PM - 3:00 PM

Investigating the Potential Mechanisms Responsible for Aerobic Performance Improvements with Neck Cooling in the Heat

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(No relationships reported)

PURPOSE: To assess the mechanisms responsible for previously reported improvements in aerobic performance in the heat with neck cooling. **METHODS**: Eight subjects (4 M, 4 F) cycled in 34°C, 30%RH at a self-selected power output (PO) with a fixed rating of perceived exertion of 16 ("hard" to "very hard") for 90 min or until PO reduced to <70% of their initial value. Participants freely altered PO but were blinded to all performance feedback. Each participant completed four experimental trials: no cooling (CON), neck cooling (NEC), abdominal cooling (ABD), or neck cooling with menthol (MEN). Esophageal (T_{es}), rectal (T_{re}), and skin temperature (T_{sk}) were measured throughout. Whole body thermal sensation (TS_{wb}) and thermal sensation of the neck (TS_{neck}) were measured on a visual analogue scale ranging from 0mm [very cold] to 200mm [very hot].
RESULTS: Mean PO (CON: 170±43 W, NEC: 173±45 W, ABD: 167±38 W, MEN: 168±41 W), exercise duration (CON: 65±22 min, NEC: 65±17 min, ABD: 66±22 min, MEN: 66±18 min) and total work (CON: 620±264 kJ, NEC: 668±280 kJ, ABD: 609±252 kJ, MEN: 643±242 kJ) were similar between trials (P>0.05). Changes in T_{re} were similar (CON: 1.36±0.34°C, NEC: 1.37±0.32°C, ABD: 1.28±0.36°C, MEN: 1.41±0.42°C; P=0.55), but changes in T_{es} were smaller with ABD (0.98±0.40°C) compared to NEC (1.24±0.25°C; P=0.01) and MEN (1.22±0.19°C; P=0.05) but not CON (1.12±0.22°C; P=0.31). Changes in T_{sk} were smaller with ABD (0.41±0.35°C)

compared to CON (0.82±0.41°C; P=0.04), NEC (0.71±0.29°C; P=0.09) and MEN (0.71±0.23°C; P=0.09). Mean TS_{wb} was cooler with MEN (122±38 mm) compared to CON (154±8mm; P=0.04), ABD (147±23mm P<0.01) and NEC (137±32; P=0.05). TS_{neck} was cooler (P<0.05) in MEN (41±48 mm) and NEC (66±28 mm) compared to CON (142±20 mm) and ABD (145±24 mm).
CONCLUSIONS: The lowest thermal strain occurred with ABD, but the coolest whole-body and neck thermal sensation occurred with MEN; however none of these differences yielded performance benefits in the heat.

1741 Board #5 June 1 1:00 PM - 3:00 PM

Cold Saline Infusion and Reduced Severity of Exertional Heat Illness

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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**: The 290 cases examined represent ~29% of all EHI at Ft Benning and ~6% of all EHI Army-wide during the study period. There were 284 men and 6 women, age 25±5 years.

	CON: 2009-10		CWI: 2011-12		
Variable	Median	IQC	Median	IQC	p-value
LOS, days	3	2	2	1	<0.01
ALT, U/L	84	170	51	56	<0.01
AST, U/L	105	203	87	116	0.13
CK, U/L	2335	5598	1530	4088	0.12
Cr, mg/dL	1.80	0.7	1.4	0.6	<0.01

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 **Chair:** Rebecca D. Larson. *Univeristy of Oklahoma, Norman, OK.*
(No relationships reported)

1743 Board #1 June 1 1:00 PM - 3:00 PM

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

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(No relationships reported)

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 (HIIE) promotes the release of specific ci-miRNAs as regulators of skeletal myogenesis; however, no study has examined the effects of acute HIIE 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 HIIE in healthy young males. **METHODS:** Eight males were recruited to participate in HIIE 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 HIIE 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 HIIE 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 HIIE protocol, to gain a better understanding of the potential role of these inflammation-associated ci-miRNAs in response to exercise.

1744 Board #2 June 1 1:00 PM - 3:00 PM

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 (HIIE) 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. HIIE.
METHODS: Nine healthy males (25±3 yrs) were recruited to participate in HIIE and CME on a cycle ergometer. HIIE consisted of 10 repeated 60 seconds of cycling at 90% max watts (W_{max}) separated by 2 minutes of cycling without resistance, while CME was 28 minutes of cycling at 60% W_{max}. 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 HIIE may potentially attenuate the expression of inflammatory mediators (calprotectin and MPO) compared to CME.

1745 Board #3 June 1 1:00 PM - 3:00 PM

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, which can indicate positive adaptations in brain health, whereas elevations in serum 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. Furthermore, to examine a possible explanation for the changes in plasma BDNF, irisin, a protein involved in the mechanism linking muscle contraction and hippocampal BDNF release, was measured in plasma. 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 BNDF 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 association between the total change in irisin and total change in plasma BDNF approached significance ($r = 0.501$, $p = 0.097$). CONCLUSIONS: These findings demonstrated that this low-volume, supramaximal HIIE protocol was sufficient for elevating serum BDNF, but not adequate for increasing circulating plasma BDNF in sedentary males. These results may suggest that the intensity of physical activity can differentially affect plasma and serum levels of BDNF. Additional research on HIIE volume and the mechanisms underlying BDNF responses (e.g. irisin) is warranted.

1746 Board #4 June 1 1:00 PM - 3:00 PM

The Response of Leukemia Inhibitory Factor to High-Intensity and High-Volume Resistance Training in Trained Men

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(No relationships reported)

PURPOSE: Leukemia inhibitory factor (LIF) and Follistatin like-1 (FSTL1) are myokines involved in the inflammatory response, and have been suggested to be involved in muscle adaptation. The purpose of this study was to characterize the LIF and FSTL1 response to a high intensity (HI) and high volume (HV) bout of resistance exercise (RE) before (PRE) 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, 75.7±13.75) 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 3-5RM, 3-min rest) training protocol for 7 weeks (4 $d \cdot week^{-1}$). Blood draws 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. Area under the curve (AUC) for each myokine was calculated via the trapezoidal method. Data were analyzed using a repeated measures ANOVA. When appropriate, post-hoc analysis using unpaired t-tests were conducted with Bonferroni corrections. In addition, bivariate relationships were examined using Pearson product-moment correlations.
RESULTS: A significant (p=0.021) training x time interaction was observed for LIF. No main effect of time (p=0.262) was observed at PRE, but was at POST (p=0.025). LIF concentrations at 60P (13.29 $pg \cdot mL^{-1}$) trended (p=0.083) towards an attenuation from BL concentrations (32.67 $pg \cdot mL^{-1}$). A significant main effect of time was also observed for FSTL1. FSTL1 concentrations at 60P (6693 $pg \cdot mL^{-1}$) were significantly (p=0.013) lower compared to IP (7542 $pg \cdot mL^{-1}$) when collapsed across PRE and POST. Significant correlations were noted between ΔBLLIF and ΔBLFSTL1(r=0.834, p=0.01), and between ΔAUCLIF and ΔAUCFSTL1 (r=0.809, p=0.01).
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.

1747 Board #5 June 1 1:00 PM - 3:00 PM

High Intensity Interval Training Improves Disease Activity and Immune Function in Patients with Rheumaotid Arthritis

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(No relationships reported)

PURPOSE: Rheumatoid arthritis (RA) is a chronic inflammatory disease characterized by a dysfunctional immune system which contributes to disease pathology. Exercise training has many anti-inflammatory and immune enhancing properties. Although exercise training is encouraged in those with RA, adherence is problematic. Adherence to higher intensity interval training is better in deconditioned adults and may offer a means to improve health of those with RA. The aim of this study was to determine if fitness, disease activity and immune dysfunction were modified by ten-weeks of a high intensity interval walking program in older adults with RA.
METHODS: Twelve older (64±7 years) sedentary participants with confirmed RA completed 10-weeks of an ambulatory high intensity interval training program with ten ≥60 second intervals of high intensity (80-90% heart rate reserve (HRR)) separated with bouts of lower intensity intervals (50-60% HRR). Aerobic capacity, DAS-28 ESR, neutrophil and monocyte functions were assessed before and after the intervention.
RESULTS: Relative peak VO_2 (↑8%; $p<.001$) and absolute peak VO_2 (↑8%; $p<.001$) improved, with no change in BMI (p=.170) or body fat % (p=.294). Resting mean arterial blood pressure and heart rate were both reduced (both $p<.05$). Medication use was stable and as compared to baseline, disease activity (DAS-28 ESR) was reduced by 38% (p=.001) which was primarily through reduced systemic inflammation (ESR; p=.03). This was accompanied by improved neutrophil migration (p=.01) and bacterial phagocytosis (p=.002), while CD14+ monocyte expression of CD16 and TLR-4 expression was reduced (both $p<.05$) but not monocyte phagocytosis of *E.Coli* (p=.187).
CONCLUSIONS: Ten-weeks of interval training in older individuals with RA rapidly improved aerobic fitness with no change in body composition. Systemic inflammation was changed concordantly with reduced disease activity (from moderate- to low-activity). Immune enhancements imply a reduced risk of infection and systemic inflammation. In sum, high intensity interval training in patients with RA was tolerable, improved cardiorespiratory fitness and favorably modified disease activity in RA, consistent with improved quality of life and infection risk. Funding: EU Marie Curie Outgoing Fellowship Grant (PIOF-GA-2013-629981).

1748 Board #6 June 1 1:00 PM - 3:00 PM

Effect of Interval vs Continuous Exercise Training on Acylated Ghrelin and Appetite in Prediabetic Adults

Emily M. Heiston, Natalie ZM Eichner, Nicole M. Gilbertson, Zhenqi Liu, Eugene J. Barrett, Arthur Weltman, FACSM, Steven K. Malin. *University of Virginia, Charlottesville, VA.* (Sponsor: Arthur Weltman, FACSM)

(No relationships reported)

Obese individuals are characterized by blunted acylated ghrelin (AG) and increased appetite in response to fasting and feeding. Although exercise may improve weight regulation, few exercise intensity data exist in obese adults with prediabetes in relation to appetite.
Purpose: To determine the effects of short-term interval (INT) vs. continuous (CONT) training on appetite regulation in this clinical population. **Methods**: Thirteen obese adults (Age: 57.8±2.2y, BMI: 34.5±2.2kg/m^2) were screened for prediabetes based upon American Diabetes Association criteria (75g OGTT and HbA_{1c}). Subjects were randomized to work-matched INT (n=7, 90% HRmax for 3 min and 50% HRmax for 3 min) or CONT (n=6, 70% HR_{max}) training for 12 supervised sessions over 2 weeks for 60 min/d. Plasma AG was measured at 0, 30 and 60 min of a 75g OGTT before and after training. Visual Analog Scales (VAS) were also administered at 0 and 120 min of the OGTT to examine appetite. Two-day food logs were collected pre- and post-testing to assess ad-libitum diet. Data were analyzed using repeated measures ANOVA and Spearman correlations. **Results**: Fasting AG was not significantly different following INT (64.8±19.7 vs. 75.1±23.5 pg/ml, P=0.31, n=6) or CONT training (71.1±21.6 vs. 70.4±25.8 pg/ml, P=0.94, n=5). Likewise, tAUC was not altered following either exercise intensity intervention (P=0.89). INT and CONT exercise also had no statistical effect on total caloric or macronutrient intake. However, fasting fullness tended to increase following INT exercise only (4.1±5.2 vs. 24.1±27.9 mm, P=0.11).

Conclusion: Despite seemingly divergent responses between AG and fullness, these preliminary data suggest that exercise intensity favorably influences appetite in adults with prediabetes. Further work is required to determine how exercise intensity impacts appetite to optimize weight loss for cardiometabolic health.

D-11 Thematic Poster - **Wearables: Applications in Research and Practice**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 304

1749 **Chair:** Patty Freedson, FACSM. *University of Mass Department of Kinesiology, Amherst, MA.*
(No relationships reported)

1750 Board #1 June 1 1:00 PM - 3:00 PM

A Consumer Activity Tracker is Sensitive to Changes In Steps during Simulated Free-Living

Greg J. Petrucci, Jr, Brittany R. Masterller, Melanna F. Cox, John W. Staudenmayer, John R. Sirard, Patty S. Freedson, FACSM. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Patty S. Freedson, FACSM)
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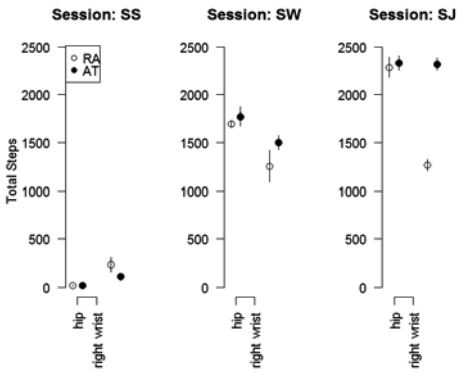
Reported Relationships: G.J. Petrucci: *Contracted Research - Including Principle Investigator; This research was funded by: UMass Institute for Life Sciences Seed Grant and Misfit/Fossil Contract.*

Noted as the top fitness trend for 2016 and 2017, activity trackers are expected to continue to increase in popularity. Forecasts predict that by the end of 2021 over 560 million units will ship, compared with 82 million units that were shipped in 2015. Moreover, there have been inclinations toward adopting consumer activity trackers in intervention research, despite limited validation efforts.
PURPOSE: To determine the sensitivity of a consumer activity tracker (AT) to detect changes in step counts using a research grade accelerometer (RA) to assess concurrent validity.
METHODS: Twenty participants wore the AT and RA, on the right and left wrist, and hip, during three one-hour lab sessions: sedentary session (SS), sedentary plus walking (SW), and sedentary plus jogging (SJ) session. For the SW and SJ sessions, participants performed 30-minutes of sitting and 30 consecutive minutes of walking or jogging at 5.15 and 8.0 kph, respectively. Presentation of sessions was balanced among subjects to eliminate the order effect.
RESULTS: Displayed in figure are total step means and 95% CI's for the 3 sessions and monitor locations. Across all sessions, no significant differences were observed between hip AT and RA estimates of total steps. There were significant changes in total steps across conditions, indicating the AT step measure can detect change as activity dose increased. However, during activity conditions, wrist-worn AT devices yielded significantly greater estimates of steps than the RA.
CONCLUSIONS: While these results are promising, the sensitivity of the AT in detecting changes in usual physical activity volume should be examined under free-living conditions.



1751 Board #2 June 1 1:00 PM - 3:00 PM

Move More, Sit Less? Analysis of an Employer Activity Tracker Workplace Wellness Program

Peter B. Kiessling II, Carol Kennedy-Armbruster, FACSM, Mariah Deinhart, Mary Kerby, Rachel Ryder, Katherine Zukerman, Samantha Schaefer. *Indiana University, Bloomington, IN.* (Sponsor: Carol Kennedy-Armbruster, FACSM)
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(No relationships reported)

Little research exists on behavioral outcomes utilizing wrist-worn activity trackers (AT's). Recent information from Endeavour Partners wearable research shows that sales of AT's 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-results of 7.55/10 and significantly ($p<.001$) increased in post-results to 8.24/10. 82% of participants self-reporting sitting ¾ 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 ¾ 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.

1752 Board #3 June 1 1:00 PM - 3:00 PM

Adding An Activity Tracker To An Ongoing Community-based Weight-loss Program: Preliminary Results Of An RCT

Kathryn E. Wilson[1], Samantha M. Harden[2], Anna E. Taggart[2], Lia Schoepke[3], Todd McGuire[3], Paul A. Estabrooks[1]. [1]*University of Nebraska Medical Center, Omaha, NE.* [2]*Virginia Tech, Blacksburg, VA.* [3]*incentaHEALTH, Denver, CO.*
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(No relationships reported)

Web- and community-based programs effectively promote weight loss, and individuals who use program features more often are more likely to lose a clinically meaningful amount of weight. Many such programs allow participants to synchronize commercially available physical activity (PA) trackers, but the degree to which the provision of such a device would improve participant engagement and weight loss is unclear. **Purpose:** To determine the reach and effectiveness of offering a PA tracker to program participants with the goal of improving program engagement and weight-loss outcomes. **Methods:** A sample of 525 obese (37±6.2 kg/m^2) females (44+12.6 yrs) newly enrolled in a web- and community-based weight-loss program were randomized into either an experimental or control group. The experimental group was offered a free PA tracker and asked to provide size and color preferences. Devices were sent to experimental participants who accepted the offer. Program engagement, device use, and weight (lbs) were tracked for three months after program enrollment. **Results:** Of the 266 participants in the experimental sample, 134 (50%) accepted the offer, and 62 (23%) synced the device to their program account. Twenty-two (9%) of the control participants independently obtained and synced a PA tracker. At 3-month follow-up, the experimental group demonstrated greater program engagement than the control group, but only with regard to their likelihood of completing online journal entries (OR(95%CI)= 2.08(1.29,3.37)). There were no significant differences in weight-loss outcomes. Secondary analyses revealed that those who accepted the offer weighed more at baseline (231 vs. 214 lbs; t(df)= 3.40(264); p=.001), and lost more weight (4.71 vs. 1.90 lbs; t(df)= -2.73(264); p=.007) than those who did not accept the offer, and they were more likely to lose 3% body-weight (OR(95%CI)= 2.30(1.21,4.37)) and less likely to drop-out (OR(95%CI)= 2.60 (1.58, 4.28)). **Conclusions:** Offering a free PA tracker for use in a web- and community-based weight-loss program, reaches a greater proportion of the sample than would independently use this feature. Whether this translates into improved weight-loss outcomes remains unclear. Data collected at 6 and 12 months will be used to determine longer-term effectiveness.

1753 Board #4 June 1 1:00 PM - 3:00 PM

Does Wearable Movement Detection Device Promote Better Exercise Compliance?

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(No relationships reported)

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 device for encouraging active lifestyle. Limited studies have examined its' effectiveness.
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: 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-min 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 devices(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.

1754 Board #5 June 1 1:00 PM - 3:00 PM

Fit Physician - An Interdisciplinary Approach To Promoting Physical Activity In Medical Students Utilizing Activity Trackers

Alexander Stangle, Jerry Balentine, Min-Kyung Jung, William G. Werner, Hallie Zwibel, Joanne DiFrancisco-Donoghue. *New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY.*
Email: astangle@nyit.edu

(No relationships reported)

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 Canadian and US medical schools offer any kind of health promotion and education to medical students.
PURPOSE: To develop a physical activity and health promotion program among first year osteopathic medical students.
METHODS: 80 first year medical students were randomized into 2 groups. Both groups were given activity trackers. Group 1 (n=40) participated in educational seminars on nutrition and healthy lifestyle habits. In addition, Group 1 attended weekly mentored walks or runs along with fitness challenges were given weekly updates on their activity level. Group 2 (n=40) was given activity trackers with no other intervention. Data was collected on a dashboard that records each subject's daily activity and sleep duration. Academic test scores were obtained from subjects first comprehensive examination within the first 8 weeks of this program. A two way t-test was used to analyze daily steps taken, sleep duration, and academic performance for 10 weeks between groups. Statistical significance was set at $p<0.05$.
RESULTS: After 8 weeks of our FIT-PHYSICIAN program demonstrated that the intervention group (Group 1) had significantly more steps taken compared to Group 2 ($p=0.001$). There were no statistically significant differences in sleep duration ($p=0.16$) or in average composite test scores ($p=0.30$).
CONCLUSIONS: Utilizing activity trackers in conjunction with health education and weekly activity interventions in the first 8 weeks of medical school yielded an increased step count compared to wearing an activity tracker alone. Physical activity and educational intervention did have an effect on composite test scores and sleep duration between groups.

1755 Board #6 June 1 1:00 PM - 3:00 PM

Comparison of Smartphone Pedometer Apps on a Treadmill versus Outdoors

Ivan A. Figueroa[1], Jesus Gonzalez[1], Perla Leyva[1], Jose L. Gamez[1], Naomi Lucio[1], Vanessa E. Salazar[1], Cindy Salazar[2], Miriam Garcia[2], Merrill D. Funk[1]. [1]*University of Texas Rio Grande Valley, Brownsville, TX.* [2]*University of Texas School of Public Health Health Science Center at Houston Brownsville Regional Campus, Brownsville, TX.*

(No relationships reported)

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 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/m^2) 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). 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.
RESULTS:G-Fit recorded 2 zero values and 2 negative values and Moves recorded 1 zero value. Mean bias scores were significantly correlated between the indoor and outdoor protocols for the pedometer ($r=0.67$, $p<0.01$) and S-Health ($r=0.46$, $p<0.5$). The remaining apps were not correlated between protocols. The outdoor protocol producing a greater mean bias for the outdoor protocol for G-Fit, Runtastic, and Accupedo (mean bias ± SD indoor, outdoor; -4.3±53.1, -19.3±120.0; -10.7±63.3, -33.4±118.7; 16.0±143.6, 79.0±75.0; respectively) and a greater mean bias for the indoor protocol for the pedometer, Moves, and S-Health (mean bias indoor, outdoor; -1.4±41.5, 0.0±34.1; -117.4±196.7, -42.2±209.6; 11.3±28.4, 0.0±58.7; respectively). MAPE was below 5% for the pedometer and S-Health 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.

1756 Board #7 June 1 1:00 PM - 3:00 PM

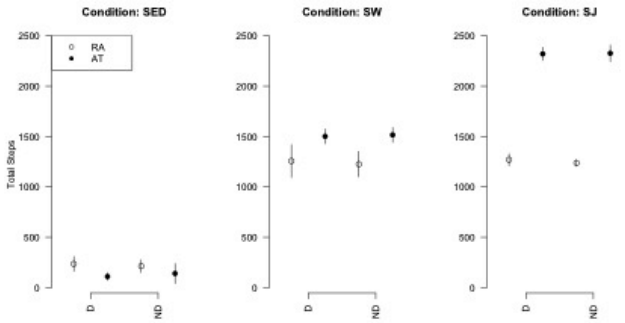
Comparison Of Step Estimates Between A Consumer Activity Tracker And Research Accelerometer On The Dominant And Non-dominant Wrist

Brittany Masteller, 01002, Melanna Cox, Greg Petrucci, John Staudenmayer, John Sirard, Patty Freedson, FACSM. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Patty Freedson, FACSM)

(No relationships reported)

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, a common metric produced by many AT.
Purpose: To compare estimates of total steps (TS) obtained from a consumer AT and a research accelerometer (RA) worn simultaneously on the dominant (D) and non-dominant (ND) wrist during three simulated free-living conditions.
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.



1757 Board #8 June 1 1:00 PM - 3:00 PM

Physical Activity Trackers in Combination with Motivational Interviewing to Increase Activity

Maria Perez, Laura Ellingson, Yang Bai, Karissa Peyer, Gregory Welk. *Iowa State University, Ames, IA.*

(No relationships reported)

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 with 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: Complete data were collected on 84 individuals. Physical activity measured in average steps per day did not increase significantly for either group (PAT+MI – pre: 7496 ± 2895 steps/day, post: 7624 ± 3557 steps/day; PAT – pre: 7519 ± 2259 steps/day, post: 7097 ± 2179 steps/day; $p>0.05$); further, no group differences were observed ($p>0.05$). When comparing those who improved over the intervention to those who did not, there were no differences in demographic characteristics including age, gender, income, or education level. However, those who improved over the intervention accumulated significantly fewer steps at baseline (6650 ± 2056 vs. 8522 ± 2871, $p < 0.0001$). CONCLUSION: The provision of a physical activity tracker (with or without brief MI sessions) was not sufficient to increase physical activity in this sample; however, individuals with low baseline activity achieved more significant benefits.

D-12 Free Communication/Slide - **Biomechanics after ACL Reconstruction**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 104

1758 **Chair:** Susan M. Sigward. *University of Southern California, Los Angeles, CA.*

(No relationships reported)

1759 June 1 1:00 PM - 1:15 PM

Limb Asymmetry During Anterior Cruciate Ligament Reconstruction Recovery

Robin M. Queen, FACSM[1], Thomas K. Miller[2]. [1]*Virginia Tech, Blacksburg, VA.* [2]*Virginia Tech Carilion School of Medicine, Roanoke, VA.*
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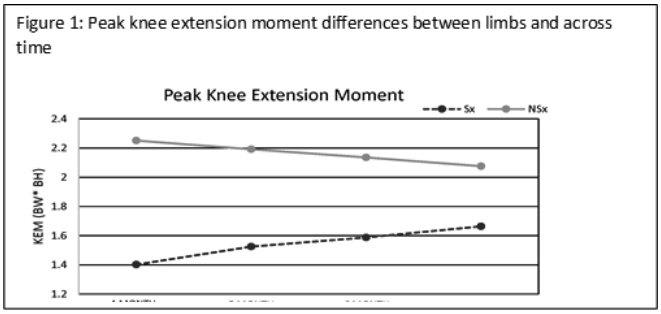
(No relationships reported)

Limb asymmetries in loading and movement patterns persist up to 2 years after anterior cruciate ligament reconstruction (ACLR) and are related to re-injury risk. **PURPOSE**: To determine changes in limb asymmetry across the first year following ACLR. **METHODS**: 23 adolescent ACLR athletes participated in the study (14 female, 9 male). Movement and loading mechanics were collected using an 8 camera motion capture system (120Hz) and 2 embedded force plates (2400Hz) during five vertical stop-jump trials. All analyses were completed using the MIXED models ANOVA procedure in SAS (version 9.3, Cary, NC), with a type I error rate of $\alpha=0.05$. **RESULTS**: An interaction between time and surgical limb was observed for the peak knee extension moment (KEM) ($p=0.041$) with the surgical (Sx) and non-surgical (NSx) limbs converging across time (Figure 1). When examining side-to-side symmetry, there were no differences in frontal plane knee range of motion (ROM), sagittal plane hip ROM, and sagittal plane knee angle at contact independent of time. For the peak vertical ground reaction force (GRF) ($p<0.001$), impulse ($p<0.001$), limb stiffness ($p<0.001$), peak posterior GRF ($p<0.001$), and peak knee flexion angle ($p=0.049$) 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 after being released to return to sports. Additional therapeutic interventions need to be implemented to restore symmetry and improve landing mechanics prior to athletes being return to sports.
Figure 1: Peak knee extension moment differences between limbs and across time



1760 June 1 1:15 PM - 1:30 PM

Biomechanical Asymmetries in Drop Jump Improve During Rehabilitation Following ACL Reconstruction in Adolescents

Mia Katzel, J. Lee Pace, Nicole Mueske, Tracy Zaslow, Bianca Edison, Curtis VandenBerg, Tishya Wren. *Children's Hospital Los Angeles, Los Angeles, CA.*
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(No relationships reported)

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=0.02), lower vertical ground reaction force (vGRF) (1.5 vs. 2.1 body weights, p=0.0005), 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° change, p=0.007; knee 9.5°, 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 athletes with ACLR reduce 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 aide 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.

1761 June 1 1:30 PM - 1:45 PM

Hip-Dominant Landing Strategy During the Second Landing of a Drop Vertical Jump After ACL Reconstruction

Paul W. Kline, Madison J. Marquez, Darren Johnson, FACSM, Mary L. Ireland, FACSM, Brian Noehren, FACSM. *University of Kentucky, Lexington, KY.*

(No relationships reported)

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 imposes greater demand in the sagittal plane. Deficits in sagittal plane angle and moments at the knee and hip are commonly seen in gait after an ACLR and are linked to poor return-to-sport outcomes. However, how this propagates to tasks such as the 2nd landing of a DVJ has not been well characterized. Furthermore, whether sagittal plane mechanics of the ACLR limb are restored to be similar to a matched control group during the 2nd landing of a DVJ is unknown. **PURPOSE**: 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 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.

1762 June 1 1:45 PM - 2:00 PM

The Effect Of Fear Of Reinjury On Biomechanics During A Jump Landing Following ACL Reconstruction

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(No relationships reported)

Fear of reinjury has been identified as a barrier patients must overcome in order to return to sports after ACL reconstruction (ACLR), but may also affect movement patterns during functional tasks. **PURPOSE:** To compare kinematics and kinetics during jump landing between individuals who have undergone ACLR with high, moderate, and low fear of reinjury. **METHODS:** An electromagnetic tracking system interfaced with non-conductive force plates was used to capture joint motion and force during landing in 59 females (age: 18.8±1.4 yr; time from surgery 25.5±11.9 mo) with a history of unilateral ACLR that were cleared to return to sport. Participants performed 5 trials of a standardized jump landing. Fear was assessed using the Tampa Scale of Kinesiophobia -11 (TSK-11) with higher scores indicating greater fear. Groups were created based on tertile cut-points of TSK-11 scores (High (HIGH): TSK > 21, n=21; Moderate (MOD): TSK 17-20, n=20; Low (LOW): < 17, n=18). Primary variables were peak hip and knee kinematics and kinetics of the reconstructed limb. One-way ANOVAs were used for between group comparisons with post-hoc analysis of least significant differences (LSD) when necessary (a-priori α<.05).
RESULTS: Demographics did not differ between groups (p>0.05) (height, weight, age, or time from surgery). TSK-11 was significantly different between all groups (p<.001) indicating our grouping was successful. Peak hip flexion angles on the were lower in HIGH (80.4±16.4°) compared to MOD (93.5±11.6°;p=.006) and LOW (95.6±15.0°;p=.002). Peak knee flexion in HIGH (90.8±14.0°) was significantly lower than in MOD (102.2±14.3°;p=.013). Peak hip abduction angle LOW (7.4±6.1°) was greater than MOD (.5±6.0°;p=0.001) and HIGH (1.0±6.9°;p=.003). Hip extension moment was significantly higher in LOW (2.3±1.0 Nm/kg) compared to MOD (1.7±.6Nm/kg;p=.01) and HIGH (1.8±.6 Nm/kg;p=.03). Finally, LOW (.7±.3 Nm/kg) had a greater hip adduction moment compared to MOD (.5±.2 Nm/kg;p=.01).
CONCLUSIONS: High fear of reinjury was associated with "stiffening" hip and knee motion during a jump landing. Fear of reinjury is a barrier that must be overcome for successful return to sport, but might not be fully addressed during current rehabilitation protocols. This important factor may influence movement patterns for years following reconstruction.

1763 June 1 2:00 PM - 2:15 PM

Reduced Rate of Quadriceps Activation during Running and Jumping in Collegiate Athletes post-ACL Reconstruction

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(No relationships reported)

Running, jumping, and most sports activities involve sequences of rapid muscle activation and relaxation, or rapid increases and decreases in force production. Rapid quadriceps activation and force development (typically assessed with isolated, isometric methods) are reduced after anterior cruciate ligament reconstruction (ACLR). Rate of neuromuscular activation during sports activities after ACLR has not been examined.
Purpose: To investigate side-to-side asymmetries in rate of neuromuscular activation of the thigh and hip muscles during jumping and running in collegiate athletes post-ACLR.
Methods: Twelve Division I athletes (age 20.6 ± 1.8, BMI 25.5 ± 2.8, 7.0 ± 3.1 months post-surgery) performed maximal countermovement jumps (CMJ) and treadmill running at preferred speed (2.88 ± 0.27 m/s) while surface electromyography (EMG) of the bilateral rectus femoris (RF), vastus lateralis (VL), medial hamstrings (MH), biceps femoris (BF), and gluteus maximus (GMX) was recorded. Root mean square values of the EMG signal from 0-50 ms were computed from the initiation of the eccentric (ECC), concentric (CONC), and landing (LAND) phases of the CMJ (e.g., RF_{0-50}). During running, rate of EMG rise (e.g., RF_{RR}) was averaged over 18.8 ± 1.3 strides. Limb asymmetries were computed and compared for each muscle and condition using Wilcoxon Signed-Ranks tests.
Results: VL_{0-50} was significantly lower in the INV limb in all CMJ phases (ECC: INV 24.3 ± 17.8%, UN 36.1 ± 22.5%; CONC: INV 59.3 ± 26.2%, UN 76.2 ± 22.1%; LAND: INV 34.1 ± 12.2%, UN 58.9 ± 27.5%). RF_{0-50} was significantly lower in the INV limb at initiation of the CONC (INV 46.0 ± 25.0%, UN 70.1 ± 23.4%) and LAND (INV 45.1 ± 19.3%, UN 57.8 ± 27.6%) phases. INV limb BF_{0-50} was significantly reduced in the CONC phase (INV 46.6 ± 28.5%, UN 64.8 ± 31.3%). During running, VL_{RR} and RF_{RR} were significantly lower in the INV limb (79.9 ± 41.7% and 78.2 ± 27.2% of UN limb values). There were no between-limb differences in MH or GMX rate of activation in either task.
Conclusion: Collegiate athletes demonstrated reduced INV limb rate of quadriceps activation during jumping and running 7 months post-ACLR. These findings have important clinical implications as sports activities require rapid muscle activation. Rehabilitation efforts to improve fast activation of the quadriceps should be explored.

1764 June 1 2:15 PM - 2:30 PM

3D Hip And Knee Mechanics During Hop Tests After ACL Reconstruction Measured With Inertial Sensors

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(No relationships reported)

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 while hopping little is known of differences in kinematics that may persist. Advancements in inertial sensor technology allow for assessment of hip and knee mechanics outside the laboratory setting and could provide significant insights into how these functional tests are performed.

Purpose

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

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 post 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 hip 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).

Table 1: Knee and hip mechanics (±SD)during single leg and each landing from triple hop at IC; an asterisk denotes a statistical significant difference at p<0.05 .

		Single leg hop			Triple Hop								
		IC			IC 1			IC 2			IC 3		
		ACLR		Control	ACLR		Control	ACLR		Control	ACLR		Control
Knee	Flexion	10.1 (9.9)	*	20.2 (7.4)	16.7 (9.3)	*	34.1 (14.1)	13.7 (9.0)	*	32.7 (17.4)	11.0 (6.6)	*	22.9 (20.7*)
	Abduction	0.2 (3.5)	*	4.0 (3.3)	0.9 (4.0)		6.1 (6.1)	0.8 (3.4)		5.0 (5.1)	-0.3 (5.8)		3.5 (7.0)
Hip	Flexion	29.3 (9.1)	*	44.1 (9.5)	33.3 (4.8)	*	42.2 (8.5)	32.1 (5.5)	*	43.4 (5.8)	28.8 (8.1)	*	40.5 (12.9)
	Abduction	7.8 (6.0)		6.0 (7.7)	0.8 (5.8)		2.4 (5.5)	1.5 (2.9)		0.5 (4.5)	7.1 (7.7)		10.0 (6.2)

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 Fulbright Centre.

1765 June 1 2:30 PM - 2:45 PM

Relationship Between Quadriceps Function and Patient Reported Outcomes in ACL-R Patients With and Without Osteoarthritis

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(No relationships reported)

The relationship between quadriceps muscle function and patient-reported outcomes over time after ACL reconstruction (ACLR) may help clinicians better understand which factors may be affecting quality of life. **PURPOSE:** To identify the relationship between objective measures of quadriceps function and patient-reported outcomes *early* (< 1 year) and *late* (> 2 years) after ACLR, including patients who experienced post-traumatic knee *osteoarthritis*. **METHODS:** This was a cross sectional study of 72 ACLR patients, categorized as *early* (n = 34, age = 22.5 ± 6.3, height = 174.1 ± 11.0 cm, mass = 73.9 ± 16.9 kg, time from surgery = 9.0 ± 4.3 months), *late* (n = 30, age = 24.9 ± 5.9, height = 171.7 ± 11.8 cm, mass = 74.9 ± 16.2 kg, time from surgery = 70.5 ± 41.6 months), or diagnosed with knee *osteoarthritis* (n = 8, age = 45.4 ± 7.4, height = 170.0 ± 9.7 cm, mass = 85.2 ± 24.8 kg, time from surgery = 115.9 ± 110.0 months). Quadriceps isokinetic strength (peak torque, total work, average power), maximum voluntary isometric contraction (MVIC) torque, fatigue index, central activation ratio, spinal reflex excitability (Hoffmann [H] reflex), and corticospinal excitability (active motor threshold [AMT]) were measured bilaterally. The Knee Osteoarthritis Outcome Score (KOOS) and Veteran's Rand 12-Item Health Survey (VR-12) were used to quantify regional knee function and global health. Multiple linear (stepwise) regression analyses were used to predict patient reported outcomes using measures of quadriceps function and patient demographics (pain, activity level, time since surgery, and age) in each group. **RESULTS:** In patients *early* after ACLR, knee extensor work, AMT symmetry, pain, and activity level explained 67.8% of variance in KOOS ($p < .001$); whereas, knee extensor work, activity level, and pain explained 53.0% variance in VR-12 ($p < .001$). In patients *late* after ACLR, age and isokinetic torque symmetry explained 28.9% of variance in KOOS ($p = .004$), and did not explain variance in VR-12. In patients with *osteoarthritis*, kinesiophobia and isokinetic torque explained 77.8% of variance in KOOS score ($p = .010$); whereas, activity level explained 86.4% variance in VR-12 ($p = .001$). **CONCLUSION:** Factors that predict patient reported outcomes are different for patients early and late after ACLR, and in those with diagnosed knee osteoarthritis.

1766 June 1 2:45 PM - 3:00 PM

The Long Term Effect Of Quadriceps Strength On Patient Reported Outcomes After An ACL Reconstruction

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(No relationships reported)

Reductions in quadriceps strength following an anterior cruciate ligament (ACL) reconstruction have been hypothesized to reduce quality of life in as little as five years. While commonly speculated upon, the relationship between quadriceps strength and patient reported outcomes (PRO's) has not been formally tested. We hypothesized that greater quadriceps strength and better performance on the timed step down test (TSDT) would predict patient reported outcomes.

Purpose: To determine if quadriceps strength and the 60 second TSDT were able to predict patient reported outcomes at an average of an eight year follow up after ACL reconstruction.

Methods: 40 subjects (29 F, 34 ± 11 years old, H 1.71 ± 0.1 m, M 73 ± 12 kg, Tegner 5.7 ± 1.3) at least 5 years from an ACL reconstruction completed the study. Five maximum voluntary isometric contractions were measured using the Biodex dynamometer and normalized to body weight. The subjects also performed the TSDT, where they completed as many single leg step downs as possible in 60 seconds off of a box of standard height, touching their heel to a scale with less than 10% of their body weight. Patient reported outcomes were recorded on the International Knee Documentation Committee (IKDC) and Lysholm Knee Questionnaire. Multiple linear regressions were performed to assess the relationship between strength and PRO's.

Results: Mean values for knee extension strength was 2.5 ± 0.50 N/kg, IKDC 82.0 ± 16.1, Lysholm 87.8 ± 11.6, TSDT 31.7 ± 13.2 stepdowns. We found that quadriceps strength, 60 second TSDT, and the interaction between quadriceps strength and Tegner activity levels explained 55% of the variance in the IKDC ($F=9.816$, $p<0.0001$) and 45% of the variance in the Lysholm scale ($F=7.034$, $p=0.0003$).

Conclusion: Quadriceps strength, TSDT, and Tegner activity levels explained almost half of the variance in self-reported knee functioning long term after an ACL reconstruction. These results suggest that modifiable factors such as muscle strength and endurance could have a significant impact on improving long term outcomes for patients following an ACL reconstruction. Additional studies are needed to assess the effect of maximizing quadriceps strength on the improvements in patient's quality of life.

D-13 Free Communication/Slide - **Mechanisms of Muscle Atrophy and Hypertrophy**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 504

1767 **Chair:** Brian Ferguson. *University of Illinois - Chicago, Chicago, IL.*

(No relationships reported)

1768 June 1 1:00 PM - 1:15 PM

Development of a Risk Index for Predicting Older Adults' Sarcopenia

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(No relationships reported)

Muscle attenuation well exists in adults especially in old adults. Decay rate of muscles in old adults was a key symbol of aging. Delaying sarcopenia is an important focal

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±1.55 kg; male: 28.9%), including vital capacity, hand grip, back muscle strength measured by pull sensor, 30 seconds Chair Stand (30sCS), 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 Work Group of Sarcopenia, the prevalence rates of sarcopenia in males and females, which ranged from 0.15 to 6.84% .The logistic regression prediction model derived was:Sarcopenia rate =exp(21.950-2.816×ASMI-0.190×Grip+0.770×GS-0.156×30sCS)/[1+exp(21.950-2.816×ASMI-0.190×Grip+0.770×GS-0.156×30sCS)]*100%
The accuracy of the prediction was supported by ROC (the area under the ROC curve is 0.95), with the sensitivity of 87.90% and the specificity of 95.00%.
CONCLUSIONS:A simple and easy-to-use risk index for older adults' sarcopenia was derived by this study and the accuracy of the prediction was supported. In addition, like commonly used individual measure of sarcopenia such as ASMI, hand grip and GS, 30sCS was found a useful single measure for determining the sarcopenia.
Corresponding author: Chunmei Cao
Study was supported by Independent scientific research plan of Ministry of Education (20121088023)

1769 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 therapeutic effects. However, the impact of heat treatment on autophagy remains unknown.
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 2h. Heated cells were harvested immediately, 2h post-heating (recovery), or 24h recovery. Bafilomycin A_1 (Baf, 100 nM), an autophagy inhibitor, was added to a subset of cells 3h prior to harvest. During recovery all cells were returned to 37°C. Cell lysates were analyzed via Western blot and densitometry. Statistical analysis of the data was performed by one-way analysis of variance (ANOVA) or an unpaired t-test, with α=0.05. **RESULTS:** One hour of HT increased the phosphorylation of $AMPK^{T172}$ (64%, $p<0.05$) and the levels of LC3 II (29%, $p<0.01$) compared to TN cells. AMPK phosphorylation returned to baseline by 2h of recovery, while LC3 II remained elevated until 24h of recovery. When heat was extended to 2h, there was a similar increase in AMPK phosphorylation (56%, $p<0.05$), and a reduction in the phosphorylation of $mTOR^{S2448}$ (15%, $p<0.01$), without altering LC3 II. In the presence of Baf, 2h of HT increased p62 (62%, $p<0.001$) and LC3 II (75%, $p<0.01$) beyond HT alone. However, in 2h HT vs TN, the addition of Baf led to a reduction in LC3 II (24%, $p<0.05$) and a trend for increased phosphorylation of $ULK1^{S555}$ (15%, $p=0.08$). **CONCLUSION:** Heat treatment of C2C12 cells increases signaling associated with the initiation of autophagy (increased p-AMPK, decreased p-mTOR) and phagophore formation (increased LC3 II). Additionally, we provide insight into the protective effect of heat treatment against the inhibition of autophagy.

1770 June 1 1:30 PM - 1:45 PM

Impact of Downhill Running on Proteasome Content in Mouse Skeletal Muscle

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(No relationships reported)

PURPOSE: The proteasome consists of two main forms, the standard proteasome and its inducible counterpart, the immunoproteasome. In skeletal muscle, the standard proteasome is responsible for myofibrillar protein degradation while the immunoproteasome generates antigenic peptides for immune surveillance. The standard proteasome and immunoproteasome both increase in content and activity following catabolic conditions, such as aging and denervation. However, little is known about how the proteasome responds to stressful conditions that do not promote large perturbations in skeletal muscle proteolysis. Therefore, the purpose of this study was to assess proteasome content following a single session of acute muscular stress.
METHODS: Male C57BL/6 wild type (WT) and immunoproteasome knockout *lmp7-/-/mecl-1-/-* (L7M1) mice ran on a motorized treadmill at a 22 degree decline for 70 min. Soleus muscles were then excised one and three days post-exercise and compared to muscle that did not exercise (baseline). Whole muscle *ex vivo* physiology, histology and biochemical analyses were used to assess the effects of immunoproteasome knockout and downhill running. TNF-α and MCP-1 levels were evaluated with ELISAs while immunoblots were used to quantify standard proteasome (19S, β1, β5) and immunoproteasome (11S, LMP7, MECL-1) content, and global levels of protein carbonylation. **RESULTS:** 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 carbonylated 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. **CONCLUSIONS:** Together, these results suggest that downhill running does not significantly alter tetanic force 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, of which are influenced by LMP7 and MECL-1.

1771 June 1 1:45 PM - 2:00 PM

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

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(No relationships reported)

PURPOSE: The CCL2/CCR2 chemokine receptor axis is necessary for successful muscle regeneration following injury. Recently, another chemokine known as CXCL10 (or IP-10) was found to be elevated in human skeletal muscle following muscle-damaging eccentric contractions. This finding may indicate that CXCL10, like CCL2, is important for muscle regeneration.
METHODS:To test this, we measured functional and histological markers of muscle regeneration in mice out to 14 days post muscle injury (DPI) 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 functional testing, the TA muscles were excised, weighed, frozen, cut by cross section and mounted on glass slides for histological studies. Mounted muscle samples were stained using hematoxylin and eosin to identify central nucleated fibers and quantify cross sectional area. Samples were also stained immunohistochemically for embryonic myosin heavy chain (eMyHC) to identify the number of fibers undergoing regeneration.
RESULTS: Relative to the saline-injected TA, strength significantly decreased ($p<0.05$) at 2 (WT=46.7±15.9%, KO=44±9.4%) and 7 (WT=65±8.3%, KO= 66±15.9%) DPI, and was recovered by 14 DPI. No significant differences in muscle strength were found between genotypes. Compared to the control TA, the CTX-injected TA muscle mass was significantly reduced ($p<0.05$) at 7 DPI (WT=86±3%, KO=91±9%) compared to 14 DPI (WT=105±8.3%, KO= 105±11%). No significant differences in muscle mass were found between genotypes. Cross-sectional area of regenerating myofibers was greater at 14 DPI compared to 7 ($p<0.05$), yet again no

significant differences were found between genotypes. The number of myofibers expressing eMyHC was greater at 7 DPI than 14 ($p<0.05$), with no significant difference between genotypes.
CONCLUSIONS: We conclude that CXCL10 is not necessary for normal muscle regeneration from a toxin-induced muscle injury in mice.

1772 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 in 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 FSR 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 low 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.

1773 June 1 2:15 PM - 2:30 PM

6 Weeks Of Nrf2-activator And Protein Supplementation Improves Myofibrillar Proteostasis In Men.

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The age-related loss of muscle mass and function are key contributors to the decline in healthspan. 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.
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.

1774 June 1 2:30 PM - 2:45 PM

Effects of Compression Treatment on Ribosome Biogenesis, Hypertrophy and Inflammation in Subjects Performing Resistance Exercise

Matthew A. Romero, Cody T. Haun, Shelby C. Osburn, Gillis L. Langston, Richard G. Anderson, Michael D. Goodlett, David D. Pascoe, Michael D. Roberts, Jeffrey S. Martin. *Auburn University, Auburn, AL.*
(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: 20 resistance-trained males (aged 21.6±2.4 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 (Days2-4) and 3 consecutive days of recovery (Days5-7) with EPC/sham only on Days5-6. *Vastsus lateralis* muscle was biopsied on Day 1 (PRE), 1-h post-EPC/sham treatment on Day2 (POST1) and 24-h post-EPC/sham treatment on Day7 (POST2).
RESULTS: : Of all of the assayed ribosome biogenesis mRNAs and rRNAs, 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.

1775 June 1 2:45 PM - 3:00 PM

Inducible Overexpression of p21Cip1 in Myotubes Promotes Increases in Protein Synthesis and Myotube Hypertrophy

C. Brooks Mobley[1], Tyler Kirby[2], Christopher Ballmann[3], John Quindry, FACSM[4], John J. McCarthy[5], Michael D. Roberts[6]. *[1]Auburn University, Auburn, AL. [2]Cornell University, Ithaca, NY. [3]Samford University, Birmingham, AL. [4]University of Montana, Missoula, MT. [5]University of Kentucky, Lexington, KY. [6]Auburn 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 skeletal muscle. However, sparse literature has demonstrated that mechanical loading can elicit robust (i.e. ~30-50+-fold) 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 C_2C_{12} p21Cip1-inducible (p21-IND) cell line was established. Empty vector C_2C_{12} clones (EV) served as the control condition. Following 7 d 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-47S rRNA trended to increase in p21-IND myotubes compared to EV myotubes (1.6-fold, $p = 0.09$). **CONCLUSIONS**: These data suggest that p21Cip1 may act in post-mitotic skeletal muscle fibers to increase translational capacity and/or efficiency, thereby promoting skeletal muscle hypertrophy.

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

Mallory Shasteen, Kyle Cassas, FACSM. *Greenville Health System/Steadman Hawkins Clinic of the Carolinas, Greenville, SC.* (Sponsor: Kyle Cassas MD, FACSM)
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(No relationships reported)

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 epicondyle, 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 week 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.

1780 June 1 1:20 PM - 1:40 PM

Elbow Injury - Baseball

Terin Sytsma, Timothy McKenna. *Mayo Clinic, Rochester, MN.* (Sponsor: Dr. Karen Newcomer, FACSM)
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(No relationships reported)

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 joint effusion
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 one year follow up, he was doing well with no pain or symptoms. He was cleared for sports but instructed to refrain from pitching.

1781 June 1 1:40 PM - 2:00 PM

Elbow Pain-Young Baseball Pitcher

Luis A. Sanchez[1], Juan C. Galloza[2], William Micheo, FACSM[1]. [1]*University of Puerto Rico, Medical Sciences Campus, San Juan, PR.* [2]*University of Texas Health Science Center at Houston (UTHealth), Houston, TX.* (Sponsor: William Micheo, FACSM)
Email: luisalberto721@gmail.com
(No relationships reported)

HISTORY: 15 year-old male pitcher with right elbow pain of 2 weeks of duration. The pain had sudden onset after a long toss during baseball practice. It was localized at the posterior-medial aspect of his right elbow, exacerbated with repetitive elbow extension and relieved with rest. He was unable to pitch/throw after the injury. No previous episodes of elbow pain. Prior history was positive for right knee chondroplasty one year before the evaluation. Sports participation was relevant for year-long baseball participation with less than one month resting period.
PHYSICAL EXAMINATION: Height: 66 inches, Weight: 141 pounds, Body Mass Index (BMI): 22.8 kg/m 2. Inspection showed protracted shoulders and no medial elbow swelling. The postero-medial aspect of the right elbow was tender to palpation. Range of motion presented full painless flexion, but a painful extension lag of 10 degrees. Strength deficits on rotator cuff. Pain with resisted elbow extension. Negative valgus testing.
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:
1. AP & Lat x-rays: Linear lucent defect at the olecranon process.
2. 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.Stretching 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

1782 June 1 2:00 PM - 2:20 PM

Medial Elbow Pain - Young Baseball Pitcher

Andrew H. Gordon, Arthur J. DeLuigi. *MedStar National Rehabilitation Hospital, Washington, DC.* (Sponsor: Garry Ho, FACSM)
Email: Andrew.Gordon@medstar.net

(No relationships reported)

HISTORY: A 14-year, 2-month old male right-handed baseball pitcher presented with chronic right medial elbow pain over 18 months, with no inciting injury/trauma. Initially he had mild right medial epicondylitis on magnetic resonance imaging (MRI) which resolved with rest and physical therapy. Still his right elbow pain recurred when throwing, ultimately failing conservative measures. Our collaborating orthopaedist then referred him to us for ultrasound and nonsurgical management. At his initial visit with us, he reported no pain at rest. He last had elbow pain one month earlier while doing lighter outfield (non-pitching) throws.
PHYSICAL EXAMINATION: Afebrile with normal blood pressure and pulse. Normal muscle bulk and appearance for his age. Focused right elbow examination showed normal range of motion and no pain with flexion/extension. No locking or swelling. He did have laxity of his right elbow with valgus stress.
DIFFERENTIAL DIAGNOSIS: 1. Valgus extension overload. 2. Osteochondritis dissecans. 3. Olecranon stress fracture. 4. Medial epicondyle avulsion fracture. 5. Medial apophysitis. 6. Medial epicondylitis. 7. Ulnar collateral ligament (UCL) sprain or tear. 8. Ulnar neuritis/subluxation.
TESTS AND RESULTS: Initial MRI 18 months prior showed no UCL injury, but rather fluid at the flexor pronator mass consistent with medial epicondylitis. New MRI showed a partial right UCL tear at the proximal insertion. No full tear, fracture, or other connective tissue injury. Under ultrasound, laxity of the right UCL and pathology consistent with the partial UCL tear was seen, with no fracture, loose bodies, or epicondylitis.
FINAL WORKING DIAGNOSIS: Partial UCL tear at the right elbow.
TREATMENT AND OUTCOMES: We injected platelet rich plasma (PRP) under ultrasound to the pathologic site of the right UCL. The boy then proceeded with our 12-week PRP rehabilitation protocol tailored to throwing athletes. At 8 weeks post-injection, ultrasound showed interval healing with reduced laxity of the right UCL. At 16 weeks post-injection, ultrasound revealed virtually complete healing with no laxity of the right UCL. The boy eventually returned to throwing full pitching distance without pain, emphasizing the potential utility of PRP injection in pediatric/adolescent athletes with musculoskeletal injuries.

1783 June 1 2:20 PM - 2:40 PM

PRP For Treatment Of Lateral Epicondylitis In A Division I Collegiate Pitcher.

Ryan Hudson, D.O., Andrew T. Martin, D.O.. *Campbell University School of Osteopathic Medicine, Lillington, NC.* (Sponsor: Pat Leary, FACSM)

(No relationships reported)

HISTORY:19 yo male, right hand dominant pitcher, presents for evaluation of progressively worsening lateral right elbow pain. He has recently increased baseball play over the past 1 year in preparation for matriculation to a D- 1 collegiate program. He has been evaluated previously by his primary care. Previous treatment included rest, ice, NSAIDs, home exercise routine and single episode of dry needling prior to moving to college.
Past Surgical Hx: Tommy John surgery to right elbow in 2013
PHYSICAL EXAMINATION:Physical examination is remarkable for tenderness to palpation over the lateral epicondyle with decreased grip strength and pain upon resisted wrist extension. Rest of physical examination is within normal limits.
DIFFERENTIAL DIAGNOSIS:
Osteochondritis Dissecans,Radial Tunnel Syndrome,Posterior Interosseous Nerve Syndrome, Elbow arthritis, Foreign body, Cervical radiculopathy, Lateral epicondlitis/osis, Posterior lateral instability
TEST AND RESULTS:
Office ultrasound showed degenerative changes to the common extensor tendon complex.
FINAL WORKING DIAGNOSIS:
Lateral epicondylosis.
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.

1784 June 1 2:40 PM - 3:00 PM

Left Elbow Pain- Push Ups

Kamyar Nabegh[1], Jeffrey Anderson[2], Matthew Hall[1]. [1]*UCHC, Farmington, CT.* [2]*University of Connecticut, Storrs, CT.*

(No relationships reported)

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.
DIFFERNETIAL DIAGNOSIS:
1. Subluxing Ulnar Nerve
2. Snapping Triceps
3. Cubital Tunnel Compression
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
-Snapping triceps muscle
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 assessment. Expected rehab is 3-4 months.

D-15 Clinical Case Slide - **Foot and Ankle II**

Thursday, June 1, 2017, 1:00 PM - 2:40 PM
Room: 402

1785 **Chair:** Ashley Zapf. *Schwab Rehabilitation Hospital, Chicago, IL.*

(No relationships reported)

1786 **Discussant:** Michael Fredericson, FACSM. *Stanford University, Stanford, CA.*

(No relationships reported)

1787 **Discussant:** David Olson, FACSM. *University of Minnesota, St. Paul, MN.*

(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, FACSM, Wayne Derman, Jeandre T. Viljoen. *Stellenbosch University, Stellenbosch, South Africa.*
Email: plviviers@sun.ac.za

(No relationships reported)

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 forefoot 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 gymnasium training as well as during scrummaging 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 **TEST AND RESULTS**: **X-rays:** reported as normal **MRI:** reported partial tears of the left medial and lateral heads of flexor hallicus brevis. No collateral ligament injury.Sesamoids were normal and no avulsion of the plantar plate could be demonstrated
FINAL WORKING DIAGNOSIS:Partial ruptures medial and lateral head of the left flexor hallicus brevis
TREATMENT AND OUTCOMES: • Imobilized non-weight bearing in moonboot for 2 weeks • Physical therapy • Gradually mobilized over next 2 weeks and full return to train and play after 4 weeks

1789 June 1 1:20 PM - 1:40 PM

Dance is Pain

Thomas A. Moran[1], Holly Benjamin, FACSM[2]. *[1]University of Chicago-NorthShore, Glenview, IL. [2]University of Chicago, Chicago, IL.*

(No relationships reported)

HISTORY: 15-year-old female dancer who attends a dance academy and regularly dances 5-6days/week presented for routine followup regarding a resolving grade I Left MCL sprain. She denied current knee symptoms with dance but stated "Oh by the way, I think I sprained my right ankle" after landing from jump 2 weeks ago. She initially developed nonspecific anterolateral ankle pain with ambulation, 6/10 in severity. She reported initial swelling over dorsum of midfoot extending to the lateral ankle, however, this improved spontaneously within 1 week. Currently she had no complaints of pain with ambulation but she described a "nagging discomfort when dancing en pointe and going down stairs." She continued dance through the pain but limited her jumping and toe work.
PHYSICAL EXAM: Nonantalgic gait. Examination of both ankles revealed bilateral pes planus, no swelling or eccymosis. Full Active and Passive range of motion, Dorsifleion 20 degrees, hyper-plantarflextion to 70degrees, inversion 30degrees and eversion to 10degrees. 1+ anterior drawer but equal bilaterally. Tender to palpation over dorsum of midfoot over anterior subtalar joint. Repeat exam at 3 week followup same.
DIFFERENTIAL
Lateral ankle sprain, specifically ATFL injury
Navicular fracture
Osteochondral defect of talar dome
Avascular necrosis talus
Tarsal tunnel capsulitis
TESTS/RESULTS
Xray AP, lateral mortise of ankle unremarkable (foot XRs not obtained)
MRI: Diffuse abnormal marrow signal within navicular bone and cortical irregularity at articulation with talus.
CBC, CMP, Calcium and VitD 25-OH levels within normal limits.
FINAL/WORKING DIAGNOSIS
Navicular stress fracture
TREATMENT/OUTCOMES
1.Short leg cast x 4 weeks
2.NWB with crutches
3. PT for crutch strengthening and Core Strengthening
4.OTC VitD and Ca supplementation
5.F/U at 4 weeks with consideration of walking boot.
6.Anticipate transition to walking boot at 4-6 weeks
7.Anticipate CT foot at 6 weeks

1790 June 1 1:40 PM - 2:00 PM

Chronic Plantar Fasciitis: From Disability To Running!

Lindsay Troilo, Irene Davis, FACSM. *Spaulding Outpatient Center Cambridge, Cambridge, MA.*

(No relationships reported)

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 forefoot. His knee pain was also reduced when he ran on his forefoot. WORKING DIAGNOSIS: 1. BIL plantar 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 Fitbit to monitor walking step progressions Wean 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 < 1/10 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: mtbdrphil@gmail.com

(No relationships reported)

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 eversion 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
1.
ER relocation of ankle
2.
Surgical fixation and plating of distal fibular fracture
3.
Aircast boot and non-weight bearing for 6 weeks; anticipated date he may start weight-bearing activity is 11/5/16.

1792 June 1 2:20 PM - 2:40 PM

An Atypical Cause for Posteromedial Ankle Pain in a Runner

Nicole T. Yedlinsky, 22033, Garry W. K. Ho, 22033, FACSM. *VCU - Fairfax Family Practice Sports Medicine Fellowship Program, Fairfax, VA.* (Sponsor: Garry Ho, MD, FACSM)
Email: nyedlinsky@ffpcs.com

(No relationships reported)

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 Peek-a-Boo heel signs negative, and Rise on Toe exhibited normal heel varus. Dorsolateral 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 insertional 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 to 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.
DISCUSSION:
The accessory soleus muscle is a rare anatomical variant that can cause exertional pain and swelling in athletes. Most patients present with swelling and pain. It usually manifests in the late teens. Accessory soleus can also be found as an incidental finding. No treatment is required for asymptomatic patients. Conservative therapy can be attempted but many patients require surgical excision due to persistent symptoms.

D-16 Clinical Case Slide - **Hip and Pelvis I**

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 103

1793 **Chair:** John C. Hill, FACSM. *University of Colorado, Denver, CO.*

(No relationships reported)

1794 **Discussant:** Siobhan M. Statuta. *University of Virginia, Charlottesville, VA.*

(No relationships reported)

1795 **Discussant:** Scott A. Paluska, FACSM. *Christie Clinic Sports Medicine, Champaign, IL.*

(No relationships reported)

1796 June 1 1:00 PM - 1:20 PM

Painful Hip Snapping In A 15 Year Old Female Soccer Player: A Case Report

Melissa Roscher, Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.* (Sponsor: Brian A. Davis, FACSM)
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(No relationships reported)

HISTORY: A 15 y/o girl with history of bilateral iliotibial band (ITB) lengthening was referred to sports medicine clinic for diagnostic ultrasound of the right anterior hip due to painful snapping in the groin. Pain was exacerbated by kicking a ball. Sonographic examination demonstrated snapping iliacus and psoas major tendons with reproduction of groin pain. Physical therapy (PT) focusing on iliopsoas stretch was ineffective; she underwent iliopsoas tendon lengthening and synovectomy with complete resolution of pain. Five months following iliopsoas tendon lengthening, she returned with a new painful grinding sensation in the right buttock. Pain was exacerbated by walking, specifically at toe-off. Pain was sharp, episodic, and debilitating. She denied groin pain or pain with hip flexion. She denied neurologic deficits**PHYSICAL EXAMINATION**:
Gen: No acute distress
Neuro: Audible clunk with ambulation. Non-focal sensory, motor, and reflex examination of the RLE
MSK: No visible defect of right buttock. Nontender over the gluteal region and ischial tuberosity. Pain reproduced with passive external hip rotation. Negative FABER, FAIR, log roll, Stinchfield, Ober, and scour
DIFFERENTIAL DIAGNOSIS: 1. Ischiofemoral impingement
2. Hip labral/intraarticular pathology
3. Snapping gluteus maximus tendon/muscle
4. Recurrent iliotibial band snapping
TEST AND RESULTS: MRI arthrogram: minimal labral fraying. Minimal symptom improvement with intraarticular steroid. Diagnostic ultrasound: hypertrophy of the right quadratus femoris (QF) (2.51cm right vs 1.54cm left) with dyskinetic motion of the QF between the ischial tuberosity and lesser trochanter during external hip rotation. Dyskinesis was more pronounced with standing and walking. Contralateral QF was void of dyskinetic movement. She underwent injection of lidocaine and triamcinolone into the right QF under sonographic guidance
FINAL WORKING DIAGNOSIS: Ischiofemoral impingement 2/2 hypertrophied QF
TREATMENT AND OUTCOMES: 1. Sonographically guided injection of lidocaine/corticosteroid resulted in diagnostic block from lidocaine component only
2. Discussed repeat injection vs debulking operation vs trial of botulinum toxin injection to the QF
3. Referred to PT for hip stretching and pelvic stabilization exercises

1797 June 1 1:20 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

(No relationships reported)

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 sprinting 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. Neurovascularly 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 symphysis. 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: 1. Stress reaction of the inferior pubic rami 2. Osteitis Pubis 3. Femoroacetabular impingement
TREATMENT AND OUTCOMES:
1. Crutches while having pain with walking for 1-2 weeks 2. NSAIDs as needed for pain 3. Restriction on soccer/running for 8 weeks 4. Plan for gradual return to activity

1798 June 1 1:40 PM - 2:00 PM

Back And Buttocks Pain In An Adolescent Athlete

Andrew Getzin, FACSM. *Cayuga Medical Center, Ithaca, NY.*
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(No relationships reported)

History
"I hurt my glut in football, then on and off in basketball, as of one week it seems like a 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

progressed into the start of baseball season. Eight days prior, his pain changed to be first thing in the AM, stabbing pain over his glut 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
DDx
1. LS strain
2. Axial discogenic pain
3. Spondylolysis
4. Slipped Capital Femoral Epiphysis
5. High hamstring tendinopathy
6. Proximal adductor tendinopathy
7. Piriformis syndrome
8. Juvenile Spondyloarthropathy
9. Pelvic stress fracture
Tests and Results
X-ray LS spine: WNL
X-ray, hip and AP pelvis: WNL
MRI LS spine:
1. Edema within the left L4 pedicle
2. Small focal protrusion at the L4-L5 level in the right lateral recess, possibly impinging on the L5 nerve root
Treated with Medrol dose pack and PT for discogenic pain. One morning he felt an explosion of pain in his right glut, 10/10 that kept him out of school for the next few days. Due to exacerbation and chronicity, further imaging was performed.
MR arthrogram R hip:
1. Mild cam FAI
2. Small focus of edema right greater trochanter
3. R unilateral sacroiliitis with erosion of subchondral bone along the iliac margin and iliac margin subchondral marrow edema.
MR LS Spine: WNL
CBC: WNL
ESR: 8
CRP: <0.5
RF: <15
HLA-B27: positive
ANA: positive
Final Dx: Juvenile Spondyloarthropathy
Outcome: He initial did well with Humira injections.

1799 June 1 2:00 PM - 2:20 PM

Hip Pain - Women's Soccer

Shawn D. Felton, Taylor K. Kramer, Jason C. Craddock. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchell L. Cordova, FACSM)
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(No relationships reported)

HISTORY:
Athlete is a 20-year-old NCAA Division II women's soccer player. Athlete's previous medical history includes chronic pelvic instability, Legg-Calve Perthes Disease (LCPD), and chronic exertional compartment syndrome bilaterally.
PHYSICAL EXAMINATION:
Athlete reported to athletic trainer complaining of sharp pain near right proximal hip region. Athlete did not recall a specific mechanism of injury. Initial evaluation revealed right hip bulge at proximal anterior hip. Athlete was point tender over bulge. Full active ROM and strength with hip flexion, extension, abduction, and adduction; decreased ROM with internal and external rotation. (+) Soft tendon bulge present with hip flexion, (-) bulge with extension. Neurological exam revealed reflexes 2/4 bilaterally and sensation grossly intact bilaterally.
DIFFERENTIAL DIAGNOSIS:
1.Generalized hip inflammation
2.Hip contusion
3.Hip flexor strain
4.Labral tear
5.Femoroacetabular impingement (FAI),
6.Legg-Calve Perthes Disease LCPD
TEST AND RESULTS:
MRI arthrogram
- revealed late abnormalities of LCPD
- flattening of superior weight bearing surface of femoral head with a shortened femoral neck, coxa 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)
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(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 Ely'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 Abdomen Pelvis
-osteitis pubis, questionable pubic symphysis abnormality, and possible sports hernia
FINAL WORKING DIAGNOSIS:
High-Tone Pelvic Floor Muscle Dysfunction
TREATMENT AND OUTCOMES:
1. Manual therapy for pelvic alignment correction
2. Abdominal and pelvic girdle myofascial release
3. Pelvic stability with Kinesio Taping
4. Internal vaginal muscle myofascial release and neuro re-education
5. Padding in leotard to reduce impact at pubic tubercle
6. Trigger point injections of obturator internus muscles
7. Trial of Lyrica
8. Reduction of high-impact & high-speed repetitive sport-related activities
9. Discharge from PT with successful return to gymnastic competition

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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)
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(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
Nigel A.S. Taylor. *University of Wollongong, Wollongong, Australia.*
(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 (NFPA1991) 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, 60% 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. *Loughborough 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

D-41 Basic Science World Congress - Thematic Poster - **Exercise, Neuroplasticity, and Cognition in Youth**

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 101

1880 **Chair:** Dawn P. Coe, FACSM. *University of Tennessee, Knoxville, TN.*
(No relationships reported)

1881 Board #1 June 1 3:15 PM - 5:15 PM

Cognitive Performance In Young Adulthood Is Associated With Sport Trajectories From Early Childhood Through Adolescence

Erin K. Howie[1], Romola S. Bucks[2], Joanne A. McVeigh[3], Leon M. Straker[3]. [1]*University of Arkansas, Fayetteville, AR.* [2]*University of Western Australia, Perth, Australia.* [3]*Curtin University, Perth, Australia.* (Sponsor: Russell Pate, FACSM)
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(No relationships reported)

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 sports 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 physical activity assessed by the International Physical Activity Questionnaire at age 22. **RESULTS**: There were significant multivariate effects in cognitive performance between sport trajectories for both women (p=.046) and men (p=.004). For women, there were differences in performance on the one back test (n=360, F=4.32, df=2, p=.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 (n=356, F=7.1, df=2, p<.001) and card detection tasks (F=3.2, df=2, p=.038). Men who dropped out of sport had slower reaction times on both tests compared to those who were in the consistent participator 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.

1882 Board #2 June 1 3:15 PM - 5:15 PM

Activity Intensity and School Readiness in Young Children

Tyler J. Kybartas[1], Jennifer I. Flynn[2], Jeffery T. Fairbrother[1], Sean R. Durham[3], Dawn P. Coe, FACSM[1]. [1]*University of Tennessee, Knoxvile, TN.* [2]*Maryville College, Maryville, TN.* [3]*Auburn University, Auburn, AL.*
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(No relationships reported)

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 school readiness 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<0.05) 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.

1883 Board #3 June 1 3:15 PM - 5:15 PM

Effects Of Playing Soccer On Executive Function In Children

Shota Sakamoto, Masamitsu Ito, Yuta Uematsu, Masahiro Katagiri, Takeru Gushiken, Kazuhiro Suzukawa. *Nippon Sport Science University, Tokyo, Japan.*
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(No relationships reported)

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. Group1 (G1) was comprised of 29 soccer players from the highest level of national youth soccer league. Group2 (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, df=169, p<.001). 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, df=61, p<.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 youth soccer players.

1884 Board #4 June 1 3:15 PM - 5:15 PM

Obesity, Visceral Adipose Tissue, And Cognition In Childhood

Lauren Raine[1], Naiman Khan[2], Eric Drollette[2], Matthew Pontifex[3], Arthur Kramer[1], Charles Hillman[1]. [1]*Northeastern University, Boston, MA.* [2]*University of Illinois, Urbana, IL.* [3]*Michigan State University, Lansing, MI.*
(No relationships reported)

Purpose: There is an increasing prevalence of physical inactivity during childhood, concurrent with a rise in obesity rates, which are associated with a myriad of health complications. Independent of weight status, central adiposity has been linked to decrements in both metabolic health and cognitive function in children. However, the effect of central adiposity on childhood brain health and cognition warrants further study. Specifically, the effects of daily physical activity on concomitant changes in adiposity and childhood cognition function are unclear. Further, the extent to which pre-existing or baseline weight status predicts physical activity derived effects on children's cognition remain unknown. Accordingly, the aim of this investigation was to examine the effect of a 9-month physical activity intervention on changes in adiposity and cognition based on baseline weight status (i.e, healthy weight vs. obese) in children. **Methods:** Participants included obese (n=77) and matched healthy weight (n=77) preadolescents (8-9-year-olds) who participated in a 9-month physical activity randomized controlled trial. Cognitive function was assessed using

an inhibitory control task (modified flanker task). **Results:** Following the 9-month physical activity intervention, children intervention participants exhibited reduction in adiposity. In contrast, children in the waitlist-control condition, particularly obese children, gained visceral adipose tissue (95% confidence interval (CI) -58.58, -9.14; *p*=0.008). Furthermore, changes in visceral adipose tissue were related to changes in cognitive performance, such that the degree of reduction in visceral adipose tissue directly related to greater positive gains in inhibitory control, particularly among obese intervention participants (CI -0.14, -0.04; *p*=0.001). **Conclusions:** These findings demonstrate that participation in a daily physical activity program not only reduces adiposity but also concomitantly improves children's cognitive function. Further, this work reveals that the benefits of physical activity on improvements in cognitive function are particularly evident among obese children.

1885 Board #5 June 1 3:15 PM - 5:15 PM

An 8 Week Aerobic Exercise Training Intervention Improved Executive Functions in Adolescents

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A recent meta-analysis examining the impact of 28 physical activity (PA) interventions on executive function (EF) outcomes in healthy children reported a significant, small to moderate positive effect on EF, though effects varied widely across qualitatively different programs, and none of the programs utilized individual, controlled exercise prescriptions. **Purpose.** To evaluate the impact of personalized exercise intervention on EF in adolescents. **Methods.** 32 normal weight adolescents (14-17 y/o, 20 girls) participated in an 8 week supervised, personalized exercise program, 3 times/week, 60 min/session (24 sessions total). VO_2 peak was assessed, before and after the program by ramp-type progressive cycle ergometer until exhaustion. EFs were measured before and after intervention using a computerized test of executive function, with three trials (congruent, incongruent, mixed) that yielded six scores each time - three response times (RTs) and three accuracy scores. Changes were examined using paired samples *t*-tests with pre- and post-test scores for each of the six variables. **Results.** Peak VO2 was improved (12.6±1.6%, p= 4.8E-08) in 31 out of 32 participants. The means for Congruent Accuracy, which measures primarily attention, were similar at pre- and post-test (93% and 94% correct), and this difference was not statistically significant, t (30) =0.61, p =.55, d =.11. Congruent RT taps into attention and processing speed and was significantly improved, t (30) =3.21, p =.00, d =.58. Incongruent Accuracy measures primarily inhibitory control and changes were not statistically significant, t (28) = - 1.41, p =.17, d -.19. Incongruent RT requires attention, processing speed, and inhibition and significantly improved, t (29) =2.44, p =.02, d =.45. Accuracy on the Mixed Trial, which measures inhibitory control and shifting, improved significantly, t (30) =-3.63, p =.00, d =.50. Mixed RT requires attention, processing speed, and shifting and significantly improved, t (30) =2.31, p =.03, d =.41. **Conclusions.** Results suggest a positive impact of an individualized exercise program on attention, processing speed, inhibitory control, and shifting in adolescents. Further research is needed to identify the underlying mechanisms involved. Supported by NIH Grant P01HD-048721 and PERC System Biology Fund

1886 Board #6 June 1 3:15 PM - 5:15 PM

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 exercise 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 the 2-year follow-up (β=0.180, 95% CI=0.021 to 0.388, p=0.026), 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. 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 CPM 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.

1887 Board #7 June 1 3:15 PM - 5:15 PM

A Novel Approach To Look At The Brain: Fitness And Shape Of Subcortical Structures In Children

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A few studies have recently reported that higher cardiorespiratory fitness is associated with higher volumes of subcortical brain structures in children. It is known however that not only the whole volume of the structure but also the shape of the brain structures influence brain functioning. To the best of our knowledge, the association between fitness and shape of subcortical brain structures has not been studied in any age group.
PURPOSE: We aimed to examine the association of the main health-related physical fitness components with shape of subcortical brain structures in children.
METHODS: The study sample comprised 44 Spanish children aged 9.7±0.2 years. Cardiorespiratory fitness, muscular strength and speed-agility were assessed using valid and reliable tests (ALPHA-fitness test battery). Shape of the subcortical brain structures was assessed by magnetic resonance imaging, and its relationship with fitness was examined after controlling for a set of potential confounders using a partial correlation permutation approach.
RESULTS: All physical fitness components studied were significantly related to shape of subcortical brain nuclei. These associations were both positive and negative, indicating that a higher level of fitness in childhood is related to both expansions and contractions in certain regions of Accumbens, Amygdala, Caudate, Hippocampus, Pallidum, Putamen and Thalamus. Cardiorespiratory fitness was mainly associated with expansions, whereas handgrip was mostly associated with contractions in the structures studied.
CONCLUSIONS: Our observational data provide preliminary evidence supporting that physical fitness could play a role in brain shaping. These findings should be confirmed or contrasted by future randomized controlled trials, demonstrating whether changes in fitness modify the shape of brain structures and the extent to which those changes influence cognitive function.

1888 Board #8 June 1 3:15 PM - 5:15 PM

Physical Fitness Components And Cortical And Subcortical Brain Volume In Overweight/obese Children:The Activebrains Project

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PURPOSE: To examine the association between the key components of physical fitness (i.e. cardiorespiratory fitness, speed-agility and muscular fitness) and brain structural volume in overweight/obese children.
METHODS: A total of 101 overweight/obese children aged 8-11 years were recruited from Granada, Spain. The physical fitness components were assessed following the ALPHA health-related fitness test battery. T1-weighted images were acquired with a 3.0 Tesla Siemens Magnetom Tim Trio system. Gray matter tissue was calculated using Diffeomorphic Anatomical Registration Through Exponentiated Lie algebra (DARTEL). All analyses were controlled for sex, peak high velocity offset, parent

education, body mass index and total brain volume. The statistical threshold was calculated with AlphaSim and further Hayasaka 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 β 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 gyri and parahippocampal gyrus) and calcarine 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 β 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.*
(No relationships reported)

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

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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% VO_2 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. Measures of fatigue analyzed included: percent change in jump height, muscle strength, and landing loading rate during the CMJ.
RESULTS: Linear mixed models revealed a significant effect of the tights on muscle vibration for all muscles except the hamstrings (hamstrings: S=7.6±3.6 mm, L=7.4±2.0 mm, H=7.2±2.2 mm, p=0.89), with significantly less vibration in both tights conditions compared to the shorts (quads: S=15.9±5.1 mm, L=8.4±2.3 mm, H=7.6±2.5 mm, p<0.0001). However, the tights had no significant effect on the fatigue measures analyzed (% change in quad strength: S=-2.6±12.1 %, L=-2.6±10.4 %, H=-0.7±14.6 %, p=0.85; % change in CMJ landing loading rate: S=+11.7±38.2 %, L=+24.9±41.9 %, H=+23.4±29.6 %, p=0.39; % change in CMJ height: S=+6.1±8.3 %, L=+8.4±9.4 %, H=+8.8±8.1 %, p=0.43).
CONCLUSION: 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

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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, hip 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 (M_{ml}), antero-posterior force (M_{ap}) and their sum (M_{grfnet}). Peak internal (PKINT) and external (PKEXT) values and values at peak braking (PKBRK) of the moments were evaluated between groups and time with a RMANOVA. **RESULTS**: In most cases, M_{grfnet} was dominated by M_{ml} in the first half of stance and by M_{ap} in the latter half and FM directly opposed M_{grfnet}. No group by time interactions were found. PKINT-M_{grfnet} (.184 ±.07 to.223 ±09 Nm/kg, p=.0005) and PKINT-FM (.163 ±.08 to .203 ±.12 Nm/kg, p=.0007) increased with time with no change in PKEXT-FM. Group differences indicated greater PKEXT-M_{ap} in the SF group (.113 ±.03 vs .092 ±.02 Nm/kg, p=.014) along with lower internal PKBRK-FM (.018 ±.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-M_{ap} suggest whole body axial rotation is controlled differently when there is a history of SF. The opposing relationship between Fm and M_{grfnet} suggests that FM acts to modify the influence of M_{grfnet} on the COM during the first half of stance. The increase in PKINT-FM and PKINT-M_{grfnet} 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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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 fatiguing run 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±4cm) 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±1mph). 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 states 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.

1893 Board #4 June 1 3:15 PM - 5:15 PM

Effect of Fatigue on Landing Biomechanics in Soccer Players with an Anterior Cruciate Ligament Reconstruction

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Fatigue has been shown to influence landing biomechanics in individuals with an anterior cruciate ligament reconstruction (ACLR). However, no study has evaluated the effect of fatigue on landing biomechanics during a soccer-specific landing task in soccer players with an ACLR.
PURPOSE: To evaluate the effect of fatigue on landing biomechanics during an unplanned landing task in soccer players following ACLR compared with healthy non-injured soccer players.
METHODS: Eighteen soccer players with an ACLR (age, 26.11 ± 3.95 years; height, 1.70 ± 0.09 m; weight, 68.15 ± 9.64 kg, BMI, 23.52 ± 2.69 kg/m^2, 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/m^2) participated in the study. Subjects were assessed during an unplanned landing task before and after completing a Wingate fatigue protocol. The landing task included jumping forward to head a soccer ball and landing on the force plates. An accumulation of 4mmol 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 ANOVA (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 the non-fatigued landing) regardless of group. The fatigued landing showed greater hip flexion ($F_{1,34}$ = 7.24, p = 0.01), greater knee flexion ($F_{1,34}$ = 12.16, p = 0.001), and greater ankle dorsiflexion ($F_{1,34}$ = 10.97, p = 0.002). Also, the fatigued landing demonstrated significantly greater hip extension moments ($F_{1,34}$ = 7.71, p = 0.009), greater knee extension moments ($F_{1,34}$ = 7.04, p = 0.012), greater ankle plantarflexion moments ($F_{1,34}$ = 10.38, p = 0.003), and decreased quadriceps activity ($F_{1,34}$ = 8.18, p = 0.007).
CONCLUSION: Fatigue caused changes in landing biomechanics; however, these changes were not significantly different when the groups were compared. These results indicate that having an ACLR (at least 1 year post-surgery) does not appear to lead to sustained changes in landing biomechanics induced by fatigue.

1894 Board #5 June 1 3:15 PM - 5:15 PM

The Influence of Hamstrings Fatigue on Knee Biomechanics During a Drop Vertical Jump

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(No relationships reported)

Anterior cruciate ligament (ACL) injuries are more prevalent in females vs. males, and are associated with significant morbidity as a result of prolonged symptoms. One mechanism thought to underlie this gender disparity is relative weakness of the hamstrings muscles, particularly the medial hamstrings, which are ACL protective. Neuromuscular fatigue may exacerbate hamstrings weakness, resulting in increases in injury risk factors such as valgus knee angles and moments during landing, cutting, and pivoting. **PURPOSE:** To examine the influence of hamstrings fatigue on female knee biomechanics. **METHODS:** Twelve female athletes performed six drop vertical jump (DVJ) tasks before and after a fatiguing protocol utilizing a glute-ham bench. Knee kinematics and kinetics were recorded during the contact phase of the DVJ, including knee abduction angle, knee abduction moment, knee flexion angle, and vertical ground reaction force (vGRF). These parameters were grouped based on leg dominance and analyzed by paired t-tests. **RESULTS:** Between baseline and the fatigued state, there was a significant decrease in the dominant limb knee abduction angle (but not in the non-dominant limb) across the contact phase (initial contact: 10.5 ± 5.3° vs. 6.4 ± 3.2°; toe-off: 10.1 ± 4.8° vs. 5.9 ± 1.6°; maximum: 13.5 ± 5.0° vs. 9.1 ± 2.2°; peak vGRF: 8.3 ± 4.6° vs. 4.7 ± 2.6°; for each $P \leq 0.05$). Knee flexion angle did not differ between baseline and fatigue in either limb. Knee abduction moment in the non-dominant limb was significantly lower with fatigue at toe-off (0.2 ± 0.2 vs. 0.1 ± 0.3 Nm/Kg), but at no other point during contact. Knee abduction moment was not affected in the dominant limb. Peak vGRF was significantly lower with fatigue compared to baseline in both limbs (dominant: 1.5 ± 0.3 vs. 1.2 ± 0.2 x BW; non-dominant: 1.4 ± 0.3 vs. 1.1 ± 0.2 x BW). **CONCLUSION:** The results were unexpected: post-fatigue knee abduction angle and moment were (partially) reduced and in theory, *less* risky. This may relate to the glute-ham exercises preferentially fatiguing biceps femoris, which has a valgus moment arm, vs. the medial hamstrings which have varus moment arms. If the protocol led to greater relative medial hamstrings force production, it may have reduced knee abduction angle via a varus net hamstrings moment. Further research is required to test this explanation.

1895 Board #6 June 1 3:15 PM - 5:15 PM

Effect of Fatigue on Lower Extremity Biomechanics during Repeated Vertical Jumps in College-Aged Females

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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; 63.9±6.5kg, 170.5±3.1cm) participated in this study. Participants performed 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 from 7 cameras (240 Hz). Dominant-side lower extremity angular joint kinematics and ground reaction forces (GRF: 1,200 Hz) were compared between the non-fatigue landings (NFL) and fatigue landings (FL) using paired t-tests (p<.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.

1896 Board #7 June 1 3:15 PM - 5:15 PM

The Effects of Different Fatigue Protocols on Lower Extremity Kinematics and Impact Forces during Landings

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Neuromuscular fatigue probably contribute to the increased incidence of ACL injuries. Previous studies have demonstrated that a more erect landing posture combined with increased impact characteristics commonly occured in fatigue condition. However, the inconsistency of fatigue protocols lead to contradictory results of kinematics and impact forces.
PURPOSE: To examine the changes in the lower extremity sagittal plane kinematics, impact forces between two fatigue protocols during drop landings. **METHODS:** 15 trained male athletes participated in the study. Two fatigue protocols were randomly used to induce fatigue. The running fatigue protocol (R) required participants to run at 4.0 m/s. The running + jumping fatigue protocol (R + J) required participants to first perform five countermovement jumps within a height above 70% of their maximal vertical jump height then completing a group of shuttle running. Before and after the fatigue protocols, each participant was required to execute five successful trials of drop landing from a 60 cm platform. kinematics and kinetics data was collected using Vicon and Kistler force plates. The variables included sagittal joint angle of the hip, knee, and ankle; peak impact forces/loading rate. **RESULTS:** 1) For kinematics, the minimum angle of hip joint (R + J: 87.8 ± 20.5 ˚ vs. 80.4 ± 21.5 ˚ ; R: 93.9 ± 26.0 ˚ vs. 85.0 ± 28.0 ˚), knee joint (R + J: 83.3 ± 16.9 ˚ vs. 75.5 ± 17.6 ˚ ; R: 85.6 ± 19.8 ˚ vs. 80.4 ± 22.0 ˚) in post-fatigue condition was lower than those in pre-fatigue condition and the range of motion of hip joint (R + J: 50.4 ± 14.2 ˚ vs. 58.6 ± 15.8 ˚ ; R: 48.5 ± 17.9 ˚ vs. 53.7

± 17.5 ˚), knee joint (R + J: 73.6 ± 13.4 ˚ vs. 83.7 ± 13.5 ˚ ; R: 73.8 ± 14.9 ˚ vs. 78.9 ± 15.9 ˚) in post-fatigue condition was higher than those in pre-fatigue condition for both fatigue protocols ($P < .05$) ; Post-tests using R + J showed an increase in the range of motion of ankle joint (37.9 ± 9.8 ˚ vs. 40.4 ± 9.6 ˚) comparing with pre-tests ($P < .05$) ; 2) No changes were found in the impact characteristics between pre- and post-tests for both fatigue protocols. **CONCLUSION:** Both fatigue protocols can induce a more flexed landing posture of lower extremities during the impact of landing. However, whether it is an intentionally or unintentionally protection of potential ACL injury still needs further considering.
Supported by NSFC grant (81302131).

1897 Board #8 June 1 3:15 PM - 5:15 PM

Improved Drop Landing Kinematics and Resistance to Fatigue Following Participation in Two Neuromuscular Training Programs

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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 (2) x Time (2) x Fatigue Condition (2)—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.

D-43 Thematic Poster - **Measurement and Modeling**

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 505

1898 **Chair:** Stella L. Volpe, FACSM. *Drexel University, Philadelphia, PA.*
(No relationships reported)

1899 Board #1 June 1 3:15 PM - 5:15 PM

Performance Modeling Applied to On Ice Measures of NCAA Div. III Collegiate Ice Hockey Players

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(No relationships reported)

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 accelerometry 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 a performance modeling algorithm to yield 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 Q4 (57.1 ± 3.18 v. 65.0 ± 2.24; $p<0.05$); TSB was significantly higher during Q2, Q3, & Q4 (-2.30 ± 0.67, -1.49 ± 0.55, 1.88 ± 0.74 v. -12.4 ± 0.52; $p<0.001$); CTL was significantly higher during Q3 & Q4 (32.5 ± 0.27, 33.5 ± 0.37 v. 29.9 ± 0.26; $p<0.001$); whereas ATL was significantly lower during Q4 (34.7 ± 0.95 v. 44.8 ± 0.67; $p<0.001$). Anaerobic accelerations for all time increments were lower during Q4 ($p<0.05$), while aerobic 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.

1900 Board #2 June 1 3:15 PM - 5:15 PM

Assessing Physical FITness In PREschool Children: Fitness Reference Standards From The PREFIT Project

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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 **FIT**ness in **PRE**schoolers) 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.
PURPOSE: To provide fitness reference standards for preschool children.
METHODS: A total of 3179 preschoolers aged 3-5 years from 10 cities geographically distributed across Spain 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 Leger in 1988), handgrip strength and standing long jump, 4x10m shuttle run and one-leg stance 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 cardiometabolic health levels in order to implement new public health strategies from very early ages.
Supported by RYC-2011-09011, BES-2014-068829.

1901 Board #3 June 1 3:15 PM - 5:15 PM

Fitness And Health Assessment And Monitoring Practices Of Fitness Trainers

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(No relationships reported)

PURPOSE: This study examined the health and fitness assessment and monitoring practices among a large sample of registered Australian fitness professionals.
METHODS:In 2014, 9,100 fitness trainers were invited to complete an online survey. Respondents were asked to report their frequency of assessment and monitoring of eight separate health and fitness constructs (e.g. body composition, aerobic fitness). The prevalence of those classified: (i) 'high' (regularly assessing/monitoring ≤5 constructs); (ii) 'medium' (1-4 constructs) and (iii) 'low' (0 constructs) are reported by sociodemographic variables (age, gender) and fitness industry-related characteristics (role, setting, qualification). Potential social ecological correlates of assessment and monitoring were also examined. A multivariate adjusted logistic regression model assessed the odds of being classified as a 'high assessor and monitor' according to potential social ecological correlates.
RESULTS: Out of 1,206 fitness trainers (response rate = 13.2%), aged 17-72 years, 39.1% (95% CI: 36.4%-41.9%) where classified as 'low', 45.0% (95% CI: 42.2%-47.8%) as 'medium' and 15.8% (95% CI: 13.7%-17.9%) as 'high' assessor and monitor. Body composition (47.7%; 95% CI: 45.0%-50.1%) and aerobic fitness (42.5%; 95% CI: 39.6%-45.3%) were the most regularly assessed constructs. In contrast, the least regularly assessed constructs where balance (24.0%; 95% CI: 24.7%-26.5%) and mental health (20.2%; 95% CI: 18.1%-29.6%). In the adjusted analysis, a perceived lack of client interest, not considering assessing their responsibility and lack of time to asses and monitor were all associated with lower odds of being classified as a 'high assessor and monitor'.
CONCLUSIONS: Our findings show that most fitness trainers do not regularly assess and monitoring client fitness and health. In Australia, efforts should be made to increase the prevalence of assessment and monitoring among fitness trainers.

1902 Board #4 June 1 3:15 PM - 5:15 PM

Player Mounted Sensors To Identify Fatigue During Games At USA 15 National Hockey Development Camp

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(No relationships reported)

Recently, there has been a great increase in the use of player mounted sensors (PMS) for performance assessment in various sports. In contrast to many other sports that involve running, ice-hockey presents a particular challenge to performance assessment due to the unique nature of ice-skating. Selection camps for elite level national ice-hockey teams consist of several intense on-ice sessions over several days and fatigue may be a factor to consider when selecting players in this setting. **PURPOSE:** To use PMS to monitor accelerations (ACC) and heart rate (HR) during an ice-hockey national team development camp to i) identify fatigue, as manifested by reduced on-ice ACC and/or HR and ii) determine if two-a-day on-ice sessions affect ACC or HR in games later on the same day.
METHODS: 22 members (15 yr; 177.5 ± 7.8 cm; 73.7 ± 12.1 kg) of the USA Hockey 15 national development camp participated in procedures approved by the Eastern Michigan University Human Subjects Committee. Players wore PMS that measured tri-axial ACC and HR (Zephyr, MD) for each on-ice session (n=7) during the 5-day camp. Three games (G1, G2 and G3) were played on days 2, 4 and 5. G1 and G2 were preceded by a morning training session (TS). Peak ACC (g's) were divided into neuromuscular (NM) (5, 10 sec), anaerobic (AN) (20, 30, 45 and 60 sec) and aerobic (AE) (5, 10, 20, 40 min) timing domains for purposes of determining relevant physiological fatigue factors.
Peak HR (bmp) was divided into AN and AE domain time points identical to the ACC. MANOVAs with time and previous TS as main effects were performed by SPSS 21.0 (IBM, NY). **RESULTS:** No significant differences were observed for ACC in the NM, AN or AE domains. There were small effects (η_p^2= 0.017 - 0.075) for reduced ACC in the AN (20 to 60 sec) and AE domains (10 and 40 min) from G1 to G3. Interestingly, no effects (η_p^2< 0.01) were observed for accelerations in the NM domain (< 20 sec) or 5 min. No significant differences were observed for HR in any domain, but small effects (η_p^2= 0.019) for elevated HR at 40 min were observed from G1 to G3.
CONCLUSION: Small effects for reduced ACC from G1 to G3 indicates fatigue was present over the course of the camp. Prior TS did not appear to affect later games on the same day. ACC may be superior to HR for identification of fatigue among 15 yr old national caliber hockey players.

1903 Board #5 June 1 3:15 PM - 5:15 PM

Submaximal Yo-Yo Test Reliability and Sensitivity in National 7-a-side Squad Preparing for Rio 2016 Paralympics

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(No relationships reported)

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 abled-body 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 heartrate (Hr) of 86-93% of the Hr achieved during a maximal Yo-Yo test (Hr_{max}), 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 1.6b·min^{-1} respectively, while the CV was 5.1%. A significant correlation between submax 1 and 2 was observed (r=0.93, P < 0.05). Different heartrate recovery's (HRR) (calculated as the average of 15sec) were calculated and it was found that HRR at 75sec 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: 97±1.8%, cl. 7: 93±4.0% and cl. 8: 88±2.9% Hr_{max}). **CONCLUSIONS**: Submax Yo-Yo tests 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.

Age (yrs)	22.8±3.2
Hr_{max} (b·min^{-1})	187.2±7.0
$\%Hr_{max}$	93.6±4.0
HRR_{75sec} (b·min^{-1})	34.8±9.7
$Hr_{submax\ 1}$ (b·min^{-1})	175.4±9.9
$Hr_{submax\ 2}$ (b·min^{-1})	175.2±8.0
Δ(beats·min^{-1})	-0.2±3.9
R^2 (submax 1 vs. 2)	0.86

1904 Board #6 June 1 3:15 PM - 5:15 PM

Validation Of The 3-min All-out Exercise Test For Shuttle Running Prescription

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(No relationships reported)

A 3-min all-out exercise test (3MT) for running has been developed to determine critical speed (CS) and finite capacity for running speeds >CS (D') to predict time limits (T_{LIMs}) and it can be utilized for prescribing interval training; however, the 3MT has not been validated for shuttle running, which is required in most team sports.
PURPOSE: To examine the efficacy of shuttle running 3MT to determine CS and D'.
METHODS: A total of 12 subjects were tested using an all-out 3MT along with three separate all-out distance time-trials (600, 810 and 1020 m) in a 30 m distance shuttle. Average speed during the 3MT for each 10 m distance and times for each time-trial was recorded. 3MT was used to calculate predicted CS, D' and T_{LIMs}. The 3 time-trials were used to determine true CS and D' using D-t, and 1/t models. Within-group analyses of CS and D' from the 3MT, D-t, and 1/t models were evaluated using a series of one-way analyses of variance (ANOVA) with repeated measures. Actual and predicted times for the 3 distances were evaluated with a 2 X 3 ANOVA with repeated measures.
RESULTS: The 3MT (2.94 ± 0.39 m·s^{-1}) and the true *CS* (3.00 ± 0.36 m·s^{-1}) for shuttle running did not differ (p = 0.71) and had a coefficient of variation (CV) of 7.7%. Conversely, *D'* from the 3MT exceeded true *D'* by 42 m (p = 0.04, CV = 36%). The T_{LIMs} estimated for the 3 different distances were within ~2 to 6% (p = 0.60).
CONCLUSIONS: The shuttle run 3MT may offer a suitable method for predicting CS and T_{LIMs} and prescribing shuttle running interval training.

1905 Board #7 June 1 3:15 PM - 5:15 PM

Maximal Oxygen Consumption Predicts Skeletal and Heart Muscle Biomarkers Changes after a Full Distance Ironman

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(No relationships reported)

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 (VO_2 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 VO_2 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: VO_2 max was on average 49.9 ± 6.4 O_2 ml/kg/minute (range 36.5-63.9). Three biomarkers measured directly after the race were predicted by VO_2 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 VO_2 max but cTnT leakage was, in contrast to the other biomarkers, higher with higher VO_2 max (R= 0.10; p=0.55) and return to normal appeared to be faster with higher VO_2 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 VO_2 max was found to be a good predictor of biomarker changes with higher VO_2 max values being correlated to lower values for CK, NT-proBNP and MG.

1906 Board #8 June 1 3:15 PM - 5:15 PM

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

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(No relationships reported)

Measuring oxygen uptake (VO_2) is the gold standard method for assessing cardiorespiratory fitness. Metabolic systems that assess VO_2 require a significant financial investment. A low-cost VO_2 system would increase the availability to measure cardiorespiratory fitness. **Purpose:** To assess the validity and reliability of a low-cost VO_2 system consisting of a Vernier O_2 sensor, CO_2 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 VO_2 system and Vmax system. Both instruments measured flow rate (L/s), O_2 (%), and CO_2 (%) and were used to calculate ventilation (VE) and relative VO_2. For the low-cost VO_2 system, VO_2 was calculated as the difference between the inspired and expired O_2 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 VO_2 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 VO_2 system and Vmax system. **Results:** There was no significant difference between low-cost VO_2 system VO_2 (21.1+10.3 ml/kg/min) and Vmax system (19.61+9.5 ml/kg/min) p = 0.388, 95% CI [-4.72, 1.85]. The low-cost VO_2 system demonstrated excellent reliability across 71 measures with an average measures ICC=0.986, 95% CI [0.941,0.994] p<0.01. **Conclusion:** Findings support that a low-cost system provides valid and reliable measures of VO_2 at rest and submaximal exercise conditions compared to the Vmax system. This project was not funded.

D-44 Thematic Poster - **Move More, Sit Less, What's Best?**

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

1907 **Chair:** Alpa V. Patel. *American Cancer Society, Atlanta, GA.*

(No relationships reported)

1908 Board #1 June 1 3:15 PM - 5:15 PM

Isotemporal Substitution of Sedentary Behavior and Physical Activity on Functional Performance in Older Adults

Nicholas L. Lerma, Chi C. Cho, Ann M. Swartz, FACSM, Nora Miller, Kevin G. Keenan, Scott J. Strath, FACSM. *University of Wisconsin - Milwaukee, Milwaukee, WI.* (Sponsor: Scott Strath, FACSM)
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(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 (ACC, Actigraph GT3X+) was worn for seven consecutive days to collect human movement. Freedson 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 [β= 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, -0.1.059)], and STS [-2.276 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 MPVA, may result in beneficial changes in functional health in older adults.

1909 Board #2 June 1 3:15 PM - 5:15 PM

Longitudinal Association Between Screen Time And Clustered Metabolic Risk Factors From Adolescence To Young Adulthood

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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, HbA1c, 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 ($\chi2$=126.12; df=25; p<0.0001; 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 accounted for 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.

1910 Board #3 June 1 3:15 PM - 5:15 PM

Physical Activity And Sedentary Behavior During The Retirement Transition: The Multi-ethnic Study Of Atherosclerosis (MESA)

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(No relationships reported)

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 at baseline. Employment status, overall MVPA (metabolic equivalent (MET)-minutes/week), and TV watching (minutes/week) were self-reported at four study exams from 2000 to 2012. Multivariable mixed-effect linear regression models were used to describe longitudinal trajectories in MVPA and TV watching by retirement status. 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 3585 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 (average difference: 108 MET-minutes/week per year, 95% CI: 19, 197) and faster rate of increase in TV watching (10 minutes/week per year difference, 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.

1911 Board #4 June 1 3:15 PM - 5:15 PM

Physical Activity And Sitting Time In Relation To Colorectal Cancer Risk. The HUNT-study, Norway

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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 influences colorectal cancer risk. **PURPOSE:** In a prospective longitudinal design, we examined sitting time and physical activity in relation to colorectal cancer risk. **METHODS:** Data were from the Nord-Trøndelag Health Study (HUNT2, 1995-97), Norway. In the present study 65,229 (69%) adults ≥20 years participated. CRC incidence was obtained (1 January 1995 to 31 December 2014). The primary exposures were physical activity and sitting time, and the endpoint were incident CRC identified using ICD-10 codes, C18-C21. Based on meta-analytic evidence, we categorized sitting time as: 0 < 8 hr/day (low risk) and ≥8 hr/day (at risk). The PA estimate was recalculated in metabolic equivalent of task (MET)- hours per week (MET-hr/wk), and categorized as low PA (0 thru 8.3 MET-hr/wk), moderate PA (> 8.3 thru 16.6 MET-hr/wk) and high PA levels (> 16.6 MET-hr/wk. Cox proportional-hazard models were used to examine associations between sitting time and PA with CRC, with the combined low risk group as the reference (Low sitting and/or vigorous PA). **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 with CRC incidence, 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.

1912 Board #5 June 1 3:15 PM - 5:15 PM

Sedentary Behaviors and Cardiometabolic Risk, an Isotemporal Substitution Analysis

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(No relationships reported)

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 hours/day sitting in six distinct activities (television, computing, paperwork, reading, phone, and car). A composite cardiometabolic risk score was calculated by standardizing and summing waist circumference, blood pressure, fasting glucose, insulin, triglycerides, and negative HDL-cholesterol. Linear regression models examined the independent and joint associations of the sedentary activities with the 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 BMI. **Results:** 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.

1913 Board #6 June 1 3:15 PM - 5:15 PM

Reducing Sedentary Behavior to Decrease Low Back Pain: 3-month Results of the Stand Back trial

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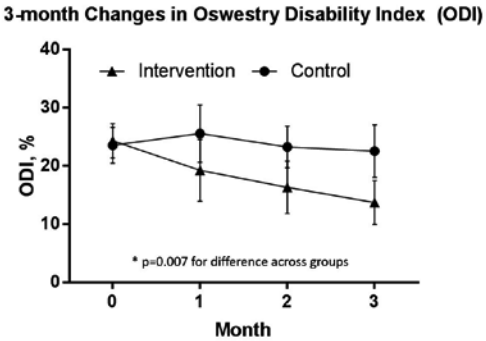
Reported Relationships: B. Barone Gibbs: *Contracted Research - Including Principle Investigator; Humanscale.*

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 prolonged sitting 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-prompting 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 decrease 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.



1914 Board #7 June 1 3:15 PM - 5:15 PM

A Comparison Between Two Different Conditions Of Breaking Up Sedentary Behaviour On Glucose Metabolism

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INTRODUCTION: Sedentary behaviour is suggested a risk factor for various health outcomes, independent of the amount of subcomponents of physical activity. There is currently paucity of experimental studies comparing frequent breaks of sedentary time with one single long bout of exercise in an iso-caloric design. ***PURPOSE:*** to examine if breaking up sedentary behaviour with short five minutes' bouts or one continuous 30-minute bout of vigorous intensity activity differentially affects metabolic risk markers compared with a control condition of prolonged sitting. ***METHODS:*** 12 healthy adults participated in a randomized cross-over design as follows;1) six hours of quiet sitting; 2) six hours of sitting, including five minutes exercise bouts (treadmill running) at 70 % of maximal oxygen uptake (VO_{2max}) each hour; 3) continuous exercise at 70 % of VO_{2max}, for 30 minutes followed by five hours and 30 minutes of sitting. Prior to each test, a fasting blood sample was collected and followed by a standardized meal consisting of 646 kilocalories. Blood samples were thereafter collected every hour. Maximal aerobic capacity was measured using indirect calorimetry and the running speed equivalent to 70 % of VO_{2max} was determined by extrapolation following a submaximal steady state exercise test prior to the experiment. Each condition was separated by a 6-day wash-out period. ***RESULTS:*** There were no differences in insulin (mean (95 % CI); 1) 60704.8 (36352.4-79412.1) pmol · L^{-1} · 360 min; 2) 53375.7 (28787.8-71847.5) pmol · L^{-1} · 360 min; 3) 44827.3 (24853-67912.7) pmol · L^{-1} · 360 min), glucose (mean (95 % CI); 1) 105 (27.6-150) mmol · L^{-1} · 360 min; 2) 48.4 (-88.6-113.5) mmol · L^{-1} · 360 min; 3) 105.8 (49.3-171.6) mmol · L^{-1} · 360 min) and triglycerides (mean (95 % CI); 1) 41 (10.4-72.1) mmol · L^{-1} · 360 min; 2) 60.63 (30-91.5) mmol · L^{-1} · 360 min; 3) 38.22 (9.4-71.1) mmol · L^{-1} · 360 min) incremental area under curve between conditions. ***CONCLUSION:*** There is no effect of either breaking up sedentary behaviour each hour or performing 30 minutes of vigorous physical activity in one bout compared with prolonged sitting for six hours on glucose and lipid metabolism.

1915 Board #8 June 1 3:15 PM - 5:15 PM

Individual and Joint Associations of Sedentary Time and Sedentary Bouts with Glycemic Biomarkers: Hispanic Community Health Study/Study of Latinos

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Excessive sedentary 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 sedentariness 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 (4.96 [95% CI: 4.59, 5.33) vs 4.49 [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

1916 **Chair:** Robin Queen, FACSM. *Virginia Tech, Blacksburg, VA.*
(No relationships reported)

1917 Board #1 June 1 3:15 PM - 5:15 PM

Altered Ankle Neuromechanics During Walking In Patients With Chronic Ankle Instability

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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 neuromechanic patterns during walking when compared to controls. **METHODS**: 100 CAI patients (22±2 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 place 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 ($p < .05$) 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 patterns by positioning the foot in a less closed-pack position and a more inverted position. CAI subjects appear to alter lower extremity biomechanics in a way that could increase injury risk during walking.

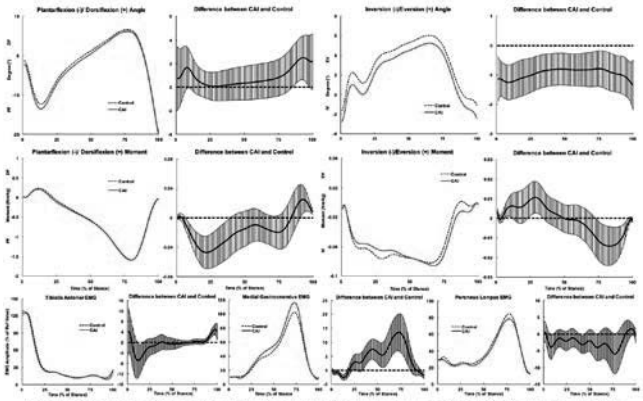

Figure 1. Plantarflexion/dorsiflexion (PF/DF) and inversion/eversion (IV/EV) angle, PF/DF and IV/EV moment, and EMG amplitude for tibialis anterior (TA), medial gastrocnemius (MG), and peroneus longus (PL) during stance phase of walking tasks. Mean differences (solid solid curve) and corresponding 95% CI (shaded area) are plotted as a function of time. When the shaded area does not overlap with the zero line (bold horizontal dotted line), a significant difference ($p < 0.05$) is indicated between groups.

1918 Board #2 June 1 3:15 PM - 5:15 PM

Ankle Muscles Reaction Time During Sudden Inversion In Individuals With Or Without Functional Ankle Instability

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Muscle reaction time (RT) represent the time lag from event to muscle activation. Person with functional ankle instability (FAI) often experiences "giving way" during activities. Whether this is because of muscle activation delay is still unclear. **PURPOSE:** To compare RT of ankle muscles using a sudden ankle inversion (30 degrees) apparatus in individuals with or without FAI. **METHODS:** A total of eight subjects volunteered to participate for this study including two subjects with FAI (FAI group, 25.5 ± 2.1 yrs, 171.5 ± 0.7 cm, 76.5 ± 17.7 kg ,CAIT score: 18.5 ± 3.5) and six control subjects without FAI (control group, 23.7 ± 0.5 yrs, 175.3 ± 4.7 cm, 78.7 ± 11.6 kg ,CAIT score:28.3 ±1.4) . Using Cumberland ankle instability tool questionnaire (CAIT) to identify whether subjects were with FAI. Scores of ≤ 23 indicate FAI. Subjects were asked to stand on the two platforms for each legs of sudden ankle inversion apparatus. The platforms were initial locked by electromagnetic force. After unlocking, one of them inclined downward to 30 degrees ankle inversion. During the test, RT of tibialis anterior (TA), peroneus longus (PL) and peroneus brevis (PB) were assessed through surface electromyography (EMG). The RT of the muscles was determined as the time between the unlocking of the platform and the increase to 5 SDs higher than the mean resting activity during stance. EMG data were collected at 1000Hz and band-pass filtered at 10 and 450 Hz and low-pass filtered at 10 Hz. Data were analyzed using independent t- test. **RESULTS:** The RT of TA, PL and PB in FAI group were 46.3 ± 1.4 ms, 45 ± 4.2 ms and 42.7 ± 5.7 ms. PB activated first and TA activated last in FAI group. The RT of TA, PL and PB in control group were 43.3 ± 6.4 ms, 50.4 ± 9 ms and 44.4 ± 14.7 ms. TA activated first and PL activated last in FAI group. There were no significant difference in RT for TA (p=0.277), PL (p=0.229) and PB (p=0.439) between groups. **CONCLUSION:** The RT of TA, PL and PB induced by sudden ankle inversion (30 degrees) in individuals with and without FAI were not different. But the sequences of activation were different. The activations of PL and PB in individuals with FAI were not delayed compared with individuals without FAI. The activation of TA might be also an important factor for ankle stability. Further studies are needed to clarify the function of TA during sudden inversion in subjects with FAI.

1919 Board #3 June 1 3:15 PM - 5:15 PM

Examining Postural Control without Feedback in Individuals with and without Chronic Ankle Instability

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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 two 20s 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 (1.1cm^2) were significantly less compared to other levels (all P<=0.001). At Level 8, OSI (1.8) and sway area (2cm^2) were significantly less compared to Static and Level 4 (both P<=0.002). Static OSI (2.3) and sway area (4.9cm^2) values were similar to those at Level 4 (OSI: 2.6; sway area: 10.9cm^2). 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.

1920 Board #4 June 1 3:15 PM - 5:15 PM

Effect of Rest Intervals during the Star Excursion Balance Test on Postural Control in Individual with Chronic Ankle Instability

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(No relationships reported)

It has been proposed that inadequate rest intervals may contribute to decreased performance of activities. However, there are a number of proposed factors that may contribute to decreased performance. Individuals with chronic ankle instability (CAI) are known to exhibit decreased balance ability and compromised postural control. **Purpose**: To determine whether rest interval affects performance of the Star Excursion Balance Test (SEBT) associated with CAI and whether postural control can be a factor which may help discriminate between healthy individuals and those with CAI during the SEBT. **Methods:** Participants included 24 individuals (age: 21.9 ± 2.3years) with a history of at least one ankle sprain in the past year and at least 2 episodes of giving way in the past 6 month prior to study enrollment, and 24 individuals (age: 22.7 ± 1.6 years) with no history of ankle sprain or instability in their lifetime. Subjects completed 3 trials in each of the 3 reach directions (anteromedial:AM, medial:M, posteromedial:PM) in random order. A total of three visits were required in order to complete the 3 rest intervals (10, 20, 40 seconds). Maximum lateral center of pressure velocity (MLCOPV) were calculated and compared between groups in each direction for each rest interval. **Results:** Rest interval did not influence differences of MLCOPV in healthy individuals and those with CAI during the SEBT (AM: Wilks' Lambda = 0.96, $F_{2,45} = 0.76$, p = 0.47, M: Wilks' Lambda = 0.98, $F_{2,45} = 0.45$, p = 0.64, and PM: Wilks' Lambda = 0.99, $F_{2,45} = 0.04$, p = 0.95. MLCOPV were not different between healthy individuals and those with CAI during the SEBT regardless of rest interval (AM; H: 0.8 ± 0.3 vs CAI: 0.8 ± 0.4, $F_{1,46} = 0.16$, p = 0.68, partial eta squared = 0.00, M; H: 0.8±0.3 vs CAI: 0.7±0.3, $F_{1,46} = 0.25$, p = 0.61, partial eta squared = 0.00, and PM; H:0.8±0.3 vs CAI: 0.8±0.3, $F_{1,46} = 0.00$, p = 0.92, partial eta squared = 0.00). **Conclusion:** Based on these results, MLCOPV may not be a useful measure in estimating postural control in healthy individuals and those with CAI.

1921 Board #5 June 1 3:15 PM - 5:15 PM

Age-related Changes in Ankle Proprioception

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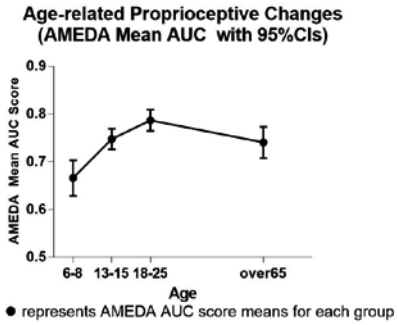
(No relationships reported)

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.



1922 Board #6 June 1 3:15 PM - 5:15 PM

Center Of Pressure Excursion Velocities During Recovery From Total Ankle Arthroplasty

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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 (TAA). However, it has been suggested that 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 ($p=0.34$) nor 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; NSx 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 MEVs 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.

1923 Board #7 June 1 3:15 PM - 5:15 PM

Neuromuscular Training Alters Preparatory Lower Extremity Muscle Activation and Movement in Subjects with Ankle Instability

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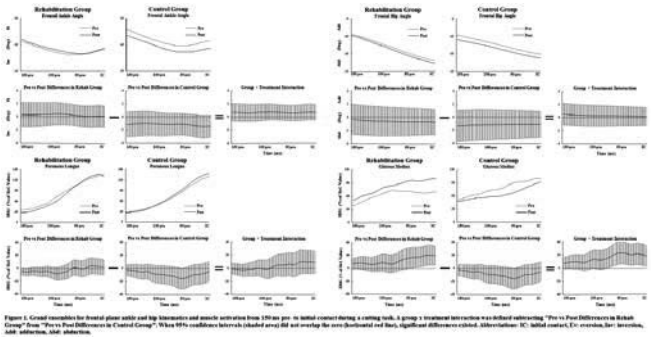
(No relationships reported)

Chronic ankle instability (CAI) may, in part, be due to poor positioning of lower extremity segments during movement. Altered preparatory muscle activation from sensorimotor deficits could perpetuate this problem. **PURPOSE**: to determine if a 6-week neuromuscular training program can alter preparatory lower extremity muscle activation and frontal plane movement in CAI subjects. **METHODS**: 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses (α=.05) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed. **RESULTS**: Figure 1. The rehab intervention resulted in up to (i) 23% more gluteus medius activation from 75 ms pre-contact to initial-contact, while no changes were detected in other variables (frontal ankle angle, frontal hip angle, and peroneus longus activation). **CONCLUSIONS**: Strength and neuromuscular control exercises enhanced GM activation prior to a demanding, athletic movement. While no corresponding preparatory movement differences were detected, the motion effect might be evident during or after foot contact. More data are needed to determine if the observed training effect could play a role in reducing injury.



D-46 Free Communication/Slide - **Concussion**

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 507

1924 **Chair:** Daniel C. Herman, FACSM. *University of Florida, Gainesville, FL.*
(No relationships reported)

1925 June 1 3:15 PM - 3:30 PM

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 3 groups: healthy controls (n=58), acute concussion (n=21) and prolonged recovery (n=10). The acute concussion group suffered a concussion ≤9 days prior to initial assessment, while the delayed recovery group suffered a concussion ≥16 days prior to initial assessment. Repeated measures ANOVA compared initial, 2 week and 6-week follow-up values between groups. Follow-up logistic equation to determine the accuracy of the diagnostic protocol. **Results:** Provoked symptoms for the Gaze Stabilization, Rapid Eye Horizontal, Smooth pursuit, and Optokinetic drum tests' and total combined number of symptoms provoked as well as near point of convergence distance were significantly greater at baseline for both the acutely concussed and prolonged recovery groups compared to a healthy group. A binary logistic regression revealed that a model total symptoms provoked across all clinical test and NPC distance was 90% accurate in predicating healthy versus concussed group status. **Conclusions:** Ocular motor tests such as near point of convergence as well as symptom provocation following the Horizontal Gaze-Stabilization Test and Rapid Eye Horizontal Test appear to be 90% sensitive to the effects of a concussion. Additionally, they appear to give valuable insight during the recovery process that may give clinicians added information when making return to play decisions and tracking recovery following a sport related concussion. Given the limited equipment, training and small time requirement, ocular-motor tests such as near point of convergence, GST, REH are valuable additions to a concussion evaluation protocol.

1926 June 1 3:30 PM - 3:45 PM

Concussion Induces Temporary Cardiovascular Autonomic Dysfunction

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Introduction: Numerous recent studies have indicated that concussions temporarily uncouple the relationship between the autonomic nervous and cardiovascular systems and thus promote abnormal heart rate variability. **Purpose:** The purpose of this study was to determine the acute effects of concussion on cardiovascular function using several common autonomic reflex tests. **Methods:** Twenty two recreational athletes (14 females, 8 males) were divided into two groups: recently concussed (n = 11) and control (n = 11). The recently concussed participants performed forced breathing, standing and Valsalva autonomic reflex tests on four occasions: 1. within 48 of injury, 2. 24 hours later, 3. 1 week after injury and 4. 2 weeks after injury. The matched controls performed the same tests on the same schedule. A Finapres Pro was used to continuously measure heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) responses to the tests, and group differences were analyzed using repeated measures MANOVAs and ANOVAs. **Results:** The concussed group had significant elevations in both resting SBP (144.1 ± 21.4 vs 126.6 ± 11.1 mmHG for the controls, $t_{20} = 2.41$, $P = 0.03$, $d = 1.03$) and HR responses to standing (HRmax/HRmin = 1.8 ± 0.4 vs 1.5 ± 0.2 for the controls, $t_{20} = 2.08$, $P = 0.04$, $d = 0.88$) within 48 hours of injury, but those abnormalities were resolved by the next day. There was also a significant interaction with the HR responses to forced breathing ($F_{3,60} = 2.78$, $P = 0.04$, $\eta_p^2 = 0.12$), which indicated the concussed group's scores declined relative to the control's over the course of the four measurements. **Conclusions:** These results indicate that concussion caused a temporary disruption in autonomic control of cardiovascular function and that autonomic reflex tests, such as the standing and forced breathing tests, may be valuable assessments with which to evaluate the recovery from concussion.

1927 June 1 3:45 PM - 4:00 PM

Attenuation of Spontaneous Baroreceptor Sensitivity following Concussion

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Perturbations to systolic blood pressure (SBP) are buffered by a reciprocal change in heart rate (HR) though the baroreflex. Sensitivity of the baroreflex (BRS) to hemodynamic challenges is present across a range of blood pressures in otherwise healthy individuals, whereas with neurological trauma/impairment BRS declines as a characteristic of autonomic dysfunction. Previous evidence indicates that a state of transient cardiovascular autonomic dysfunction is present after concussion, but whether or not BRS is affected, has yet to be identified.
Purpose: To evaluate changes in BRS in recently concussed male athletes and non-injured controls during the first week following injury.
Methods: A prospective, parallel-group, repeated-measures and observational study was performed. Eight intercollegiate male athletes with concussion (age: 20±1 years; height: 71±5 inches; weight: 178±18 pounds) and 6 non-injured male athletes (age: 20±1 years; height: 71±4 inches; weight: 180±35 pounds) participated. Cardiovascular autonomic assessment (i.e., digital electrocardiogram and continuous beat-to-beat blood pressure) was performed in the seated upright position at rest within 48 hours (48H) of concussion and 1 week (Wk1) later. HR and systolic blood pressure (SBP) were determined and BRS was calculated using the bi-variate phase-rectified signal averaging technique of the respective digital signals.
Results: Separate univariate analysis of variance was performed and there were no group differences for demographics, HR or SBP at 48H or Wk1. At 48H, concussed athletes presented with a significantly reduced BRS compared to non-injured controls (concussion: 3±2 vs. control:
6 ±2 ms/mmHg; $p<0.05$). At Wk1, the reduction to BRS in the concussed athletes was still apparent (concussion: 3±3 vs. control: 7±3 ms/mmHg; $p<0.05$).
Conclusions: These preliminary findings demonstrate that reduced BRS is a characteristics of post-concussive autonomic dysfunction during the first post-injury week. Further work is needed to extend and define the implications of impaired BRS and determine whether it contributes to exercise intolerance during the progressive return-to-play.

1928 June 1 4:00 PM - 4:15 PM

The Effect of Exercise Induced Dehydration on SCAT3

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(No relationships reported)

Sports-related concussions are plentiful in the United States. Various diagnostic tools are utilized in order to monitor deviations from baseline in memory, reaction time, symptoms, and balance. Evidence indicates that dehydration may also alter diagnostic tests. **PURPOSE**: To determine the effect of exercise-induced dehydration on deviations in cognitive performance related to concussion diagnostics. **METHODS**: Seventeen recreationally active subjects (age = 23.1 + 3.1 years, height = 168.93 + 10.71 cm, mass = 66.16 + 7.14 kg). Subjects performed three thermoneutral, counterbalanced sessions (control, euhydrated, dehydrated). Subjects were either restricted (0.0 L/hr) or provided fluids (1.0 L/hr) while treadmill running for 60 min at an intensity equal to 65-70% age-predicted maximum heart rate (APMHR). Sport Concussion Assessment Tool 3 (SCAT3) was utilized to assess symptoms, memory, balance, and coordination. **RESULTS**: We found a significant difference between sessions on modified BESS. ($F_{2,16} = 8.87$, $P = 0.003$). The control session had a significantly lower mean symptom score (2.93 + 3.28) than the dehydrated session (10.93 + 11.46; $P = .028$). The control session had a significantly higher mean memory score (28.27 + 1.28) than the dehydrated session (27.60 + 1.72; $P = .046$). **CONCLUSIONS**: Mild exercise-induced dehydration results in increased self-reported symptoms associated with concussions. Similarly, adequate hydration during exercise may help maintain cognitive function and balance during sport.

1929 June 1 4:15 PM - 4:30 PM

The Effectiveness Of Prescribed Rest Depends On Initial Presentation Following Concussion

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Reported Relationships: A.P. Kontos: *Contracted Research - Including Principle Investigator; GE.*

Following a concussion athletes are often prescribed physical and/or cognitive rest. However, 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 presentation.
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- Symptoms, 2+ Signs) x 2 (treatment- prescribed rest, usual care) ANOVAs were performed for each outcome measure. Univariate nonparametric tests (i.e., $\chi 2$ 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 ($F=6.31$, $p=.01$, $\eta 2=.07$). Prescribed rest increased the likelihood of being symptomatic at days 1-6 and 8 ($p <.05$) for the Symptoms group. In contrast, rest was beneficial for patients in the 2+ Signs group on verbal memory performance ($t=-2.28$, $p=.029$).
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 benefitted 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.

1930 June 1 4:30 PM - 4:45 PM

Predictors Of Concussive Recovery In Adolescents: The Influence Of Race And Gender

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(No relationships reported)

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 disorders [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 16 days in white 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 = .449, 95% CI = .272 - .741, p = .002) and prior concussion (HR = .574, 95% CI = .397 - .828, p = .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 = .003). **CONCLUSION:** 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.

1931 June 1 4:45 PM - 5:00 PM

An Examination of Adolescent Athletes and Non-athletes on Baseline Neuropsychological Test Scores

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An estimated 15.3 million adolescent students are enrolled in high school. However, approximately 7.6 million participate in athletics. Research has examined different demographics in high school athletes, however athletic participation may play a larger role in test performance than previously thought. Currently, research involving concussion assessment utilizes non-injured athletes as controls, but due to the intense nature of athletics, this may not be appropriate. **Purpose:** Examine differences between athletes and non-athletes using a common computerized neuropsychological test. **Methods:** 662 adolescent high school students (athletes (ATH): n=383, non-athletes (NON): n=279) were administered a computerized neuropsychological test battery (ImPACT ®) during baseline concussion assessment. Differences between groups were calculated using a one-way ANOVA. All statistical analyses were conducted using SPSS 23.0. Significance levels were set *a priori* at $p \leq .05$. **Results:** Statistically significant differences were found between ATH and NON in Composite Verbal Memory ($F(1, 660) = 4.653$, $p =.031$), Composite Reaction Time ($F(1, 660) = 15.869$, $p \leq .001$), and Total Symptom Score ($F(1, 660) = 38.996$, $p \leq .001$). Non-athletes performed better on verbal memory and reported more symptoms, while ATH had faster reaction times. No significant differences were found in composite visual memory, composite visual motor, and composite impulse control ($p \geq 0.05$).
Conclusion: Significant differences were found between ATH and NON for symptom reporting, verbal memory, and reaction time. Athletes may have additional training or motivational factors during testing which may affect participation or return to play decisions. Overall, these significant differences in baseline performance should be accounted for when making concussion diagnostic and management decisions. Future research should be conducted to examine the influence of athletic participation on the recovery process to see if non-athletes can be used as healthy controls.
Supported by: The National Operating Committee on Standards for Athletic Equipment (NOCSAE).

1932 June 1 5:00 PM - 5:15 PM

Establishment of Normative Clinical Reaction Times in a Pediatric Population

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Introduction: The puck-drop (PD) test has been utilized to assess clinical reaction time (CRT) and has been proposed as a tool to aid in the management of sports related concussion. The simplicity of the test and low cost make it an attractive tool in the management of these injuries; however, no normative data has been established in children, making post-concussion testing in this population difficult to interpret.
Purpose: The purpose of this study is to examine the use of the PD test in the pediatric and adolescent population: 1) to develop age specific normative values and 2) to examine the effect of sex and handedness on test performance.
Methods: Patients (ages 8-18) who presented to sports medicine clinics for evaluation and treatment of non-concussive injuries and whose presenting complaint would not confound completion of the PD test (LE injury, recovered injury, etc.) were recruited for baseline assessment. Testing was conducted in accordance to protocols previously described in the literature. Two practice trials were conducted. The distance of stick transversal was recorded to the nearest 0.5 cm, as well as the number of drops and failed attempts. The test was completed when 8 successful trials for each hand were recorded. Children with hands too small to circumvent the puck diameter were accommodated by starting at 10 cm above the puck base at the discretion of the test administrator.
Results
463 subjects completed the study (n=178 male, n=285 female, average age 13.04 +/- 2.57 years). Regression analysis of baseline CRT indicated a strong effect of age on overall CRT for both right and left hands ($R^2 = 0.21$, $p<0.001$, Figure 1). The estimates (SE) of right hand CRT ranged between 255.51 (4.66) to 216.15 (4.97) ms, and those of left hand ranged from 257.41 (4.71) to 219.08 (5.02) ms across 8-18 years of age. There were no differences in performance on CRT based on handedness (p=0.78) or sex. (p=0.84).

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, preliminarily 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. Chomistek. *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-Labelled Water

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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 (SEE 251-319 kcal/d or 9-11% of DLW-measured TEE), 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.

1935 June 1 3:30 PM - 3:45 PM

Workplace Sedentary Behavior Questionnaire: Validity and Responsiveness to Change

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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 activPAL3c 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 reported behaviors to 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 hours was over-reported (51.7 [34.5, 68.8] min/day, RMSE= 211.8). Sitting on non-work days was underestimated (-87.2 [-111.6, -62.7] min/day, RMSE= 298.8). SBQ 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.

1936 June 1 3:45 PM - 4:00 PM

The Validity of Fitbit Charge in Free Living Conditions

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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/day.
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 against the criterion using indicators of Pearson correlation, mean absolute percent errors, mean percent errors, and equivalence testing. The activity classification agreement of MVPA at the minute level was evaluated with Kappa, sensitivity and specificity.
RESULTS: Complete data were collected on 61 individuals with an average of 5.5 days of wear-time. The average daily MVPA measured by accelerometer was 76.3 minutes compared to a higher value, 118.7 minutes, estimated by the FBC. The correlation between the two methods was 0.8 ($p<0.0001$). The mean absolute percent errors and mean percent errors were 68.2% and -64.2% indicating a consistent overestimating MVPA by the FBC. The average daily steps were 8,897 and 7,716 measured by FBC and accelerometer, respectively, with a correlation of 0.76 ($p<0.0001$). The mean absolute percent errors and mean percent errors of steps estimated by FBC were 30.0% and -20.1%. Neither of the MVPA and steps measured by FBC fell into the ±10% equivalence zone set up by the accelerometer. The Kappa statistics of the classification agreement between the two methods was 0.32 with a low the sensitivity of 30.1% but a high specificity of 96.7%.

CONCLUSIONS: This FBC estimated substantially higher minutes of MVPA in free living conditions among healthy adults and significantly higher steps compared to research grade accelerometer. The researchers who use FBC to track physical activity need to interpret their results with caution.

1937 June 1 4:00 PM - 4:15 PM

Reliability and Validity of a Workers' Sitting Time Questionnaire (JNIOSH-WPAQ) Using The Percentage Method

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(No relationships reported)

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 reliabilities for sitting time in all four domains. That is, the ICCs for working time, commuting time, non-working time on a workday and non-workday 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-workday (0.41) was "low" (0.30-0.49). On the other hand, the ρ values during working time (0.61) and non-working time on a workday (0.55) 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)

1938 June 1 4:15 PM - 4:30 PM

Evaluating Measures of Physical Activity and Sedentary Behavior Suitable for Large Epidemiologic Studies

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(No relationships reported)

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 wore an ActiGraph (AG) on the waist twice for 7-d. AG equations (Freedson, Sasaki, Crouter 2-regression, Lyden machine learning [Soj3x]) were used to estimate PAEE. A/ST was quantified via Crouter, 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 activPAL measures, mean age and BMI was 63 y and 23.8 kg/m^2. Mean criterion values were: DLW PAEE (747 kcal/d, n=689) and activPAL A/ST (6.0/9.8 hrs/d, n=932). Accuracy in assessing PAEE was similar for the Q and ACT24 (-12% vs. 10%), but accuracy was lower for the Q than ACT24 for estimating A/ST (-48%/-18% vs. 3%/1%). Among AG measures, Crouter was most accurate for PAEE (-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 (r=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.

1939 June 1 4:30 PM - 4:45 PM

Dietary And Physical Activity Measurement Tools Accurately Predict Total Energy Expenditure In Adults Aged 50-74

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(No relationships reported)

Unfavorable changes in body composition associated with the aging process can contribute to the development and severity of chronic diseases. Adequate dietary intake and physical activity (PA) after the age of 50 can reverse these changes to sustain overall health and quality of life. **PURPOSE**: We 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) 93% 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 Mifflin-St. Joer equation (mean 1,496 kcal) (*Beta* = -.433, $p < .001$), steps measured by ActiGraph acclerometers (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 REE 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 REE from the Mifflin-St. Joer equation, steps measured by ActiGraph, and fiber intake from DHQ-II are the most advantageous tools to determine TEE in older adults.

1940 June 1 4:45 PM - 5:00 PM

A Consumer Activity Tracker Is Sensitive In Detecting Change In Free-living Energy Expenditure And Steps

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(No relationships reported)

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. **PURPOSE:** To explore the sensitivity of ATs in detecting change in estimated EE and steps compared to changes in directly observed behavior and criterion steps in free-living settings. **METHODS:** Seven participants were directly observed on three separate days for 2-hours each day in free-living settings. Participants wore 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			
CSC step change	5%	15%	25%
AT hip (% agreement)	90.4	85.7	80.9
AT wrist (% agreement)	100	95.2	85.7
Percent agreement: criterion energy expenditure compared to estimated energy expenditure			
DO EE change	5%	15%	25%
AT hip (% agreement)	66.6	66.6	76.2
AT wrist (% agreement)	71.4	66.6	61.9

CONCLUSIONS: These preliminary results provide evidence that ATs are sensitive in detecting change in steps and EE. For step estimates, the wrist 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 regular rhythm with no murmurs. No friction rub heard. Distal pulses are intact. 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** WBC 5.5, HGB 13.7 Troponins- 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 Barium swallow study: transient "feline esophagus" without diverticulum or stricture EGD: longitudinal furrows with punctate white spots. Biopsies revealed increased intra-epithelial eosinophils up to 50 per hpf TSH 1.06 ANA, ANCA, Anti-SCL 70, C4 all negative **FINAL WORKING DIAGNOSIS** Presumptive Viral Myocarditis Eosinophilic Esophagitis (EoE), biopsy-proven **TREATMENT AND OUTCOMES** Placed on medical hold for remainder of football season Repeat cardiac MRI improved Returned to light weightlifting and easy spinning without recurrence of symptoms. Will be reevaluated by exercise stress test and echocardiogram before further return to sport decisions are made Remains on twice daily omeprazole 40 mg for management of his EoE until follow up with GI.

1945 June 1 3:35 PM - 3:55 PM

Cardiopulmonary- Soccer

Kaleigh Suhs, Luke Stephens. *Advocate Lutheran General, Park Ridge, IL.*
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(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. Lungs: 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
TEST AND RESULTS: CBC: 4.8>13.2/40<202, PT: 13.6, INR: 1.0, PTT 29, Quantiferon Gold: negative. Protein C:98 Protein S: 88 Cardiolipin AB:4 Factor V Leiden, prothrombin gene mutation, and lupus anticoagulant: negative
Chest X-ray : Infiltrate in posterior segment left lower lobe
CT PE: Multiple pulmonary emboli in bilateral distal lobar and segmental pulmonary arteries with probable right heart strain.
2D ECHO: 1. Normal left ventricular function. LV ejection fraction estimated to be 55 to 60%. **FINAL WORKING DIAGNOSIS**: Bilateral pulmonary emboli-provoked (likely causation-oral contraceptives)
TREATMENT AND OUTCOMES: Athlete was admitted to University Hospital for 24 hour observation after outpatient CT showed bilateral pulmonary emboli. A Work-up for coagulopathy was performed and the athlete was started on Apixaban 10mg PO BID x 7 days followed by Apixaban 5mg PO BID for a total treatment duration of 3 months. While on anticoagulation, the athlete was held out of all activities for 6 weeks, and then was slowly progressed to non-contact cardiovascular training, which she has tolerated well.

1946 June 1 3:55 PM - 4:15 PM

Cardiovascular Injury-Marathon Running

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(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, her right sided 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
TEST AND RESULTS: BMP, CBC, Troponin, UDS, EKG, and CT Head without contrast were all normal. CT angiography of the neck: Acute focal right vertebral artery dissection at C2-C3. MRI of the brain and MR angiography of the neck: Right cerebellar vermis infarct and confirmed right vertebral artery dissection at C2-C3 with associated thrombus. Cerebral angiography: Dissection of the right vertebral artery with associated non-occlusive thrombus and distal occlusion of the right PICA.
FINAL WORKING DIAGNOSIS: Right vertebral artery dissection and right cerebellar vermis infarct
TREATMENT AND OUTCOMES:
The patient was started on a heparin drip with transition to warfarin for anticoagulation and secondary stroke prevention. The patient will continue on warfarin for at least 3 months.

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 Marines-Price, Andrew R. Tomlinson, Tony G. Babb, FACSM, Benjamin D. Levine, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Tony G. Babb, FACSM)
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(No relationships reported)

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 (mean 24); 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
3. Deconditioning
4. Aging
TEST AND RESULTS:

CPET Results

Variable	Rest	SS 1	SS 2	Peak
Workload (W)	0	40	60	120
VO_2 (L/min)	0.22	0.88	1.14	1.60
HR	77	124	149	179
Q_C (L/min)	3.24	7.2	7.45	9.19
V_E (L/min)	9.56	38.18	52.97	101.8
V_E/VCO_2	59	43	45	53
SpO_2 (%)	100	96	95	95
$PetCO_2$ (mm Hg)	40	34	31	24
Lactate (mmol/L)	2.1	2.9	4.6	9.1
V_D/V_T (%)*	38	27	26	24

SS: steady state; * V_D/V_T estimated dead space to tidal volume ratio.

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:
PTE surgery
Post-surgery cardiopulmonary rehabilitation
Repeated CPET 15 months after surgery due to persistent DOE and no fitness gains

Repeated CPET Results (After PTE)

Variable	Rest	SS 1	SS 2	Peak
Workload (W)	0	40	60	140
VO_2 (L/min)	0.24	0.82	1.09	1.60
HR	79	103	132	170
Q_C (L/min)	3.89	7.17	8.63	-
V_E (L/min)	11.19	33.04	46.86	111.86
V_E/VCO_2	56	40	40	53
SpO_2 (%)	100	100	99	98
$PetCO_2$ (mm Hg)	37	37	36	26
Lactate (mmol/L)	2.8	2.1	3.6	9.9
V_D/V_T (%)*	34	27	28	24

SS: steady state; * V_D/V_T estimated dead space to tidal volume ratio.

Interpretation:
Mildly improved functional status
Improved hemodynamics
Mildly improved ventilatory inefficiency
TREATMENT AND OUTCOMES:
Cardiopulmonary rehabilitation and interval training
Consider RHC with exercise to evaluate for residual pulmonary vascular disease
Consider pulmonary vasodilator therapy if present

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

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(No relationships reported)

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: n/a
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, VO_2peak was 24.4 ml/kg/min and peak workload was 167 Watts For the CPX without LVAD support VO_2peak 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 ventricular 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.

D-49 Clinical Case Slide - **Leg**

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 402

1949 **Chair:** Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.*

(No relationships reported)

1950 **Discussant:** Terry Nicola, FACSM. *UIC Sports Medicine Center, Chicago, IL.*

(No relationships reported)

1951 **Discussant:** Martin P. Schwellnus, FACSM. *University of Pretoria, Pretoria, South Africa.*

(No relationships reported)

1952 June 1 3:15 PM - 3:35 PM

Foot Drop in a Cheerleader After a Yoga Pose

Vince Si, Melody Hrubes, Terry Nicola, FACSM. *University of Illinois at Chicago, Chicago, IL.* (Sponsor: Terry Nicola, FACSM)

(No relationships reported)

HISTORY
15-year-old healthy female referred for right foot drop and numbness of the right lower leg x 1 month and occurred during yoga. She is a cheerleader and is quite flexible, and the instructor had her do advanced poses that she had not done; she subsequently experienced pain in her anterior shins. She has experienced pain in anterior shins before; however, this time she had numbness and difficulty with ambulation and noticed she was tripping on the right. Of note, she was on oral antibiotics for recurrent ear infections that eventually required tubes to be placed. The antibiotics upset her stomach causing 15 pound loss from 12/2015 - 3/2016.
PE
Thin female, alert, in no distress
Extremities warm, well-perfused with 2+ pulses in DP, PT bilaterallyFull range of motion in lumbar spine and bilateral hips without pain
Atrophy of the right tibialis anterior, no subluxation of right fibula, no swelling
5/5 in strength in bilateral hip flexion, knee extension, knee flexion, ankle plantarflexion, left ankle dorsiflexion, and left 1st toe extension. 0/5 strength in right ankle dorsiflexion, right ankle eversion and right 1st toe extension. 5/5 in right ankle inversion

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
Plexopathy
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 WORKING 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.

1953 June 1 3:35 PM - 3:55 PM

Lower Leg Injury-Dance

Brittany J. Moore, Karen Newcomer, FACSM, Cara Prideaux. *Mayo Clinic, Rochester, MN.*
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(No relationships reported)

HISTORY: A 15 year old female high school dancer presented to clinic with recurrent left leg pain in setting of recently treated left fibular stress fracture. She initially presented 6 months prior with focal distal fibular pain. At that time stress fracture diagnosis was confirmed with X-Ray and MRI; imaging revealed incidental left talocalcaneal coalition (TCC). Treatment with walking boot immobilization and activity modification for 6 weeks resolved her pain. She returned to full activities including dance. After 4 months of pain free activity she now presented with left lateral fibular pain more diffuse than prior, worse with weight bearing. She denied trauma, swelling, numbness, tingling, or weakness. Her nutritional status was appropriate. Menstrual cycles were normal since menarche at age 11.
PHYSICAL EXAMINATION: Ankle and foot alignment was neutral. She was point tender over several inches of distal left fibula without tenderness of ankle or foot. Left subtalar pronation and supination motion was markedly limited compared to right, but pain free. Ankle strength was full and pain free through available range. Gait was normal. She was neurovascularly intact.
DIFFERENTIAL DIAGNOSIS: 1. Recurrent fibular stress fracture 2. Fibular stress syndrome 3. Symptomatic TCC 4. Peroneal tendinopathy
TEST AND RESULTS: Left leg MRI, 6 months prior: distal fibular shaft cortical thickening with increased T2 signal of intramedullary canal and periosteum consistent with early stress fracture. Left leg X-Ray, 2 view: cortical thickening of distal fibular diaphysis unchanged from 6 months prior. Left ankle CT: left fibrocartilaginous TCC with cortical irregularity, subchondral sclerosis and cystic changes of middle subtalar facet and adjacent calcaneus surface.
FINAL WORKING DIAGNOSIS: Recurrent left fibular stress fracture secondary to impaired subtalar motion from TCC
TREATMENT AND OUTCOMES: 1. Walking boot immobilization for 4 weeks to treat stress fracture 2. Orthopedics referral and surgery for left TCC excision with intraoperative normalization of subtalar motion 3. Postoperative short leg immobilization for 10 days 4. Ankle range of motion and strengthening exercises started 2 weeks postoperatively 5. Returned to sport 2 months postoperatively once incision healed and ankle motion/strength appropriate

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1954 June 1 3:55 PM - 4:15 PM

A Fibular Hook

Kevin N. Blythe, Bronson E. Delasobera. *MedStar Georgetown University Hosptial, Washington, DC.*
(No relationships reported)

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 pallor. PT for calf strain provided no relief. She previously 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 McMurray'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 Tendonopathy 4) Lumbar 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.*
(No relationships reported)

HISTORY:A 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 left 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. Allodynia 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. Superficial peroneal neuropathy 2. Common peroneal neuropathy 3. Lumbar radiculopathy
TEST AND RESULTS: -MRI lumbar spine: Mild multilevel DJD without 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. -Left 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-innervation 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.

1956 June 1 4:35 PM - 4:55 PM

Foot Numbness - Basketball: Doc, My Foot Is Numb!

Elizabeth Kaufman, MD, Bronson Elizabeth Delasobera, MD. *Georgetown, washington, DC.*
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(No relationships reported)

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 postero-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 radiculopathy 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:
Msk:
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 gastrocnemius rupture
Tests & Results:
L-spine xray: L3/L4 retrolisthesis.
Sono: 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
Final Working Diagnosis:
Tibial nerve compression due to popliteus muscle injury with concomitant mild rhabdo
Treatment:
Phentermine was stopped. He started PT after a 6-week period of rest from weight bearing exercise.
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.

1957 June 1 4:55 PM - 5:15 PM

A F44 Paralympic Track and Field Discus Thrower: A Case Report

Donald L. Hoover[1], David M. Bellar[2], Lawrence W. Judge[3]. [1]*Western Kentucky University, Bowling Green, KY.* [2]*University of Louisiana at Lafayette, Lafayette, LA.* [3]*Ball State University, Muncie, IN.* (Sponsor: Matthew Harber, FACSM)
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(No relationships reported)

HISTORY: A 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.

D-50 Clinical Case Slide - **Shoulder III**

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 504

1958 **Chair:** David Jewison. *University of Minnesota, Minneapolis, MN.*

(No relationships reported)

1959 **Discussant:** Bryan Wiley. *Kaiser Permanente, Rancho Cucamonga, CA.*

(No relationships reported)

1960 **Discussant:** Clifton Page. *University of Miami, Miami, FL.*

(No relationships reported)

1961 June 1 3:15 PM - 3:35 PM

Acute Atraumatic Shoulder Pain in a 39 Year Old Female

Sheila E. Taylor. *Wellspan Sports Medicine, York, PA.* (Sponsor: Mark Lavallee, FACSM)
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(No relationships reported)

Presentation: 39 year old female with acute onset of severe left shoulder pain and weakness 8 weeks prior. No history of trauma or prior shoulder injuries. Due to progressively worsening nature of pain, MRI was ordered prior to referral which revealed tears of supraspinatus, infraspinatus and biceps tendon.
History: Patient admitted to IV drug use and recent hospitalization for endocarditis and septic pulmonary emboli related to her IV drug use.
Physical Exam:
Left shoulder exam: No significant erythema, or edema. AROM: severely limited AROM in all planes due to pain. PROM: limited with pain. Strength: Diffuse weakness as compared to right side. Supraspinatus: 2/5, External Rotators: 2/5, internal rotators: 4/5, Biceps: 3/5, Triceps: 4/5. Tender to palpation over anterior shoulder, coracoid, long head of biceps and lateral deltoid. Negative Hawkins and Neers.
Broad Differential Diagnosis: Etiology of rotator cuff tear: Infectious- septic, osteomyelitis; trauma- bone bruise, contusion; degenerative; inflammatory- RA; ischemic- AVN; metabolic- gout; neoplastic- tumor; Iatrogenic- drug induced
Lab Studies: Fluoro guided aspiration and culture that revealed pseudomonas, susceptible to cipro, elevated WBC, CRP, and ESR. Positive RF, Negative ANA, Negative Lyme
Other Studies: Arthroscopy, irrigation, debridement, humeral and synovial biopsy which revealed acute synovitis, culture positive for pseudomonas. Humeral bone biopsy negative for osteomyelitis.
Consultations: Infectious disease
Working Diagnosis: Rotator cuff tear secondary to chronic septic arthritis related to IV drug use
Treatment: Arthroscopic irrigation, debridement, IV antibiotics and subsequent prolonged oral antibiotics, physical therapy, activity modification, cessation of IV drug use.
Outcome: Patient continues to have small improvements in her pain s/p above treatment and physical therapy.

Author's Comments: This case entails a common complaint (acute shoulder pain and MRI revealing rotator cuff tear) with uncommon mechanism. It is thought that her chronic septic arthritis eroded the insertion of her rotator cuff as evidenced by the soft bone found on arthroscopy. Moving forward, the question is when and if to repair her rotator cuff given her high risk of future illicit drug use and increased risk of repeat infection.

1962 June 1 3:35 PM - 3:55 PM

A Collapse that Led to Shoulder Pain

Michael Seifert, Krystian Bigosinski. *Maine Medical Center, Portland, ME.* (Sponsor: Heather Gillespie, FACSM)
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(No relationships reported)

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 back 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, Hawkin's, 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 posterolateral 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

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1963 June 1 3:55 PM - 4:15 PM

Shoulder Pain - Recreational Basketball

Julian D. Willoughby, Daniel Blatz. *Rehabilitation Institute of Chicago, Chicago, IL.* (Sponsor: Joseph Ihm, MD, FACSM)

(No relationships reported)

HISTORY:
A 35-year-old right hand dominant male with a history of right rotator cuff injury years ago presented with right shoulder pain for 3 weeks. He plays recreational basketball regularly but did not recall a specific injury. He described intermittent numbness, burning, and aching of the right posterior shoulder and proximal arm. Denied weakness, neck pain, or changes in pain with arm movement.

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:
Hypoechoic 1.6 cm structure without internal color doppler flow adjacent to the supraspinatus muscle.
R shoulder MRI:
Large paralabral cyst measuring 11x31 mm transaxially, spanning the spinoglenoid notch cranially and caudally. Tearing of the posterior superior and posterior labrum. Edema within the infraspinatus 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

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1964 June 1 4:15 PM - 4:35 PM

Shoulder Injury- Snowboarding

Kelsey Hoffman. *RiverStone Health, Billings, MT.*
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(No relationships reported)

HISTORY: A 25yo R hand dominant M sustained a shoulder injury during a fall snowboarding. Reported "catching an edge", falling directly on L shoulder. Immediate pain, difficulty with ROM at the shoulder. Presented 3 days after fall. Reported decreased ROM, swelling, and trouble sleeping due to pain, especially lying on the affected side. Had tried ice, topical methyl salicylate without improvement. Reported numbness, tingling in his L hand. Denied any previous injury/surgery.
PHYSICAL EXAMINATION: On inspection, L shoulder appeared inferior to R. Swelling, ecchymosis noted over L clavicle. No gross deformity or tenting. An asymmetrical appearance and feel when comparing both clavicles, L clavicle not as prominent and well-defined. Mild tenderness to palpation over L AC joint, severe tenderness at L SC joint. Decreased ROM with overhead movements, abduction across the body. Biceps, triceps, brachioradialis reflexes and sensation intact. Pulse intact.
DIFERRENTIAL DIAGNOSIS:
1. Clavicle fracture
2. SC joint dislocation
3. SC joint sprain
4. AC joint sprain
TESTS AND RESULTS:
2 view L clavicle, no fracture. Given concern for posterior dislocation of clavicle, CT upper chest/neck to rule-out damage to structures behind clavicle was ordered. He could not afford a CT scan so it was decided that his PE was not concerning for damage to posterior structures. Serendipity and lateral sternum radiographs at 2-week follow-up, no posterior dislocation, normal anatomical alignment of SC, AC joints. No labs were indicated.
FINAL/WORKING DIAGNOSIS:
SC joint sprain (grade I)
TREATMENT AND OUTCOMES:
1. Immobilization in a sling for 1-2 weeks for patient comfort
2. Pain control with ibuprofen, acetaminophen
3. Early range of motion exercise, followed by home or formal physical therapy
Initially referred to Orthopedics, but did not go due to financial concerns.
2-week f/u, out of the sling a majority of the time. Complained of "popping" sensation at SC joint. Started ROM exercises, resistance band work at home. Wanted to return to work (box sorter at shipping company) with lifting restriction/light duty.

4-week f/u, great improvement in pain symptoms and return of function, returned to work without issue or restrictions. NSAID daily. No laxity at the joint and exam symmetrical. "Popping" resolved. Patient lost to further follow-up.

1965 June 1 4:35 PM - 4:55 PM

Shoulder injury- Rugby, Progressive Shoulder Pain After Fall

Shane L. Larson[1], Caitlin M. Colitti[2], Lance LeClere[2]. [1]*Womack Army Medical Center, Fort Bragg, NC.* [2]*US Naval Academy, Annapolis, MD.* (Sponsor: Francis O'Connor, FACSM)
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(No relationships reported)

HISTORY: A 28-year-old female US Naval Academy college freshmen sustained a left wrist injury after fall on outstretched hand during an intercollegiate rugby match. She endorsed immediate onset pain, tingling, hypoesthesias into 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 hypoesthesias and ipsilateral palmar hypoesthesias in nondermatomal pattern.
DIFFERENTIAL DIAGNOSIS: 1. Cervical nerve root compression 2. Chronic Regional Pain Syndrome 3. Conversion Disorder 4. Brachial Plexopathy 5. Thoracic Outlet Syndrome 6. Parsonage-Turner Syndrome **TEST AND RESULTS**: Left shoulder anterior posterior, y-outlet view radiographs: —unremarkable left shoulder EMG left upper extremity: —normal electrodiagnostic study without evidence of brachial plexopathy or peripheral neuropathy MRI brachial plexus: —normal MRI Left forearm, humerus, and shoulder MRI: —normal MRI Cervical Spine MRI: —normal study
FINAL WORKING DIAGNOSIS: Conversion Disorder
TREATMENT AND OUTCOMES: 1. Relative rest, ice, compression and NSAIDs for 4 weeks with no improvement. 2. Activity modification demonstrated minimal improvement in shoulder pain 3. Range of motion, shoulder, and neck strengthening exercises with minimal improvement in symptoms 4. Further history revealed adjustment issues with college life, family stressors 5. Psychology consult placed and cognitive behavioral therapy started 6. Further follow-up with team physician revealed 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.

1966 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 to his left shoulder. He had no known other injuries. The first night he noticed stiffness localized to his chest and pectoral area. The following morning his left hand, forearm and arm were swollen and mildly discolored with prominent veins. His hand also felt funny and heavy. He had no chest pain or dyspnea. He continued to participate in baseball until he brought this to the attention of his athletic trainer two days later. He then presented to the emergency room for further evaluation.
PHYSICAL EXAMINATION: BP 130/70 mmHg | Pulse 62 | Temp 36.6 °C | Resp 18 | Ht 1.905 m | Wt 90.719 kg | BMI 25.00 kg/m2 | SpO2 98% Constitutional : Alert, no distress. Neck: Supple, non-tender. Cardiovascular: Heart regular rate and rhythm, no murmur. Respiratory: Lungs clear. Extremities: Diffuse swelling and mild duskiness of the left upper extremity compared to right. Prominent, dilated veins on left upper chest. Sluggish capillary refill with palpable but weak pulses. Arm circumference was 33.5 cm on the left and 32 cm on the right. Forearm circumference was 29.5 cm on the left and 28 cm on the right. Strength was normal. Neurological: Normal sensation to light touch.
DIFFERENTIAL DIAGNOSIS: 1. Deep venous thrombosis 2. Thoracic outlet syndrome 3. Soft tissue hematoma 4. Proximal biceps rupture
TEST AND RESULTS: Chest radiographs: - Clear lungs. Normal cardiac silhouette and pulmonary vasculature. Left upper extremity duplex ultrasound: - Acute venous thrombosis with total obstruction of the left subclavian vein and left axillary vein. The internal jugular, brachial, basilic and cephalic vein were patent. Labs: - Normal CBC and metabolic panel.
FINAL WORKING DIAGNOSIS: Paget-Schrotter Syndrome - Acute venous thrombosis with total obstruction of the left subclavian and axillary veins.
TREATMENT AND OUTCOMES:
1. Anticoagulation with heparin drip. 2. Venous thrombolysis, mechanical thrombectomy and angioplasty via interventional radiology. 3. Left first rib resection

D-59 Free Communication/Poster - Activity Interventions and Programming in Older Adults

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1988 Board #1 June 1 2:00 PM - 3:30 PM

Light and Moderate to Vigorous Physical Activity Correlates with Physical Fitness in Hispanic Elders

Roberto A. Meléndez-Toro[1], Osvaldo J. Hernández-Soto[1], Farah A. Ramírez-Marrero, FACSM[2], Shanes D. Padilla-Aponte[1]. [1]*Inter-american University of Puerto Rico, San Germán, Puerto Rico.* [2]*University of Puerto Rico-Río Piedras Campus, Río Piedras, Puerto Rico.*
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(No relationships reported)

Recent evidence suggests that light activity (LA) as well as moderate to vigorous physical activity (MVPA) are associated with reduced mortality from all causes. Physical fitness (PFit) is also associated with better health maintenance and functionality, particularly among elders. However, the association between LA and PFit components has not been explored in this population. **Purpose:** To evaluate the association between PFit and LA, LA to MVPA (LMVPA), and MVPA in a group of Hispanic elders in Puerto Rico. **Methods:** Sixty-two elders (24 females, 38 males; mean age= 76.4±8.4 yrs) completed a battery of PFit testing (sit and reach for flexibility, hand dynamometer and arm curls in 30 sec. for muscle strength and resistance, distance in 6 min for cardiorespiratory fitness, and foot up and go for agility), and wore an ActiGraph accelerometer (GT3X+) attached to a waist band during 7 consecutive days. Wilcoxon rank-sum tests were conducted to detect differences by sex, and spearman correlations to determine associations between PFit, LA, MVPA, and LMVPA. **Results:** PFit and physical activity variables were not different between females and males; but some differences were detected in some anthropometric variables (WHR; 0.96±0.07 vs. 0.91±0.07, and muscle resistance = 18.3±3.3 vs. 15.4±4.9, respectively, $P<0.05$). LA (27.7±11.5 hr/day), MVPA (59.7±118.0 min/week) and LMVPA (28.7±12.3 hr/day) correlated with cardiorespiratory fitness (0.30, 0.31, 0.28; respectively, $P<0.03$); time in agility test (-0.38, -0.27, -0.35; respectively, $P<0.04$), and muscle strength (0.29, 0.26, 0.28; respectively, $P<0.05$). Flexibility correlated only with LA and LMVPA (0.30, 0.29; respectively, $P<0.04$). **Conclusion:** Our results suggest that LA as well as LMVPA positively influence cardiorespiratory fitness, agility, muscle strength and flexibility components of PFit in Hispanic elders. Therefore, LA could be integrated in physical activity recommendations for this population.

1989 Board #2 June 1 2:00 PM - 3:30 PM

A Unique Yoga Meditation Program's (Yo-Med) Effect on Balance and Proprioception in Older Fallers

Savannah V. Wooten[1], Kiersten Mooney[2], Sohil S. Desai[1], Amelia K. Paine[1], Joseph F. Signorile[1]. [1]*University of Miami, Miami, FL.* [2]*Green Monkey Yoga, Coral Gables, FL.* (Sponsor: Arlette C. Perry, FACSM)
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(No relationships reported)

Falls are a major factor affecting mortality and morbidity in older individuals. Proprioception is a central factor modulating fall frequency and severity. Although specific protocols have been developed to improve proprioception in older fallers, many are too challenging or not palatable to a large segment of the population.
Purpose: Given the current popularity of yoga, and the effectiveness of mental imaging in training proprioception, this study examined the effectiveness of our newly developed yoga meditation program (Yo-Med) on balance and proprioception in a sample of older persons with moderate risk of falling.
Methods: Sixteen older persons were randomly assigned to one of two training interventions; Yo-Med Group (Yo-Med) or Proprioception Training Group (PT). Each group received 45 minutes of specified training, 3 days per week, for 6 weeks. Pre- and post-training outcome measures were used to quantify the effect of both interventions. Measurements taken included; The Balance Error Scoring System (BESS), The Tenetti Balance and Gait Assessment, Dynamic Posturography (Proprio 5000), Joint Position Sense, and Joint Kinesthesia.

Results: The primary findings of the study were that neither the Yo-Med or PT intervention groups showed statistical improvements in proprioception tests or field tests of balance. The Proprio 5000 overall dynamic motion analysis score (DMA) showed a significant time by group interaction (ηp2=.271; p=.039) and the time spent on the test (TOT) showed a trend toward a significant time x group interaction (ηp2=.221; p=.066), both favoring the Yo-Med group.
Conclusion: Our results indicate that our Yo-Med program has the capacity to improve dynamic balance even beyond a standard proprioception training program. The lack of significant findings in our proprioception and field tests were likely due to the healthy nature of our sample and the
duration of the intervention. Given our successful results in dynamic balance we suggest that this study be repeated with a larger sample with a greater risk of falls across a longer intervention period.

1990 Board #3 June 1 2:00 PM - 3:30 PM

Effect Of Strength Training On "excess" VO2 In Older Adults

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(No relationships reported)

Exercise tolerance is instrumental to obtain the health benefits associated with physical training in older adults. During cycling an "excess" in oxygen cost (VO_2) relative to power output (PO) (*i.e.* higher VO_2/PO ratio) appears above the lactate threshold (LT). This loss of muscle efficiency, of which type I fibers fatigue and/or increased type II fibers recruitment are putative causes, impairs exercise tolerance. **PURPOSE**: 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" VO_2. **METHODS**: 8 healthy older males (67±5yrs.) performed 5-weeks of ST (three, one-hour sessions per week). *Pre* and *Post* training we measured muscle strength (1RM Squat and Deadlift) and performed an incremental cycling test to exhaustion to determine: *i)* peak power output (PO_{peak}) and VO_{2peak}; *ii*) the slopes of the VO_2/PO relationship below (S_1) and above (S_2) the LT (modeled using a double-linear fit). Parameters were compared with paired *t*-test. **RESULTS**: Following strength training, muscle strength and PO_{peak} increased (+24 ± 9 % Squat, + 30 ± 16 % Deadlift; +8 ±7 % PO_{peak}, $p<0.05$) while VO_{2max} did not change (+2 ± 5 %, $p=0.24$). No "excess" VO_2 was present before (S_1=10.4±1.2, S_2=10.2±2.7 ml-min^{-1}-W^{-1}, $p=0.86$) or following strength training (S_1=9.3±0.3, S_2=10.2±2.7 ml-min^{-1}-W^{-1}, $p=0.38$). However, S_1 significantly decreased (Δ=-1 ml-min^{-1}-W^{-1}, $p=0.045$) after training. **CONCLUSIONS**: The "excess" VO_2 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 VO_2/PO relationship in the moderate-intensity domain (*i.e.* reduced S_1). 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.

1991 Board #4 June 1 2:00 PM - 3:30 PM

Effects Of Long-term Elastic Resistance Training On Oxidative Damage Of DNA In Older Adults

Phil Page, FACSM[1], Juan C. Colado[2], Guillermo Saez[2], Pedro Gargallo[2], Amaya Hernando[3], Nuria Estañ[3], Alvaro Juesas[2], Victor Muñoz[2], Victor Tella[2], Michael E. Rogers, FACSM[4].
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(No relationships reported)

It is theorized that age-related physiological changes are a consequence of the accumulation of random oxidative damage to deoxyribonucleic acid (DNA), lipids, and proteins. The major by-product of oxidative DNA damage, 8-Oxo-7,8-dihydro-2'-deoxyguanosine (8-oxo-dG), is the most extensively analyzed oxidative stress marker. The concentration of this biomarker increases as age increases. A higher concentration of 8-oxo-dG is related to diseases such as Alzheimer's, osteoporosis and oncogenesis. Despite the multiple benefits of resistance training on the aging process, the effect upon mitochondrial function and oxidative stress in older adults is unknown. **Purpose**: To determine the effects of a long-term, moderate-intensity elastic resistance training (ERT) program on oxidative damage of DNA in older adults. **Methods**: 46 sedentary older adults (69.1 ± 5.1 yr) were randomized into two groups: Control Group (CG) (n=15) and ERT group (ERTG) (n=31). A 32-wk ERT program was performed 2d/wk with 6 exercises (3 for upper and 3 for lower extremities) completed for 4 sets of 15 repetitions. Perceived effort was 6-7 on the OMNI-RES scale for elastic bands during the first 4 wks and at 8-9 for the final 28 wks. Urine 8-oxo-dG was analyzed using high-performance liquid chromatography at baseline, 16 and 32 wks. Urinary levels of 8-oxo-dG were calculated relative to creatinine levels. Trial (3) by group (2) repeated measures ANOVA was used to determine differences. **Results**: 8-oxo-dG was not different between groups at baseline (CG: 3.20 ± 2.51; ERTG: 3.72 ± 2.47 nmol/nmol creatinine). ERTG showed a significant ($p<0.05$) decrease in 8-oxo-dG for time and group of 26.07% at 16 wks and 49.43% at 32 wks. **Conclusion**: It is possible to reduce oxidative damage of DNA in older adults through regular ERT performed at moderate intensity. A longer training duration provokes greater effects on oxidative stress metabolism. These results highlight the possibility of using a non-invasive and low cost diagnostic method in conjunction with a simple and inexpensive ERT to prevent oxidative stress in older adults.

1992 Board #5 June 1 2:00 PM - 3:30 PM

Dynamic Postural Control and Hip Abductor Muscle Performance Following a 12-week Introductory Golf Program

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Aging is associated with physiological declines that impair the ability to perform activities of daily living and increase fall risk. Specifically, older adults demonstrate poorer mediolateral (ML) postural control and hip abductor muscle (ABD) performance as compared to young adults, and fallers demonstrate greater declines than non-fallers. Moreover, individuals with poorer ML postural control also have weaker hip abductors. PURPOSE: The purpose of this study was to investigate the effects of an introductory golf training program on dynamic ML postural control and hip ABD performance in an older military veteran. METHODS: One older military veteran (74 years old) completed 12 weeks of an introductory golf training program (2-90 minute sessions/week) that began with introductory swing training and progressed to regular golf play. Pre- and post-training, ML postural control was assessed via a choice reaction step task (10 trials). Weight-shift time, step time and movement time were calculated for 5 trials when stepping with the left limb. Peak hip ABD isometric torque and rate of torque development (RTD) was assessed utilizing a previously validated weight-bearing assessment (3 trials). RESULTS: Weight-shift time, step time and movement time decreased by 8.1%, 19.15% and 19.26%, respectively. Peak hip ABD torque increased 16.1% (0.81 N/kg to 0.94 N/kg) and RTD increased in the first 200 ms of the isometric contraction 83.62% (1.19 N/kg·s to 2.19 N/kg·s). CONCLUSION: Following the 12-week golf intervention, the participant was able to shift his weight and execute the step more rapidly, resulting in a shortened movement time and providing evidence of improved dynamic ML postural control. Additionally, the hip ABD performance improved as evidenced by increases in peak torque and RTD. The golf swing is initiated through near maximal activation of the gluteal musculature resulting in hip abductor torques on par with drop jump landings. Additionally, during a swing, the golfer rapidly shifts the center of pressure through a large range of the base of support. The demands of the golf swing likely served as a training stimulus to improve the ML postural control and hip ABD performance of our older military veteran, suggesting that golf is a viable physical activity intervention to attenuate declines associated with aging.

1993 Board #6 June 1 2:00 PM - 3:30 PM

Analysis of Aquatic Training Program In Water On Functional Parameters Of Elderly Women

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PURPOSE:To examine the effects of a training program based on impact and explosive movements performed in swimming pools on body composition (Total body weight, Body Mass Index-BMI, waist Hip Index-WHI, Fat Mass, lean mass), explosive strength (squat jump-SJ, counter movement jump-CMJ, counter movement jump arm swing-CMJas), and gait parameters (centre of pressure-COP, longitudinal displacement-LD) in women over 60 years
METHODS: seventy healthy and physically active old women (60 ± 4.19) was divided into a training group based on multi-jumps performed in a swimming pool ("n=35, GE") and a control group ("n=35, CG"). GE trained three times a week, an hour and a half per session and for a period of 32 weeks. Tests of body composition, explosive strength and gait parameters were applied before and after the training program

RESULTS: There were significant differences in body weight (GE=+2% vs CG= -1%; p=0, 013), BMI (GE=-1,6% vs. CG=-1%, p= 0,023) and WHI (GE=-1,6% vs CG= 1%; p=0, 042) between GE vs CG. Differences 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 (JG 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 swimming pools improve the strength expressions and induces significant adaptations in gait parameters, but not enough to alter body composition

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 decrease falls risk.
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 (74.41±7.57 years; 1.62±.10 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 visual acuity. Pre- and post-intervention FRS were compared. A repeated measures ANCOVA 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- (1.39±0.91) and post-assessment (1.66±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 improvements 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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(No relationships reported)

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±0.1m; 80.2±23.6kg), with a history of falling within the year prior to the study, participated in an 8-week exercise intervention program. The intervention program consisted 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 (9.45s±3.71) and post-intervention (9.86s±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 falls history. No differences in pre- and post-intervention TUG values were detected. Based on the findings of this study, the eight-week intervention program used had no meaningful effect in improving mobility for fallers. A plausible explanation is that participants were already within the TUG 95% confidence interval for their age group (8.2 – 10.2 seconds), and therefore further improvements may be difficult to achieve. Nonetheless, further interventions should focus on improving outcomes for individuals with a history of falls.
Research supported by grant from the Potomac Health Foundation

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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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: over 85 years) and tree by age equal control 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 (2.26-8.67%), 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 (5.35-11.57%) and blood pressure only for E2 (3.38%) 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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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 muscle 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 (HRR) 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 (1RM) 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 1RM 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 fat percentage (F=6.87, P=0.004). Significant interaction effects were observed in 1RM (leg press: F=19.394, P=0.001; leg curl: F=17.495, 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,

there was a significant difference regarding cfPWV between the AR and RA groups (P<0.05). cfPWV significantly reduced in the RA group (8.8±2.1 m/s to 7.6±1.9 m/s,P<0.05), while increased in the AR group (7.9±2.8 m/s to 10.0±2.6 m/s, P<0.01). **CONCLUSIONS**: Based on our results, no effects of different intra-session exercise order were observed regarding body composition and muscle strength. However, aerobic exercise after resistance training reduced arterial stiffness and difference of exercise order was observed.

1998 Board #11 June 1 2:00 PM - 3:30 PM

Effects Of Periodized Resistance Training On Sarcopenia Classification In Older Inactive Women

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(No relationships reported)

Sarcopenia is the age-related loss of lean mass and is associated with strength and functional impairment. Criteria developed by the European Working Group on Sarcopenia in Older People (EWGSOP), the International Working Group (IWG), and the Foundation for the National Institutes of Health Sarcopenia Project (FNIHSP) 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 will alter sarcopenia classification in women with sarcopenia symptoms. **METHODS**: Inactive women (n = 25) aged 72.3 ± 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 dynamometer, 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=7) to post intervention (n=8) by EWGSOP criteria; IWG criteria, baseline (n=10), post intervention (n=12), with no change in FNIHSP criteria. CON showed increases in non-sarcopenic classification from baseline (n=8) to post intervention (n=10) by IWG criteria, but no changes in classification by EWGSOP or FNIHSP criteria. There were no significant between group changes in distribution frequency of sarcopenia classification (EWGSOP, p = 0.392; IWG, p = 0.841; FNIHSP, no change). **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.

1999 Board #12 June 1 2:00 PM - 3:30 PM

Structured Exercise Classes And Non-structured Exercise Increase Functionality In Older Adults

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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. **PURPOSE**: To provide a summary of five collaborative teams that used standardized tests to measure changes in functional fitness scores among adults. **METHODS**: Adults ranged in age from 39-90+ years. Six tests for strength, aerobic fitness, flexibility, and dynamic balance were administered: CHAIR stand, ARM curls, 2-min STEP, sit-and-REACH, BACK scratch, and 8-FOOT up-and-go. Paired t-tests were used to analyze pre-and-post scores. Test sessions were arranged with the 5-6 collaborators and conducted in fall/spring: (1) F2008, (2) F2010, (3) F2014, (4) Spr2015, and (5) Spr2016. At the completion of the pre-tests, collaborators provided individual feedback and exercise recommendations to the adults and encouraged enrollment in a fitness class. **RESULTS**: Significant pre-and post-results, Mean (SD), were found for the following tests. **Fall2008** CHAIR M = 14.29 (2.27), M = 21.21 (5.19), p < 0.001; ARM: M = 16.79 (2.36), M = 21.57 (3.80), $p < 0.005$; EIGHT-FOOT: M = 5.44 (1.33), M = 4.81 (1.05), $p < 0.01$; **Fall2010** CHAIR: M = 18.14 (2.67), M = 22.00 (2.52), p <0.005; ARM: M = 24.86(3.49), M = 27.86 (3.63), $p < 0.01$; STEP: M = 144 (9.60), M = 131 (7.63), $p < 0.005$; **Fall2014-to-Spr2015** CHAIR: M = 14.73 (3.26), M = 18.07 (3.10), p < 0.001; ARM: M = 16.20 (2.65), M = 20.73 (3.31), $p < 0.0001$; STEP: M = 90 (15.15), M = 108 (18.63), $p < 0.001$; REACH: M = 1.55 (2.58), M = 3.57 (3.52), $p < 0.05$; **Spring2016** ARM: M = 17.32 (4.66), M = 196.04 (5.47), $p < 0.05$; EIGHT-FOOT: M = 5.67 (1.40), M = 5.16 (1.03), $p < 0.05$. **CONCLUSIONS**: Significant results indicating improved functionality were found for each testing session. Greater improvements were reported with longer time periods between pre-to-post assessment (e.g., F2014-to-Spr2015) and for 2 sets of test results administered only to adults enrolled in two evidence-based prevention/intervention programs (F2008 & F2010).

2000 Board #13 June 1 2:00 PM - 3:30 PM

Role Of Self-regulation In A Community-based Physical Activity Intervention For Older Adults

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Regular physical activity can reduce the risk of falls, hypertension, osteoporosis, stroke, and diabetes, yet only 27.3-44.3% 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 behavior change program. **METHODS:** Fifty-two older adults (age=72.3, yrs±8.0) 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. SR 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<.000) were noted in SR techniques (SR self-monitoring: 1.573±.72 vs 3.19±.91; SR goal setting: 1.55±.75 vs 3.02±.88; SR social support: 1.35±.55 vs 2.09±.67; SR reinforcement: 1.92±.76 vs 2.77±.67; SR relapse prevention: 1.45±.56 vs 2.17±.63; SR time management: 1.45±.80 vs 2.80±1.01) and total PA energy expenditure: 2143.31±2153.24 vs 4092.99±2635.78; moderate to vigorous energy PA expenditure: 742.84±1476.00 vs 2366.96±2112.94). **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.

2001 Board #14 June 1 2:00 PM - 3:30 PM

The Psychometric Properties Of The Self-efficacy For Walking Scale In Community-dwelling Older Adults

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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_{age}=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) 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 correlations of each item with the overall mean score ranged from 0.80 to 0.98. Concurrent validity with walking performance (M=431±119yds), as measured by yards walked in 6 minutes, was moderate (PPMC=.56); there was no correlation with current aerobic PA level (PPMC=.15; M=220±284min/wk)).
CONCLUSIONS: The SE for Walking Scale in community-dwelling older adults has evidence of reliability and moderate correlation 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.

2002 Board #15 June 1 2:00 PM - 3:30 PM

Effects Of A Physical Exercise Program To Improve The Level Of Independence In Elderly

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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 investigat 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=little dependence, 100=total independence. Data were recorded at baseline and 2-post-test (1st month 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 applied to analyze the effects and interactions between the factors: study groups and measure moments on the Barthel test overall score (0-100).
RESULTS: Experimental group showed trend towards to increase Barthel overall score (MD=11.77±6.26; p=0.066) 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.

2003 Board #16 June 1 2:00 PM - 3:30 PM

Disease Burden is Associated with Differences in Diurnal Patterns of Physical Activity in Older Adults

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(No relationships reported)

Physical activity is an important risk factor for disease and functional outcomes with aging. Measurement of objective physical activity by accelerometry has become common in recent years and is often reported as total or average daily physical activity. However, a better understanding of the diurnal patterns of physical activity may elucidate the associations among physical activity, disease, and functional outcomes in older adults.**PURPOSE**: To evaluate the relationship between disease burden and objectively measured physical activity, overall and by time-of-day. **METHODS**: Physical activity (PA) was measured using wrist-worn ActiGraph Link accelerometers continuously over 7 days in 63 older participants (31 women, aged 68±10 yrs) of the Longitudinal Aging Study at Towson (LAST). Data was smoothed into one minute intervals and expressed as the average counts per minute across the three axes. Diurnal patterns of activity were modeled as the average activity counts over six 4-hour time bins. Number of chronic diseases was determined using a health history questionnaire and calculated as the sum of eight different diseases (hypertension, high cholesterol, heart disease, diabetes, arthritis, respiratory disease, gastrointestinal disease, and psychological well-being). Disease burden was categorized as either low (0-2 chronic diseases) or high (3 or more). The association between the mean of the log-transformed activity counts and disease burden was modeled overall and across each time bin using linear regression, adjusting for age, sex, and BMI. **RESULTS**: Total 24-h PA (counts) was lower in those with high disease burden compared to those with low disease burden (3.2x106±0.9x106 vs. 3.8x106±1.0x106 counts, p = 0.01). When examining diurnal patterns, early morning (4:00am-8:00am), afternoon (noon-4:00pm), and early evening (4:00pm-8:00pm) PA was lower in those with high disease burden compared to individuals with low disease burden (p<0.05 for each period). **CONCLUSIONS**: PA is lower in older adults with high chronic disease burden, particularly in the late afternoon and evening. Interventions aimed at increasing PA in older adults with multiple chronic conditions should consider targeting daily nadirs of activity by promoting PA during the afternoon and evening when their activity is typically lowest.

D-60 Free Communication/Poster - **Concussion II**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2004 Board #17 June 1 3:30 PM - 5:00 PM

Eye Tracking as a Sports Concussion Assessment Tool: A Meta-Analytic Review

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Reported Relationships: N. Snegireva: *Salary; SensoMotoric Instruments. Consulting Fee; SensoMotoric Instruments.*

Sports concussion is a growing concern for many sports globally, with currently no standalone objective diagnostic tool. Several literature reviews on sports concussion are available, however few have focused on the use of eye tracking technology (ETT) as a possible diagnostic tool. PURPOSE: Provide a systematic synopsis of empirical evidence related to sports concussion diagnostics and ETT, highlight the limitations and the viability of ETT. METHODS: Electronic databases search was conducted in accordance with PRISMA guidelines. 134 selected studies were subjected to a full text scrutiny by two reviewers according to the predefined in- and exclusion criteria. A meta-analysis was conducted on the variables reported in 2 or more independent studies. Risk of bias was assessed using the RoBANS tool, and effect sizes were calculated in RevMan5 using the inverse-variance method and 95% confidence interval. RESULTS: The review integrates 10 publications on sports concussion and ETT with 410 participants (concussed N = 153, controls N = 257). Effect sizes were calculated across 12 variables for reflexive and self-paced saccades, smooth pursuit (SP), and fixations. Only 3 variables showed statistical significance: number of fixations outside of AOI ($Z = 5.65$, $p < 0.001$), radial error of SP ($Z = 4.44$, $p < 0.001$), and tangential error of SP ($Z = 3.59$, $p < 0.001$). As there is only limited research on EET in sport concussion and dependent measures vary across the studies considerably, it was only possible to conduct the meta analysis on a maximum of 3 studies, which is not sufficient to adequately estimate heterogeneity. CONCLUSIONS: Relative to controls, the concussed participants showed deficits in radial and tangential errors of SP and in number of fixations in a fixation stability task, but not in saccadic eye movements. Due to its quick and objective nature, ETT may be a promising diagnostic tool for sports concussion, but more comparable research is needed to establish best practices.

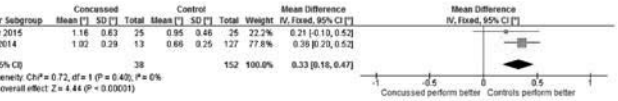

Figure 1: Radial error of the smooth pursuit

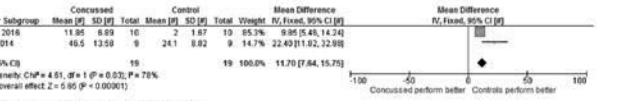

Figure 2: Number of fixations outside of AOI

2005 Board #18 June 1 3:30 PM - 5:00 PM

No Performance Changes Following a Concussion Amongst National Hockey League Players

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(No relationships reported)

Athletic performance following sport-related concussion (SRC) is an emerging area of research. Lingering neurological deficits in postural control and neurocognition may impair athletic performance. Previous reports have found no difference in performance after SRC among professional hockey players as measured by routine statistics (e.g. goals, assists), yet advanced metrics may identify subtler differences in performances have not been studied. PURPOSE: To examine changes in hockey player performance using advanced metrics upon returning from a SRC as compared to non-injury time loss players. METHODS: Between 2008 and 2015, 90 National Hockey League (NHL) players with documented concussions and 51 NHL players who missed games due to non-injury related causes were identified. Players with intervening missed times and confounding orthopaedic injuries were excluded. Advanced metrics were retrieved from WAR-on-ICE blog and available statistics were compared to NHL.com to ensure validity. A total of 51 metrics were identified and performance was compared between pre- and post-concussion over 5 games, 10 games, or the season (all games

prior versus all games post-concussion). Dependent variables were compared with a 2 (Group) x 2 (Time) repeated measures ANOVA and a conservative alpha value of 0.01 was set due to lack of variable independence. RESULTS: There were no significant interactions between groups for the 5 game analysis. Significant interactions were noted only for Time on Ice - Percentage (percentage of time a player was on the ice) for 10 games (Concussion: +0.59%, Control: -0.97%; P<0.001, d=0.007) and full season (Concussion: 0.34% change, Control: +0.96%, P=0.04; d=0.055). Several variables including high danger scoring chances and PDO (on-ice save and shooting percentages) were below 0.05, but effect sizes were less than 0.1; suggesting the differences were not meaningful. CONCLUSIONS: These results suggest there are no meaningful performance differences in NHL players upon return from SRC. The only significant finding was an inconsistent change in time on ice following injury, but the effect sizes were very small (Cohen's d<0.06). These findings are consistent with previous studies which found little impaired performance in professional hockey or basketball players upon return from SRC.

2006 Board #19 June 1 3:30 PM - 5:00 PM

Head Impacts In Men's Lacrosse: Incidence And Force Application

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(No relationships reported)

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 wore 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. 36.8 + 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 impacts position dependent. Further research is required to understand the potential implications of head impacts in men's lacrosse.

2007 Board #20 June 1 3:30 PM - 5:00 PM

Sleep Quality and Concussion Recovery Utilizing Subjective Sleep Assessments

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(No relationships reported)

Sleep is pertinent in maintenance of cognitive functions including learning and memory formation, and may play a role in brain recovery following concussion. However, the relationship between sleep quality and concussion recovery remains unclear. **PURPOSE:** To determine if post-concussion sleep quality, as measured by subjective sleep assessments, influences days to recovery. **METHODS**: Seventeen college-aged participants (age: 19.6±1.2years, height: 174.3±9.4cm, mass: 76.4±23.2kg) were recruited following concussion diagnosis by a physician. Once clinically recovered based on symptom severity, neurocognitive, and balance performance scores, participants completed the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS) to assess for sleep quality since concussion. Analyses included PSQI global scores, PSQI individual scores from seven sleep components: duration, disturbance, latency, day dysfunction, efficiency, overall quality, and medication, and ESS total scores. We considered PSQI global scores ≤5 "good sleep quality" and >5 "poor sleep quality". ESS scores ≤10 indicated lesser fatigue and >10 greater fatigue based on published cutoffs. Pearson's correlations were conducted to determine the relationship between sleep quality outcomes and days to recovery. Independent samples t-tests were performed to compare days to recovery between participants with 1) good and poor sleep quality and 2) lesser and greater fatigue ($\alpha \leq 0.05$). **RESULTS:** We found that greater sleep efficiency following concussion was strongly correlated with fewer days to recovery (r=-0.66, p=0.004). Days to recovery did not significantly differ between participants based on sleep quality (good quality: 15.3±5.5days; poor quality: 24.4±30.8days; $t(4.1)$=-0.65, p=0.548). Fatigue-related groups did not differ based on days to recovery (lesser fatigue: 14.8±6.3days; greater fatigue: 12.3±2.2days; $t(14)$=0.79, p=0.442). **CONCLUSION**: Participants with better sleep efficiency were more likely to recover faster compared to those with poorer sleep efficiency. Sleep efficiency may be an important factor in brain recovery. Clinicians should consider providing educational sleep interventions with a focus on maximizing total time asleep compared to total time in bed following concussion.

2008 Board #21 June 1 3:30 PM - 5:00 PM

Relationship Between Subconcussive Impacts on Clinical Measures of Neurologic Function in College Women's Soccer Players

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(No relationships reported)

Sport concussions have been associated with acute and chronic neurologic impairment. The specific contribution of sub-concussive impacts in women's soccer has not been adequately studied.
PURPOSE: To explore the relationship between sub-concussive head impacts on clinical measures of neurologic impairment in Division I women's soccer players. **METHODS:** College women's soccer players (n=19) completed two clinical measures of neurologic function (pre- and postseason) commonly employed when evaluating concussion. These tests included computerized neurocognitive testing (CNS Vital Signs) and the Balance Error Scoring System (BESS). Peak head linear and rotational accelerations were recorded using the X2Patch. Statistical analyses included 12 separate multiple linear regression analyses (enter method on change scores (preseason minus postseason) computed for each of our dependent variables, including all 11 CNS Vital Signs standard scores and the BESS total errors. The 5 independent variables included for each analysis consisted of: (1) head impact frequency, (2,3) head impact frequency exceeding the sample's 95th percentile (linear and rotational), and (4,5) the total impact cumulative magnitude (linear and rotational). **RESULTS:** College women's soccer players sustained a median of 78 head impacts over the course of a single season. We observed significant regressions for Composite Memory (p=0.02, R^2= 0.71), Verbal Memory (p=0.04, R^2= 0.64), Visual Memory (p=0.04, R^2= 0.65), and Reasoning (p=0.03, R^2= 0.68), but none of the other CNS Vital Signs or BESS outcomes (p>0.05; R^2 range: 0.25–0.58). In most cases, total head impact frequency had a positive effect (improvement), yet the total impact cumulative magnitude had a deleterious effect on observed change scores. **CONCLUSION:** With the few exceptions noted above, any changes in performance were widely independent of total impact frequency, severity (>95th percentile), and cumulative impact magnitude over one season. Repetitive sub-concussive head impacts over a single season do not result in pronounced short-term neurologic impairment. The effect of cumulative head impact burden should be further investigated to determine long-term changes resulting from a potential dose–response over a player's college career.
Supported by NOCSAE.

2009 Board #22 June 1 3:30 PM - 5:00 PM

Dynamic Balance Deficits Following Concussion

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(No relationships reported)

Dynamic balance deficits during gait have been observed following concussion and often linger beyond an athlete's return to activity. However, there are limited data describing balance performance during functional movements.
PURPOSE: To determine if participants with a concussion history demonstrate dynamic balance deficits compared to control participants during single leg squats and single leg hops. **METHODS:** Participants with a concussion history (n=15, median time since concussion=126 days; range 28-432) were matched by age, mass, and height to control participants (n=15). Participants performed single leg squats while standing on a force plate from which center of pressure path and speed were obtained. During single leg hops, participants jumped off a 30cm box placed 50% of their height behind a force plate, landed on a single leg, and attempted to come to a stable position as quickly as possible. Single leg squat outcomes were averaged across legs as there were no between leg differences (p=0.480; dominant leg=leg participant kicks ball with). Time to stabilization (TTS; time taken for center of pressure to stabilize after landing) was calculated for the single leg hop, and each leg was analyzed separately due to concerns with between leg differences (p=0.055). Groups were compared using

ANCOVA, 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 different between groups (p=0.431). 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 between 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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(No relationships reported)

PURPOSE: The vestibular, visual, and somatosensory (cervical proprioception) systems may have deficits without overt symptoms. One 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 (±6.56) 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 or concussion injury. Concussion had correlational 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 injury 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.

2011 Board #24 June 1 3:30 PM - 5:00 PM

Pre- and Post-season Assessments Of Neurologic Function In Youth Football Players

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(No relationships reported)

Nearly 70% of US football players are younger than high school age, yet little is known about the potentially damaging effects of repetitive sub-concussive head impacts in this population. Objective measures of neurologic function used to evaluate concussions may be useful for assessing neurologic impairment in non-concussed players. **PURPOSE:** To assess neurologic function of youth football players before and after a full season using selected clinical measures commonly used for concussion evaluation. **METHODS:** During a five year span (2011-2015), fifty-six middle school (7th & 8th grade) football players (13.0 ± 0.6 yr) were evaluated before (PRE) and after (POST) their respective seasons, using objective, clinical assessments of neurologic function. Sixteen subjects participated for two consecutive seasons, allowing season-to-season (7th vs. 8th grade) subgroup comparisons to be made. Participants were assessed PRE and POST for oculomotor function (King-Devick Test; KD; sec), simple reaction time (RT; sec), and standing balance, performed during an eyes-open (EO) and eyes-closed (EC) condition. Balance testing was performed on a force plate and results were calculated as center of pressure excursion (95% ellipse area; cm^2) during the balance task. **RESULTS:** KD time was significantly faster ($P < 0.0001$) from PRE (50.22 ± 10.56 sec) to POST (46.02 ± 9.57 sec). PRE to POST differences in RT (0.31 ± 0.05 vs. 0.30 ± 0.05 sec; $P = 0.12$), EO (1.47 ± 0.96 vs. 1.23 ± 0.82 cm^2; $P = 0.05$), and EC (2.20 ± 1.58 vs. 2.00 ± 2.90 cm^2; $P = 0.41$) were not significant. Only KD time (55.03 ± 13.65 vs. 47.88 ± 12.48 sec) was significantly different (faster; $P < 0.001$) when comparing 7th grade PRE to 8th grade PRE measures. **CONCLUSION:** No short-term deficits in neurologic function were discovered when comparing PRE to POST group means. Oculomotor function assessed by the KD test seems to improve during a youth football season, though it is unclear if a learning effect, maturation and/or other factor(s) may underlie this finding. While these results suggest that short-term impairment in neurologic function is not pervasive in youth football, examination of individual responses and associations with head impact exposure are necessary to fully elucidate the interaction of repetitive head impacts and neurologic function of youth football players.

2012 Board #25 June 1 3:30 PM - 5:00 PM

The Effect of Legislation on Concussion Management and Return-to-Play Policies in High Schools

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(No relationships reported)

Purpose: Previously, we conducted a survey and published results that showed that there was a significant difference in concussion awareness education provided to athletes participating in football (97%), hockey (65%), and boys (57%) and girls (47%) soccer ($P < 0.01$) and the use of sideline screening tools was significantly greater for football ($P = 0.03$). After publication of the study, state legislation was passed requiring training for coaches and concussion education for all athletes and parents. The purpose of the current study was to examine the effect of this legislation. Methods: A survey link was sent via email to the athletic directors of 108 schools that participated in the original study. They were asked to complete the survey and forward it to coaches and athletic trainers if available. The survey consisted of questions to determine concussion education, management and return-to-play policies in girls' soccer (GS), boys' soccer (BS), boys' football (FB) and boys' ice hockey (IH). A Chi-Square analysis was conducted to determine statistical significance where appropriate. Results: Ninety participants representing 52 school completed the survey. Participants were asked about concussion education for athletes and parents (92% GS and BS, 94% FB and 77% IH reported providing education to athletes; 76% GS and BS, 93% FB, 68% IH reported providing education to parents). Generally, participants reported that an athletic trainer (ATC) was routinely present at the games of all 4 sports. An ATC was routinely present at practices for 60% of the schools for GS, 76% for BS, 93% for FB and 14% for IH. This difference was significant ($p<0.001$). On-field or sideline screening tools were reportedly used at the schools 64% of the time in GS, 66.7% BS, 80.6% FB and 80% IH ($p=0.402$). Coaches and ATCs were asked how frequently the athletes self-reported a possible concussion. GS and FB athletes were more likely to report a concussion than BS or IH athletes. Once a concussion occurs, 100% of the schools reported that written authorization from a physician was required prior to return-to-play for all sports Conclusion: Concussion education has improved since the passage of state legislation. In addition, sideline screening tools, while previously used predominantly for boys' football are now being used in other sports.

2013 Board #26 June 1 3:30 PM - 5:00 PM

Baseline Predictors Of Prospective Concussion In Collegiate Athletes

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Reported Relationships: M. Putukian: *Consulting Fee; Major League Soccer. Contracted Research - Including Principle Investigator; NCAA-DoD research grant, NOCSAE research grant, Ivy League research grant.*

Purpose:
It has been proposed that female gender, history of prior concussions, depression, anxiety, headaches/migraines, and learning disorders (LD) may be associated with an increased likelihood of sustaining a concussion and prolonged clinical recovery.
In previous work we demonstrated that none of these anticipated concussion modifiers were predictive of clinical recovery time in a group of concussed collegiate athletes. In contrast, initial post-injury symptoms and scores on cognitive measures predicted recovery time.
The current study evaluates possible baseline predictors of prospective concussion in collegiate athletes.
Methods:
One thousand one hundred fifty three collegiate student athletes (M=799, F=354) were assessed at baseline.

Athletes completed a modified sideline concussion assessment tool (m-SCAT) including symptom checklist, Standardized Assessment of Concussion (SAC), modified Balance Error Scoring System (m-BESS), Generalized Anxiety Disorder scale (GAD-7), Patient Health Questionnaire (PHQ-9), and self-report history of concussion, LD, 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 ($X^2(2)$= 16.124, p<.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.

2014 Board #27 June 1 3:30 PM - 5:00 PM

Variation In King-Devick Performance Time By Primary Language And History Of A Learning Disorder

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(No relationships reported)

The King Devick (K-D) is a brief screening test for sport-related concussion (SRC) that involves rapid number naming and assesses reaction time, visual-motor function and reading skill. This test has been used to screen athletes for potential SRC by comparing performance on this test with baseline performance. Some authors have recently begun to explore normative data for this test, but little is known about variation in baseline performance time on this test, or how that might affect its utility for SRC detection. **PURPOSE**: To examine variation in baseline performance time on the K-D test by demographics and medical history. **METHODS**: We analyzed data from an ongoing prospective cohort study of varsity collegiate athletes sponsored by the National Collegiate Athletic Association and the Department of Defense from 2014-2016. We analyzed first time administration of the K-D only, examining differences in means with 95%CI by demographics and medical history Student's T-test. **RESULTS**: We report on first-time administration data from 2331 athletes (20.1 +/-3.4 yrs) at five universities. Performance time did not differ by age. Athletes whose primary language was not English had significantly slower baseline times (44.7 s., 95% CI: 43.0-46.3) than primary English speakers (41.2 s., 95% CI: 40.9-41.5), as did those with history of a learning disorder (45.7 s., 95% CI: 43.7-47.6) compared to those without a learning disorder (41.1 s., 95% CI: 40.8-41.4). Athletes in collision sports had significantly faster performance time (40.7 s., 95% CI: 40.3-41.1) compared to those in non-collision sports (42.4 s., 41.9-42.9). History of prior concussion and attention deficit hyperactivity disorder (ADHD) were not significantly associated with performance time. **CONCLUSION:** Performance time on the K-D is significantly slower in athletes who have a primary language other than English and those with a history of a learning disorder. These results suggest caution in the use of normative data with this test given significant individual variation. Future studies should explore whether sensitivity of this test for detecting brain injury is affected by these characteristics.

2015 Board #28 June 1 3:30 PM - 5:00 PM

Impact of Concussion History on Sway Velocity and BESS Scores in Division I Football Players

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(No relationships reported)

PURPOSE: Impaired postural control is a hallmark sign of a concussion injury, with balance disturbances persisting weeks after initial injury. Postural deficits can negatively impact one's performance and increase one's risk for injury. The purpose of our study was to investigate if concussion history has an effect on balance measurements.
METHODS: 75 Division football players (age = 19.76 ± 1.1) from one university participated.
The Balance Error Scoring System (BESS) test was scored by one evaluator for all participants. The Stability Evaluation Test (SET) on the VSR Sportä system by NeuroCom® (Clackamas, OR) was used to assess sway velocity. The BESS and SET were completed in the same testing session; order was randomized. Players performed the standard 3 stances (double leg, single-leg, tandem) on 2 surfaces (firm and Airex Balance-Pad; Airex (Switzerland)). For the 6 trials, players closed their eyes, placed hands on iliac crests, and held the position for 20 seconds. Regarding the SET: in the event of a fall, the participant was given a second opportunity to complete the trial. In the event of a second fall, the "mark as a fall" button was selected, and the athlete moved on to the next trial. A fall was defined as touching a hand or foot down for support, or stepping off the plate. An overall sway velocity score was calculated for each trial, as well as a total composite score.
RESULTS: There were significant and positive correlations between sway velocity and BESS errors, indicating as sway velocity increased so did the number of errors, on the following trials: single leg firm surface (r_s = .62, p < .001), tandem stance firm surface (r_s = .72, p < .001), single leg foam surface (r_s = .25, p = .029), tandem stance foam surface (r_s = .70, p < .001), and composite scores (r_s = .68, p < .001). There was a positive relationship between the two variables, and the strength of relationship is considered larger than typical.
There were no statistical associations between concussion history and sway velocity or BESS errors.
CONCLUSION: Concussion history does not appear to have an impact on sway velocity measures or BESS scores. However, there was a significant and positive correlation between sway velocity and BESS errors during four of the trials and the composite scores, supporting the validity of the BESS test.

D-61 Free Communication/Poster - **Correlates and Behavioral Aspects of Physical Activity**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2016 Board #29 June 1 2:00 PM - 3:30 PM

Aerobic Fitness and Neurocognitive Performance in Older Adults from Costa Rica and the United States

Mónica Salazar-Villanea[1], Yamileth Chacón-Araya[1], Amber Watts[2], Eric D. Vidoni[2], Sandra A. Billinger[2], David K. Johnson[2], José Moncada-Jiménez[1]. *[1]University of Costa Rica, San José, Costa Rica. [2]University of Kansas, Lawrence, KS.*
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PURPOSE: To determine the association between aerobic fitness and neurocognitive performance, and to compare the cognitive function in elderly from Costa Rica (CR) and United States (US). **METHODS**: A sample of 78 older adults from CR (males = 26, females = 52) and 100 participants from Kansas, US (males = 35, females = 65) was recruited. Participants underwent a graded exercise test on a treadmill to determine peak oxygen uptake (VO_2peak), and completed a comprehensive test battery designed to assess cognitions: cognitive screen, simple speed of processing, spatial visualization, visuospatial processing, episodic memory and verbal abilities, executive functioning and cognitive control, and working memory. Z-scores on each neurocognitive dimension was computed to create an index of global neurocognitive performance called cognitive function total score (CFTS). Inferential analysis included a 2x2 ANCOVA (sample by gender) on z-scores for cognitive variables (adjusted by age). Pearson correlations were computed between VO_2peak and cognition dimensions and CFTS. **RESULTS**: No significant z-score interactions were found on neurocognitive performance (p > 0.05). Regardless of the sample, males scored higher than females on visuospatial processing (Males = 0.691 ± 0.392 vs. Females = -0.422 ± 0.273; p = 0.021). For the entire sample, VO_2peak was correlated to visuospatial processing (r = 0.251, p ≤ 0.001) and CFTS (r = 0.178, p = 0.021). For the male sample, VO_2peak was correlated to working memory (r = 0.396, p = 0.019) in the KS sample, and to visuospatial processing (r = 0.431, p = 0.045) in the CR sample. For the female sample, VO_2peak was correlated to visuospatial processing (r = 0.342, p = 0.006), executive functioning and cognitive control (r = 0.357, p = 0.004), and CFTS (r = 0.328, p = 0.008) in the KS sample, and to executive functioning and cognitive control (r = -0.311, p = 0.030) in the CR sample. **CONCLUSIONS**: Cognitive function was similar between male and female elderly from CR and US. Aerobic fitness as assessed by the VO_2peak was related to visuospatial processing and the elderly ability to organize visual information into meaningful patterns and understanding how they might change as they rotate and move through space.

2017 Board #30 June 1 2:00 PM - 3:30 PM

Feasibility of Conducting Ecological Momentary Assessment of Exercise Antecedents using an Online Survey Distribution Platform

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Ecological Momentary Assessment (EMA) allows individuals to report perceptual, affective, social, and behavioral factors in real time, reducing recall bias and allowing multiple measures per day. While this approach may help build a predictive model of exercise behavior, EMA procedures typically require additional devices (e.g. palm pilot, electronic diary), which can increase participant (PPT) burden and study costs. **PURPOSE**: Determine feasibility of conducting EMA using an online platform capable of distributing survey links to personal smartphones via text message. **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 17±16-min of receipt (79% within 30-min). Average survey duration was 4.40±7.93-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.

2018 Board #31 June 1 2:00 PM - 3:30 PM

Training-related Factors Associated With Running Adherence In Recreational Runners: A 3-year Follow-up Cohort Study

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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 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.

2019 Board #32 June 1 2:00 PM - 3:30 PM

Understanding the Motivational Strategies Used by Exercise Professionals: A Latent Profile Analysis Approach

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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' motivation, work-related need satisfaction/frustration, type of motivation, and burnout. **METHODS:** Participants were 366 exercise professionals (193 males; experience = 7.7±5.8 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 so-occur, seems comparably important. Professionals relying mostly on this type of strategies displayed more problems related to the quality of their own motivation and burn-out.

2020 Board #33 June 1 2:00 PM - 3:30 PM

Motivational Correlates of Physical Activity among Adults with Type 2 Diabetes

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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 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_{age} = 56.18, SD = 11.41; M_{BMI} = 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, but PBC was the only significant predictor ($\beta = .73$; $p < .001$). For the prediction of physical activity, the model that included only intention ($\beta = .45$; $p = .03$) accounted for 20.5% of the variance. The addition of PBC did not add a significant amount of explained variance and was not a significant predictor of physical activity. **CONCLUSION:** These results are similar to previous research and suggest that the TPB is useful for understanding the physical activity intention and behavior of adults with type 2 diabetes. Further research with larger and more diverse samples are needed to inform intervention design.

2021 Board #34 June 1 2:00 PM - 3:30 PM

Processes Of Change Used To Fulfill With The Recommendations Of Healthy Practice Of Acsm

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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. **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 were found to have a higher use of cognitive processes than participants in C and PC. Moreover, participants in C, P, and A used more behavioral processes than those in PC. Also, participants in M used behavioral process more than participants from any other stage. **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.

2022 Board #35 June 1 2:00 PM - 3:30 PM

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

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(No relationships reported)

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 five motivation constructs including external, introjected, identified, intrinsic, and amotivation. Although 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 predictive validity of a C-BREQ-2.
Methods: Participants were middle and high school students recruited from Shanghai, China. The final sample (N = 437, 49% for boys) was randomly split into two subsamples with the first subsample (N = 208) was used for exploratory factor analysis (EFA) and the second subsample (N = 229) used for confirmatory factor analysis (CFA). Measurement invariance and latent mean difference across gender was examined. Structural equation modeling (SEM) was utilized to explore different motivation constructs in predicting adolescents' moderate to vigorous physical activity (MVPA).
Results: Both EFA and CFA tests identified a 14-item, three-factor (i.e., autonomous motivation, introjected motivation, and external motivation) model. Both 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 following latent mean comparison revealed that boys perceived higher introjected regulation than girls. Finally, only introjected regulation significantly and positively predicted adolescents' MVPA.
Conclusions: The revised C-BREQ-2 seems to be a validated scale. Researchers can use this scale to better understand Chinese adolescents' motivation towards PA.

2023 Board #36 June 1 2:00 PM - 3:30 PM

Behavioral Processes For Healthy Exercise According To The ACSM Through The Stages of Change

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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´s HSD 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<A, C, 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

2024 Board #37 June 1 2:00 PM - 3:30 PM

Exercise Dependence, Affect, And Preferred Weight Of Female Exercisers

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Regular exercise offers many benefits, but some individuals may develop a dependency on exercise to continue receiving these benefits, such as affect regulation or attaining a preferred weight. **PURPOSE:** To examine associations among exercise dependence, affect, and current and preferred weight of female exercisers who hire personal trainers. **METHODS:** Female exercisers (n=39; 47+13 yrs; 167+36 lbs) who hire personal trainers at fitness centers in the Midwest completed the Exercise Dependence Scale-Revised (EDS-R), Positive Affect and Negative Affect Scale, and Eating Attitudes Test (EAT-26). A separate questionnaire collected demographic and exercise information as well as perceptions about their personal trainer. A difference score between their current and preferred weight (C-PW) was also created. Pearson correlations were used to identify predictor variables that were related (p < .10) to the exercise dependence score, and these predictor variables were included in a backward multiple regression with the exercise dependence score as the criterion variable. **RESULTS:** The exercise dependence score was related to positive affect (r = .33 p < .05) negative affect (NA: r = .29, p = .07), C-PW (r = -.45 p < .01), current weight (r = -.31, p = .05), minutes per week exercising *without* their personal trainer (ExwoT: r = .37, p < .05), and the extent they followed their personal trainer's suggestions for exercise (r = .36, p < .05). Regression results indicated a final model of three predictors (NA, C-PW, ExwoT) for the exercise dependence score, R^2 = .45, R^2_{adj} = .41, F(3,35) = 9.36, p < .001. The unstandardized and standardized coefficients are provided in parentheses for NA (1.169, .335, p < .001), C-PW (-.195, -.343, p < .05), and ExwoT (.046, .431, p < .01). **CONCLUSION:** Female exercisers with more negative affect who were closer to their preferred weight and exercised more without their personal trainer were found to have higher exercise dependence scores. Thus, female exercisers may be using exercise as a means to self-regulate negative affect, and as they get closer to their preferred weight, they exercise more than what they do with their trainer. Personal trainers and exercisers should be aware because as women become more tolerant of exercise, this behavior may lead to clinically significant issues.

2025 Board #38 June 1 2:00 PM - 3:30 PM

The Effects of Playing Pokemon Go on Physical Activity and Lifestyle Changes

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(No relationships reported)

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.

2026 Board #39 June 1 2:00 PM - 3:30 PM

Sources Of Competition Stress Among Elite Tennis Players In ITF Women's Circuit

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(No relationships reported)

PURPOSE: Competition stress is closely related to competition performance. This study was to identify sources leading to competition stress in elite tennis players participating International Tennis Federation (ITF) match.
METHODS: The sample consisted of 258 female tennis players (mean±SE age =21.07±3.38yr) participating in ITF Women's Circuit. According to sports level, there were 35 first-grade players, 86 second-grade players, and 137 players below second-grade. A modified version of the competitive state anxiety questionnaire was used to measure the types and the characters of competition stressors. All participations responded to the questionnaire with 39 validated questions using a five point Likert-scale. SPSS18.0 was used for the statistical analyses using principal component analysis (PCA) and variance test, and a significant level was set at P≤0.05.
RESULTS:
According to PCA, technical and tactical defeat (33.23±14.32), interpersonal relationship (21.35±11.32), environmental factors (19.84±10.87), unpleasant physical effects (15.71±10.55), and life experience (9.87±7.07) were detected as the major components of competition stressors successively. The stress level of first-grade players in technical and tactical defeat (p<0.01), interpersonal relationship (p<0.01), and environmental factors (p<0.05) were significantly higher than that of other levels, while there was no statistical difference in physical effects and life experience among different sports level. The stress levels of all players in technical and tactical defeat (p<0.01), and life experience (p<0.01) on the qualifying and final match were dramatically higher than that in other match rounds, while there were no differences in other stressors.
CONCLUSIONS: Determinants of competition stress were multiple among female tennis players attending ITF matches, including technical and tactical defeat, interpersonal relationship, environmental factors, unpleasant physical effects, and life experience. Levels of multiple stressors were linked to player's grade and tournament rounds. Recognizing individual stressor is essential for tailored pre-match intervention.
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2027 Board #40 June 1 2:00 PM - 3:30 PM

Exploring the Relationship Among Physical Fitness Level, Social Norm Perceptions and PA Intention

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College students' healthy behavior choices are influenced by social norms, defined as the standards by which an individual judges the appropriateness of a behavior. Intentions then directly affect behavior. The Focus Theory of Normative Conduct (FTNC) identifies task value, outcome expectations and injunctive norms (i.e. what others approve of) as underlining mechanisms moderating the relationship between descriptive norms (i.e., what others do) and intentions. While FTNC identifies underlying psychosocial mechanisms, the interaction between physiological factors and social norms are currently unexplored. **PURPOSE:** The purpose of this study was to investigate the relationship among aerobic fitness (VO_2 max), percent body fat, social norms, and physical activity intention. **METHODS:** Participants (N = 43, 25 females, 18 males; mean age = 21 ± 6 years) college undergraduate students. A survey consisting of previously validated measures was administered to assess normative perceptions, task value, and outcome expectations. Body fat, aerobic fitness, muscular strength and endurance and flexibility were assessed in the university's applied physiology laboratory by an ACSM certified heath fitness specialist. **RESULTS**: Hierarchical regression equations were run to address the research questions. Block 1 for each analysis remained constant with descriptive norms entered as the independent variable. Descriptive norms accounted for 39.5% of the variance in intention to be active [F (1,41) = 27.33, p < .001]. Insertion of interaction variable one (descriptive norm x VO_2 max) into the model did not contribute significantly to the model (b = .017, p = .52), indicating VO_2 max was not a moderator (Aiken & West, 1991). Insertion of interaction variable two (descriptive norm x percent body fat) into the model did not contribute significantly to the model (b = .02, p = .46), indicating VO_2 max was also not a moderator. **CONCLUSION**: Results suggest that descriptive norms may play more of an important role in college students' decisions to be physically active than previously thought. Additionally, the findings suggest that regardless of current physical fitness level, emphasizing the positive behaviors of respective peer groups is a potential avenue for practitioners seeking to increase physical activity in students.

2028 Board #41 June 1 2:00 PM - 3:30 PM

Cross-sectional And Longitudinal Correlates Of Leisure Time Physical Activity: The Tromsø Study 1979-2008

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PURPOSE: The aim of this study was to examine potential cross-sectional and longitudinal correlates of leisure time physical activity (LTPA) in a large population-based study.
METHODS: Data are collected from 30 765 individuals (49.7% men) aged >20 years who participated in at least one of five Tromsø Study surveys between 1979 and 2008. In each survey, the participants completed a self-administered questionnaire and underwent physical examinations. LTPA were assessed by the validated "Saltin-Grimby" 4-scale questions. Potential correlates of LTPA (sex, age, body mass index (BMI), education, smoking, self-reported cardiovascular disease, self-perceived health, and employment status) were tested using ordinal logistic regression in cross-sectional and longitudinal models.
RESULTS: As shown in the Table, sex, age, education, BMI, smoking, occupational physical activity, and excellent self-perceived health were cross-sectional correlates of LTPA (P <0.05), after adjustment for respective correlates. Men had 33-115% higher odds of being physically active in leisure time than women, and odds of being physically active in leisure time in general decreased with increasing age (P <0.05). High occupational activity levels increased the odds of being physically active in leisure time, and smokers were 22-47% less likely to be physically active than non-smokers (P >0.05). Having a healthy BMI was associated with higher odds of being physically active in leisure time, compared with being underweight and overweight/obese. Longitudinal associations between participant characteristics in 1979-80 and LTPA in 2007-08 largely confirmed these findings. Baseline LTPA (1979-80) was a strong predictor of LTPA in 2007-08 (P <0.05) (Table, longitudinal model).
CONCLUSION: Several individual-level factors were associated with LTPA. The most inactive individuals in leisure time were female, older, smokers, obese or underweight, and had lower education.

Adjusted odds ratio of being at a higher LTPA level by characteristics					
	Adjusted Odds Ratio (95% Confidence Interval)				
	1979-80 (n=14 039)	1986-87 (n=18 533)	2001 (n=2969)	2007-08 (n=7834)	Longitudinal model 1979-80 and 2007-08 (n=5037)
Sex					
Women	1.0	1.0	1.0	1.0	1.0
Men	2.15 (1.99-2.31)	1.87 (1.76-1.99)	1.33 (1.14-1.56)	1.52 (1.39-1.67)	1.47 (1.28-1.67)
Age					
20-29	1.02 (0.94-1.10)	1.17 (1.09-1.27)			1.06 (0.91-1.24)
30-39	1.0	1.0	1.0	1.0	1.0
40-49	0.96 (0.88-1.04)	1.06 (0.98-1.14)	0.98 (0.79-1.23)	0.77 (0.64-0.94)	0.93 (0.81-1.05)
50-59	0.76 (0.65-0.89)	1.10 (1.00-1.21)	1.20 (0.94-1.53)	0.64 (0.53-0.79)	0.72 (0.49-1.03)
60-69		0.80 (0.65-0.99)	1.38 (1.08-1.76)	0.68 (0.56-0.84)	
70-79				0.53 (0.39-0.73)	
80-89				0.26 (0.13-0.53)	
BMI (kg/m^2)					
<18.5	0.69 (0.56-0.85)	0.61 (0.49-0.75)	0.94 (0.31-2.86)	0.69 (0.35-1.35)	0.92 (0.61-1.39)
18.5-24.9	1.0	1.0	1.0	1.0	1.0
25-29.9	0.81 (0.76-0.89)	0.78 (0.73-0.84)	0.94 (0.79-1.11)	0.82 (0.74-0.91)	0.83 (0.72-0.96)
≥30	0.64 (0.53-0.76)	0.54 (0.48-0.62)	0.69 (0.55-0.86)	0.51 (0.45-0.58)	0.48 (0.34-0.68)
Education level					
£9y	1.0	1.0	1.0	1.0	1.0
10-12y	1.19 (1.10-1.29)	1.21 (1.12-1.30)	0.97 (0.79-1.19)	1.40 (1.23-1.60)	1.17 (1.02-1.34)
>12y	1.55 (1.42-1.69)	1.45 (1.34-1.57)	1.26 (1.03-1.55)	1.53 (1.34-1.75)	1.26 (1.08-1.47)
Smoking					
No	1.0	1.0	1.0	1.0	1.0
Yes	0.60 (0.57-0.65)	0.57 (0.53-0.60)	0.78 (0.66-0.92)	0.53 (0.47-0.60)	0.71 (0.63-0.80)
Self-reported cardiovascular disease					
No	1.0	1.0	1.0	1.0	1.0
Yes	0.71 (0.49-1.03)	0.84 (0.68-1.04)	0.84 (0.59-1.21)	1.09 (0.89-1.33)	0.40 (0.15-1.03)
WPA					
Mostly sedentary	1.0	1.0	1.0	1.0	1.0
Walking	1.29 (1.20-1.40)	1.46 (1.37-1.56)	1.33 (1.11-1.58)	1.30 (1.17-1.45)	1.10 (0.96-1.26)
Walking and lifting	1.50 (1.36-1.65)	1.69 (1.56-1.84)	1.42 (1.16-1.74)	1.28 (1.13-1.45)	0.99 (0.83-1.18)
Heavy manual labour	1.54 (1.33-1.79)	1.98 (1.73-2.28)	2.61 (1.68-4.05)	1.56 (1.29-2.02)	1.41 (1.06-1.87)
Employed					
No	1.0	1.0	1.0		1.0
Yes	0.82 (0.67-0.99)	0.90 (0.77-1.05)	1.58 (0.82-3.06)		1.02 (0.69-1.52)
Self-perceived health					
Very bad		1.0	1.0	1.0	
Bad		0.82 (0.44-1.54)	1.89 (0.73-4.90)	0.85 (0.26-2.73)	
Neither good nor bad		0.89 (0.48-1.64)		1.18 (0.38-3.69)	
Good		1.40 (0.76-2.58)	2.80 (1.09-7.20)	2.18 (0.70-6.84)	
Excellent		2.28 (1.24-4.21)	5.78 (2.21-15.11)	4.68 (1.49-14.74)	
LTPA					
Inactive					1.0
Light					2.58 (2.20-3.02)
Moderate					4.85 (3.96-5.94)
Vigorous					10.78 (7.47-15.56)

2029 Board #42 June 1 2:00 PM - 3:30 PM

At-risk Preschoolers' Perceived Physical Competence and Observed Fundamental Movement Skills

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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 Bruininks-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=.14, t=2.19, p≤.05) with the overall model accounting for 16% of the variance in locomotor scores, F(5,219)=8.43, p≤0.05. Further, PPC was significantly related to strength scores (β=.12, t=1.97, 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.

2030 Board #43 June 1 2:00 PM - 3:30 PM

Types Of Leisure, Leisure Motivation, And Well-being In University Students With An Empahisis On Physical Activity

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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 = -.21, p < .01) and amotivation (r = -.23, p = .01). Perceived stress was positively associated with amotivation (r = .23, p < .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 [b = .83, β = .71, t = 4.72, p < .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 (ΔR^2 = .048, F [1, 138] = 7.02, p = .009). There was a significant interaction between BMI and perceived stress, indicating the impact of BMI on passive leisure differs depending on perceived stress (ΔR^2 = .034, F [1,148] = 5.23, p < .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 stress levels. 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

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(No relationships reported)

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. **PURPOSE**: The objective of the study was to use psychosocial factors, including affective associations, to predict physical activity intentions and physical activity behavior in cancer survivors.**METHODS**: A convenience sample of cancer survivors (n=122) were recruited for the study. Participants completed a survey which included questions on demographics, current physical activity, survivorship, cognitive measures, affective associations, and implicit measures. Multiple regressions were run to predict intentions and 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/m^2. Results show physical activity intentions were significantly predicted by cognitive measures (p<0.01). In contrast, positive affective associations (p<0.01), worry about physical activity (p<0.01) and implicit measures (p<0.05) were the only significant predictors of physical activity behavior. Affective measures predicted physical activity behavior approximately 2 weeks later, even when intentions were included in the regression model (p<0.05).**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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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: **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/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 < .05 at three months with the treatment group (4.61 + .65) displayed a higher level of competence t(22) = 4.33, p = .05 than the control group (3.72 + .63). Repeated measures ANOVA indicated a significant increase in Autonomy (p = .032) and Competency (p = .002) for the treatment group from baseline to 28 months.
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 women's feelings of automony and competence. Future analyses inclusive of a post intervention follow up period would test lend further insight by assessing both groups during a time exclusive of any supervised training.

2033 Board #46 June 1 2:00 PM - 3:30 PM

Effects of External Stimuli on Exercise Engagement in College Females

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(No relationships reported)

Important to the promotion of physical activity is the assessment of the psychological effects that occur when trying to adhere to exercise regiments. By measuring the effects of exercise on mood, enjoyment, and perceived exertion it allows for the ability to evaluate engagement in one's program and provides a means to measure and potentially predict their continuance in the exercise. **PURPOSE:** To examine the effects of external stimuli on mood, enjoyment, and perceived exertion in college females. **METHODS:** 18 college female subjects (age: 19 ±1 years) completed 4 separate trials of treadmill walking with a different intervention for each trial. The conditions being tested: no external stimuli (NES), self-selected music (MU), self-selected video with sound (VS), and self-selected video without sound but with captions (VC). Every 3 minutes throughout the 30-minute session, the subjects rated perceived exertion and mood with the Borg rate of perceived exertion (RPE) scale and the Fast Assessment of Children's Emotion scale (ES). At the end of each session, the participants evaluated their enjoyment of the exercise using the Physical Activity Enjoyment Scale (PACES). Statistical comparisons on each condition were determined as well as any correlations between having stimuli (MU, VS, and VC) vs no stimuli using a single factor ANOVA, contrast, and Bonferroni statistical analysis. **RESULTS:** We found when comparing no stimuli to all external stimuli collectively, PACES (F=6.08, p < 0.05) and ES ratings (F=2.66, p < 0.05) were significantly different. Specific to the PACES scale, we found significance when comparing NES to MU (t=2.90, p < 0.05), NES to VC (t=3.11, p < 0.05), and NES to VS (t=4.03, p < 0.05). RPE was not statistically significant in any condition (F=0.01, p > 0.05). **CONCLUSION:** Greater levels of overall enjoyment and increased mood were seen when an external stimuli was used as compared to exercising with no stimuli. No changes in perceived exertion were seen whether a stimulus was used or not. For best adherence to an exercise program use of external stimuli is recommended.

2034 Board #47 June 1 2:00 PM - 3:30 PM

Sustainable Healthy Commuting: Environmental Factors Associated With Bicycling And Walking Among Danish Students.

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Cycling and brisk-walking to university, leisure-time activities and part-time jobs represents an opportunity to incorporate sustainable transport related moderate- to-vigorous physical activity (MVPA) and exercise into daily routine among students, and thus, may make an important contribution to health. Denmark has a strong and well-developed cycling culture with good walkable paths and cycle lanes, infrastructure and traffic. Still, a large proportion of commuters choose to use other means of transport when cycling and walking would be a highly appropriate transport mode.
Purpose:
The aim of this study was therefore to investigate the associations between commuting mode and environmental factors in a group of young students in Aalborg municipality in Denmark.
Methods:
In an internet survey gathered data about students` commuting behaviour and their perception of the influence of environmental factors. Comparisons were made using cross tabulation and chi-square statistical tests (p<0.05).
Results:
In total, 348 students, mean age 23 ±2.1 years, responded to the questionnaire, of which 80.5 % were categorised as active commuters (walkers and cyclists) and 19.5 % were categorised as passive commuters (car and public transporters). The mean commuting distance for the active commuters were 3.0 km ±1.4 and 2.9 km ±1.6 for the passive commuters when summarizing all localisations (part-time job, leisure-time activities and university location). The passive commuters perceived the traffic as more unsafe than the active commuters when commuting to part-time job (31.4% vs. 11.5%, p<0.05) and leisure time activities (69.6% vs. 52.8%, p<0.05). Those students who were categorized as active commuters more likely to go by bike to their university location than those categorized as passive commuters (37.9% vs 19.1%, p<0.05) if they perceived the cycling paths as well maintained.
Conclusion:
Those categorised as active commuters perceived the environment as more comprehensive for active commuting than those categorised as passive commuters.

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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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 does not 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. **Methods:** 29 volunteers (17 women's) Age (years) 34,97±9,51 ,BMI (kg/m²) 26,47 ±4,36 and attendance (months) 8,1± 3,45 ,were grouped by adherent (Adh) and non-adherent (NAdh). Personality and level of motivation were assessed via translated version of the BREQ-2 (Markland D, Tobin VA, 2004) and IMPRAF-54 (Barbosa MLL, Balbinotti AAM., 2006) and attendance during 1-year exercise program were assessed too. A Mann Whitney U. Test, Speraman correlation and

Logistic regression are used. **Results:** Considering attendance in months, Spearman correlations were made with sociodemographic measures and scales scores IMPRAF, BREQ and NEOPIR. Correlations were found in attendance with the IMPRAF sociability (rho = 0.4) and NEOPIR extraversion (rho = -0.43). These variables were adjusted in a linear regression model (R square = 0.53) and they had coefficients significantly different from zero (IMPRAF sociability B = 0.29, t = 2.158 p = 0.04 and B = -0 NEOPIR extraversion, 38 t = -2.24 p = 0.03). Finally , considering Adh (N = 6) or NAdh (N = 23) group , there are significant only for NEOPIR extroversion (U = 31.5 , p = 0.04) , where the Adh (119.0) has a median less than the NAdh (106.5). **Conclusion**: In this study, the longer training produced greater sociability (need basic psychological issues related to acceptance and gaining new friends, self -esteem and motivation for physical activity practitioners) and lower extraversion (possibly due to a structured that exercise was offered).
CEPE, CEMSA, CNPq, CAPES, AFIP.

2036 Board #49 June 1 2:00 PM - 3:30 PM

Physical Strength by Mental Health Profile in School-Aged Boys and Girls

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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 wellness 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 boys: "partial psychopathology" (PP) and "partial mental health" (PMH). Participants showing the former profile had lower scores in SU (PP: 13.09; PMH: 17.89), SBJ (PP: 96.89; PMH: 123.57), BAH (PP: 3.91; PMH: 8.74), and HG (PP: 12.15; PMH: 14.60). Both profiles had low scores in relation with cut-off points for their age. Girls only belonged to PP, also showing lower results than expected at their age (SU = 15.22; SBJ = 111.59; BAH = 7.27; HG = 12.25). **CONCLUSIONS.** Partial mental health is not a sufficient condition for triggering the development of healthy physical strength. PE teachers need to create the proper conditions for children to reach full mental wellbeing, which may increase their chances to achieve beneficial levels of physical fitness.

2037 Board #50 June 1 2:00 PM - 3:30 PM

Relation between Body Composition, Physical Fitness, and Mental Health in Primary School Students

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According to the World Health Organization, the fulfillment of a complete health state implies balance between physical and mental condition. Physical fitness (PF), comprised of health-related strength, endurance, and flexibility, is an essential indicator of physical condition. Good levels of PF have been linked to lower risk of injuries and chronic diseases. In addition, body composition (BC) is an indicator of health, the accumulation of abdominal body fat having being associated to higher cardio-metabolic risk. However, mental state can negatively affect individuals' overall health regardless of their physical condition. For instance, research has demonstrated that high anxiety in athletes may not only increase the risk of psychological diseases, but also activate unhealthy physiological processes.
PURPOSE: To assess the relation between body composition, physical condition, and mental health in primary school students. **METHODS:** A sample of 339 children aged 10-11 were asked to fill self-esteem, psychological wellbeing, anxiety, and stress questionnaires. Measurements of PF comprised handgrip (HG), standing long jump (SLJ), 30-second sit-ups (SU), sit-and-reach (SR), and course navette (CN) tests. Body composition was assessed by means of waist circumference (WC). **RESULTS:** Outcomes showed a significant negative correlation of WC with CN (r = -.509; p < .001), and SLJ (r = -.175; p = .033). However, WC was positively correlated with HG (r = .355; p < .001). No significant correlations were found between the elements of mental health, PF, and BC. **CONCLUSIONS.** Both mental health and physical condition must be taken into account if we aim to increase people's overall health state. Despite previous literature suggests a connection between these two spheres of health, our outcomes seem to hint at isolated approaches, implying the implementation of different strategies to enhance physical condition and mental state simultaneously, though separately.

2038 Board #51 June 1 2:00 PM - 3:30 PM

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% F_IO_2, ~2400 m) or simulated high altitude (HA; 12.8% F_IO_2, ~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, alongside 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.

2039 Board #52 June 1 2:00 PM - 3:30 PM

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

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Waist-to-hip ratio (WHR) has been used as an indicator of biological attractiveness, which has been associated with reproductive potential, health, and youthfulness. Previous reports have shown that women with a WHR closer to 0.70 than 0.80 are found more biologically attractive (BA). Considering the potential health implications of 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. A 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 to exercise F (1, 45) = 8.592, 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 ± LBA, 3026.91 steps/day). **CONCLUSIONS**: Although the health pressure-related score was higher 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 of women 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.

2040 Board #53 June 1 2:00 PM - 3:30 PM

Reasons Why College-aged Women Perform Resistance Training

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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. Limited research is available on the resistance training practices of both sexes. **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 gives them a sense of accomplishment and they enjoy how it makes them feel. Ninety-four percent agreed that resistance training will make them healthier. The results showed that 90.91% agreed that resistance training relieves stress. Over 90% agreed that they resistance train with the goal of improving muscular strength and endurance. Maintaining body weight is why 69.69% of the respondent's resistance train. Half of the respondents (50%) resistance train because they have someone willing to do it with them. In regards to appearance, 84.38% resistance train because they feel that it will make them more attractive. Of the women who responded 65.65% resistance train because they know it won't make them bulk up. Approximately 84.38% resistance train because it makes them happy. In order to improve bone health 62.5% of the respondents said that they resistance train. In order to cope with depression 53.13% of respondents said they resistance train. Coping with stress and anxiety is one reason why 75.51% resistance train. **CONCLUSIONS:** These findings suggest that females who participate in resistance training are health and fitness focused. These findings also suggest that resistance training helps college-aged women improve mental, physical, and emotional health overall.

2041 Board #54 June 1 2:00 PM - 3:30 PM

Predicting Affective Responses To, And Enjoyment Of, High-intensity Interval Exercise: Comparison Of Two Tolerance Measures

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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 f; 20.72 ± 1.33 yrs, M±SD) 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 (Tol; r= 0.45; P< 0.001). PAAQ was related to enjoyment (r= 0.21; P= 0.001), but not FS (r= 0.11; P=0 .09). Tol was related to both enjoyment (r= 0.31; P< 0.001) and FS (r= 0.22; P= .001). Using hierarchical regression, PAAQ accounted for 3.8% unique variance in enjoyment (β= 0.199, P= 0.003), after accounting for age, sex and BMI; the addition of Tol explained an additional 6.8% unique variance in enjoyment (β= 0.297, P< 0.001). In a separate regression, Tol explained 10.0% unique variance in enjoyment (β= 0.332, P < 0.001], after accounting for age, sex and BMI; the addition of PAAQ did not explain any additional variance (β= 0.088, P= 0.21). The PAAQ did not account for any variance in FS (β= 0.074, P= 0.28); Tol explained 4.2% unique variance in FS (β= 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.

2042 Board #55 June 1 2:00 PM - 3:30 PM

Cognitive Processes Of The Stages of Changes for Healthy Exercise Practice According To The ACSM

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Within the Transtheoretical Model, the stages explain *when* and the process *how* the people change his problematic conducts. The stages involve the 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 cognitive processes involve Increasing Knowledge (IK), Being Aware of Risks (BAR), Caring About Consequences to Others (CACO), Comprehending Benefits (CB) and Increasing Healthy Opportunities (IHO). **PURPOSE**: To analyze which cognitive process are most commonly used in the different stages to fulfill with the recommendations of physical exercise healthy of the ACSM. **METHODS**: A total of 533 subjects (48% female and 51.8% male; 33.22 ± 15.27; range = 11-76). A Mexican Spanish version of the Stages of Change Questionnaire, as well as items on cognitive processes from the Processes of Change Questionnaire, were applied. **RESULTS**: The internal consistency of the different CP ranged from .65 to. 81. The results of One-Way ANOVA revealed significant differences in IK, BAR, CACO, CB and IHO in different stages ($F_{(4,525)}$ = 7.844 - 25.761, p < .001). Tukey HSD post hoc indicated that the use of IK (PC<C, P<A, M), CACO (PC<P<A, C, M), CB (PC<A<C, P, M) and IHO (PC<C, P<A, M) increases through the stages, except the BAR process (PC<P, A, M, C) which was more emphasized in the use in C. **CONCLUSION**: All the CP contribute to the achievement of the recommendations of the ACSM, however, the BAR process had more relevance to generate the intention of being physically active.

2043 Board #56 June 1 2:00 PM - 3:30 PM

Motivators for Physical Activity in Older Latino Caregivers

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Alzheimer's disease (AD) and related dementia may affect 1.3 million people by 2050, and nearly 70% of people with AD live at home. Caregivers face challenging responsibilities, and experiences of enduring stress and frustration are common among family members caring for people with dementia. Physical activity (PA) can lead to reducing burden and stress, and a positive impact on well-being and quality of life in caregivers. **PURPOSE**: To determine the motivators for PA in older Latino caregivers. **METHODS**: Participants were 16 Latino caregivers, aged 50 years and older, who had been caring for a relative (N=6 for the mother, 4 for a husband, 3 for the wife, 2 for father, and 1 for both parents) with AD or related disorder for at least 6 months. The majority of caregivers were female (12). Interviews were conducted in English and Spanish about the caregiver role, family, and social support, coping strategies and PA. For the purposes of this study answers regarding PA were analyzed. **RESULTS**: Six caregivers (4 female and 2 male) did not mention motivators for PA. Of those who stated motivators for PA, the remaining two men indicated staying healthy and fit as primary motivators to exercise, as well as receiving social encouragement from their wives. Women stated the motivation for PA as resulting from social support (7), especially from their sons, daughters, brothers, friends and boss. The importance of facilities available for engagement in PA was also noted. Parks were the most cited environmental factors to motivate PA (3). **CONCLUSIONS**: A significant number of older Latino caregivers did not stress any motivators for PA. Men cited health-

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 motivating source for PA 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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Few studies have examined the relationship between baseline fitness and exercise adherence in adults with overweight/obesity during a comprehensive behavioral weight loss program (BWLP). Differentiating individuals who adhere to an exercise prescription based on fitness level may improve future intervention approaches.
PURPOSE: To examine the association between baseline fitness and exercise adherence during a 26-week supervised exercise program.
METHODS: 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 (VO_2 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 kg/m^2, BMI 34±3.8 years, 87% female) were enrolled in the BWLP. Participants were classified based on baseline fitness level: 29% very poor (VO_2 max 21.8±4.2 mL/kg/min), 48% poor (24.2±3.1 mL/kg/min), 19% fair (26.4±2.4 mL/kg/min), 3% good (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 as compared to those categorized as very poor (95%CI: 1.1-78.5; p=0.039).
CONCLUSION: Baseline fitness levels in our study population were surprisingly low. Those starting an exercise program with very poor fitness may struggle with adherence over time as the exercise volume reaches higher levels and may require more coaching during this phase of the program.

2045 Board #58 June 1 2:00 PM - 3:30 PM

Relationships between Physical Activity and Motivation in Early Secondary School Adolescents in Scotland

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PURPOSE: High prevalence of physical inactivity and sedentary behaviour (SB) in adolescents is a global issue with as few as 18% of adolescents meeting physical activity (PA) guidelines. Research has suggested that higher intrinsic motivation is positively related with higher levels of PA. The purpose of this study was to test this relationship in early secondary school adolescents.
METHODS: PA/SB was measured using an adapted version of the survey used in the Health Behaviour in School Children study and motivation was measured using the BREQ-3 questionnaire (Mark & Tobin, 2004; Wilson, Rodgers, Loitz & Schime, 2006). Questionnaires were completed during class time by students aged 11-14 years. The Relative Autonomy Index (RAI) was calculated using the weightings provided for each subscale. Spearman's Rho was used to determine the relationship between number of days active and each subscale of the BREQ-3, as well as the RAI.
RESULTS: Participants' (N = 94) mean age was 12.79 ± 0.95 yr and 55.3% of the sample were male (n = 52). Based on 7-day recall, participants spent an average of 3.77 ± 2.05 days active. Correlations between the BREQ-3 and number of days active were: amotivation ($r_s = -.12, p = .27$); external regulation ($r_s = .27, p = .01$); introjected regulation ($r_s = .01, p = .95$); identified regulation ($r_s = .17, p < .01$); integrated regulation ($r_s = .35, p < .01$); intrinsic motivation ($r_s = .35, p < .01$). These results suggest there is no relationship between introjected regulation and PA in early adolescents. Total RAI scores were significantly positively correlated with days active ($r_s = .25, p = .02$).
CONCLUSIONS: The strongest positive relationships with PA are for external regulation, integrated regulation and intrinsic motivation. The patterns of these correlations appear to support the sub-theory of 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 Cueing 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 cueing 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 flicking the wrist; Al-Abood et al., 2002; Wulf et al., 1999; Zachry et al., 2005). Most commonly, deviation from a target has been employed as the measure of objective success, across a variety of specialized sport skills (for a review, see Wulf, 2013).
PURPOSE: Consistent with this body of research, it is reasonable to hypothesize that when cueing individuals performing a vertical jump-and-reach task, an external focusing cue would lead to a superior task performance compared to an internal focusing cue. 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., ns = 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- (Mexternal = 19.97in.; SD = 5.38) and internal-focus groups (Minternal = 18.91in.; SD = 5.31; p > 0.05), as well as similar performances between the external focus and control groups (Mcontrol = 21.55in.; 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.

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 (Hellsten & Rogers, 2009). Moreover, when measured, this construct is often unidimensional.
PURPOSE: To determine the psychometric properties of the 3-factor (physical, social, and self-evaluative) 15-itme Multidimensional Outcome Expectations for Exercise Scale (MOEES; Wójcicki, White, & McAuley, 2009) in a sample of young adult college students enrolled in a health-related fitness course.
METHODS: Confirmatory factor analysis was used to examine the 3-factor MOEES model in 346 young adults (52% female, M_{age} = 20.59 ± 4.79) from a public university located the Southwest United States. 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 MOEES in young adults, $\chi^2(81) = 312.11$, $p < .01$, RMSEA = .09, CFI = .95, SRMR = .04 (Hu

& Bentler, 1999). Using structural equation modeling, construct validity was further demonstrated by significant path coefficients from barrier self-efficacy and self-esteem to the outcome expectations, as well as significant variance explained by 3-factor MOEES model in cardiorespiratory fitness ($r^2 = .18$, $p < .01$), muscular strength and endurance ($r^2 = .09$, $p < .01$), and body composition ($r^2 = .10$, $p < .01$). **CONCLUSION:** The MOEES appears to be a reliable and valid measure of outcome expectations for exercise in this limited sample of young adult college students enrolled in a health-related fitness course. Further validation in alternative young adult and adolescent samples is warranted.

2048 Board #61 June 1 2:00 PM - 3:30 PM

The Relationship between Cell Phone Use, Physical Activity, and Sedentary Behavior In Adults above College-age

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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 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 ($r \leq 0.1$, $p \geq 0.3$ for all). There were also no significant differences in physical activity or sedentary behavior between the low, moderate, and high cell phone user groups ($F \leq 2.0$, $p \geq 0.12$ 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.

2049 Board #62 June 1 2:00 PM - 3:30 PM

Understanding Active Behaviors Among Insufficiently Active Adults During Experimental Studies: A Descriptive Analysis

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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 >48H 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. **RESULTS:** Tolerance for exercise intensity was significantly higher in WALK relative to WALK/SIT (3.2 vs. 2.5 p=0.04). No other significant differences were observed >0.05) between WALK and WALK/SIT, respectively (BMI=29.8 m/kg 2 vs. 31.6 m/kg 2 , %body fat=34.0% vs. 36.0%, estimated VO 2max =29.4ml/kg/min to 26.6ml/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 not significantly different, WALK reported nearly twice the average minutes of MPVA (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 intensity 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.

2050 Board #63 June 1 2:00 PM - 3:30 PM

Competence Beliefs Mediate the Relation between Physical Activity and Motor Competence in Elementary School Children

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PURPOSE: Recent research has proposed that a lack of motor competence (MC) leads to physical inactivity during childhood as children lack the competence beliefs to participate in physical activities. Stodden and colleagues' conceptual model suggested children's physical activity (PA) will drive the development of MC during childhood, but this assumption has not been tested in the pediatric literature. This study, therefore, aimed to examine whether the changes of PA after an 8-week pedometer-based intervention would cause the changes of MC through competence beliefs in physical education (PE). **METHODS:** A pretest-posttest comparison group design was used with an 8-week pedometer-based intervention combined with a goal setting strategy (3 days/week for 24 sessions). Elementary school children were randomly allocated to three conditions: 1) an intervention group with a personalized pedometer weekly target, 2) an intervention group with the fixed pedometer target range, or 3) a control group. Children's PA in PE (steps/class), competency beliefs in PE, and MC (PE Metrics™) were measured at baseline and follow up after the 8-week intervention. Of 273 original participants, 259 (Mean $_{age}$ = 10.88; boys = 131, girls = 128) were in the final data analyses. **RESULTS:** AMOS 22.0 was employed to assess the hypothesized mediation model using structural equitation modeling (SEM). The model represented an acceptable fit (χ^2/df = 11.51/6, RMSEA = 0.06, CFI = 0.98, NFI = 0.96). Standardized path coefficients indicated competence beliefs fully mediated the relationships between PA ($\gamma = .26$) and MC ($\gamma = .33$). The model accounted for 39% of the variance in MC. We then inspected the path coefficients between the same outcome variables across times. The magnitude of the path coefficients across intervention ranged between 0.14 and 0.56. Hence, there were some degrees of change in the relative rank ordering of participants on scores from the measures through the intervention. **CONCLUSION**: This study provided evidence from a randomized controlled intervention to test Stodden et al.'s conceptual model. The results supported that PA intervention results in increased MC through competency beliefs in PE, which highlighted the mediation role of competence beliefs in PA interventions designed to increase MC among elementary children.

2051 Board #64 June 1 2:00 PM - 3:30 PM

Is Playing PokéMon Go Associated With Increased Walking Behavior?

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PURPOSE: One of the latest advancements in the video gaming industry is the location-based, augmented, reality, mobile games (e.g., Pokémon GO). Different from other exergames, the location-based augmented reality games utilize GPS and camera compatible devices to create a fantasy setting in which the games take place. The users need to physically walk in the real world to participate in the game. It is expected that playing the Pokémon GO game will promote walking behavior by the users. The current study compared the walking behavior of the Pokémon GO users to the non-users.
METHODS: 393 college students (Female=175, age M=19.03, SD=2.04) from a medium size college in the Northeast took an online survey that measured their user activity (how much time they played the APP in the last 7 days), whether they agree the APP makes them walk more (Likert scale from 1 strongly disagree to 5 strongly agree), as well as their walking behavior (recall their total walking time in the last 7 days). Based on the responses, 105 athletes were excluded from the study. The rest of participants were classified as non-users (n=227, 79.1%), regular-users (i.e., playing less than 30 min a day, n=24, 8.4%), and active-users (i.e., playing more than 30 min a day, n=36, 12.5%).

RESULTS: 25.6% of regular-users and 75.7% of the active-users strongly agreed or agreed that playing the APP made them walk more. Different from the hypothesis, ANOVA and Post Hoc analysis showed that regular-users and active-users walked significantly less than non-users, M=4.73hr/w SD=3.76, M=4.65hr/w SD=3.67, and M=6.96hr/w SD=4.76, respectively, F (2,247)=4.78, p<.001.
CONCLUSIONS: Although most Pokémon GO players believed that playing the APP made them walk more, they still walked less than non-players in general. There may be pre-existing differences in the walking behaviors between players and non-players. There can be an assumption that video game users are more sedentary than non-users and therefore this is why there are differences in walking behaviors between the two groups. However, future studies would need to investigate this.

2052 Board #65 June 1 2:00 PM - 3:30 PM

Comparative Influence of Exercise Self-efficacy and Physical Activity on Depression in Older Adults

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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 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< 0.05. **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.

2053 Board #66 June 1 2:00 PM - 3:30 PM

Perceived Barriers to Physical Activity among Latino Caregivers

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The older Latino population will increase rapidly over the next four decades, from 7.3% in 2012 to a projected 18.4% by 2050. Latinos have twice the incidence of Alzheimer's disease (AD) compared to Non-Latino Whites. Caregivers face challenging responsibilities, stress and frustration are commonly experienced among family members caring for people with dementia. Physical activity (PA) can reduce familial caregiving burden and stress; however, caregivers often report barriers to being physically active. **PURPOSE:** To identify older Latino caregivers' barriers to engage in PA. **METHODS:** Interviews were conducted with Latino caregivers (N=16, 12 females; 4 males), 50 years and older, caring for a relative with AD or related dementia for a minimum of 4 hours daily, for the past 6 months. Eight interviews were conducted in Spanish and eight in English about the caregiver role, family, and social support, coping strategies and PA. For the purposes of this study only responses regarding barriers that prevent PA were analyzed. Interviews were recorded, transcribed, translated and coded according to directed content analysis. **RESULTS:** Fifteen caregivers cited many barriers that prevent them from participating in PA, and only one reported no barrier. Most obstacles cited involved the care recipient. The necessity to stay at home caring for the relative was the main barrier mentioned (8). Interestingly, this barrier was only mentioned by female caregivers. Women also reported laziness, lack of time due to work, illness, and necessity to take care of grandchildren as other barriers. Males pointed out the lack of time because of work, disability, and laziness as barriers. The most relevant barrier for PA was the impossibility of leaving the care recipient by him/herself or with other temporary caregivers; however, this barrier did not seem to prevent males to engage in PA. **CONCLUSIONS:** Older Latino caregivers cited caring for the family member as the main obstacle to engage in PA. Gender differences seem important, as males are still able to participate in PA despite of caregiving. Future research and interventions should considerate the need of offering an alternative type of assistance to the primary caregiver to allow extra time to PA participation. Funded by the Department of Kinesiology and Nutrition of UIC.

2054 Board #67 June 1 2:00 PM - 3:30 PM

Exercise Preference Mode Related to Trait Anxiety in College Students

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Previous research has indicated that exercisers report lower levels of trait anxiety than non-exercisers regardless of age and gender (De Moor et al., 2006). Significant reductions in trait anxiety occur when aerobic exercise interventions exceed 10 weeks (Petruzzello et al., 1991). However, there is limited research examining the relations between trait anxiety and preferred mode of exercise in both population studies and exercise interventions. **PURPOSE:** To examine the association between trait anxiety and preferred mode of exercise during leisure time in health-conscious young adults. **METHODS:** Participants included 770 college students from 14 health-related fitness courses (416 male, 354 female, M_{age} = 20.64 ± 3.16) who completed a measure of trait anxiety (Spielberger, 1983) and an item that assessed preferred mode of exercise during leisure time (i.e., no exercise, playing sports, strength training, aerobic training, or multiple modes). **RESULTS:** Descriptive statistics revealed 88 students preferred no exercise during their leisure time, whereas 140 students preferred playing sports, 158 preferred strength training, 129 preferred aerobic training, and 255 students preferred multiple modes of exercise during their leisure time. One-way ANOVA indicated there was a significant main effect for preferred mode of exercise on trait anxiety levels, $F(4,765) = 25.00$, $p < .01$, $r^2 = .12$, $\omega^2 = .11$. Hochberg's GT2 post hoc tests indicated that mean trait anxiety scores for students who preferred no exercise during their leisure time were significantly higher than students who preferred playing sports ($d = 0.86$), strength training ($d = 0.92$), aerobic training ($d = 0.84$), and multiple modes ($d = 1.16$). In addition, students who preferred multiple modes had a significantly lower mean trait anxiety scores than students who preferred playing sports ($d = 0.31$) and aerobic training ($d = 0.38$). **CONCLUSION**: These findings indicate that exercise preferences relate to trait anxiety in a collegiate sample. Specifically, participants that did not prefer to participate in any mode of exercise reported the highest levels of anxiety. These results are consistent with previous research indicating that exercise, in general, may lead to reductions in trait anxiety (Petruzzello et al., 1991).

2055 Board #68 June 1 2:00 PM - 3:30 PM

The Relationship Between Motivational Factors And High Intensity Functional Training (HIFT)

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INTRODUCTION: High Intensity Functional Training (HIFT) is characterized by varied weight training, gymnastic, and body weight movements performed at high intensity. HIFT presents participants with the opportunity to improve factors related to physiological and psychological health. Considering its global growth, it is important to recognize the motivational factors behind participation in this training modality. **PURPOSE**: We sought to examine what motivational factors were most important among participants engaging in HIFT at different frequencies throughout a week. **METHODS**: 732 adults (32.4 ± 8.2 years) with more than three-months of HIFT experience (<3 d/wk, N = 114; 3-5 d/wk, N = 413; >5 d/wk = 205) completed an online version of the Exercise Motivation Inventory (EMI-2) survey.**RESULTS**: Significant Spearman rho (ρ) correlations were seen between HIFT frequency and all EMI variables (p<0.01) except those related to health pressures (ρ = -0.036; p = 0.331), ill health avoidance (ρ = 0.011; p = 0.774), and appearance (ρ = -0.025; p = 0.506). Kurskal-Wallis H test and post-hoc comparisons showed that individuals training 3-5 and >5 d/wk scored higher in factors related to enjoyment, affiliation, and competition (p<0.001) compared to those training <3d/wk. Also, those training >5 d/wk scored higher in factors related to challenge, social recognition, strength and endurance, and nimbleness (p<0.001), and lower in factors related to weight management (p<0.001) than the other two groups. **CONCLUSIONS**:This is the first study to express differentiation of motivational factors in HIFT participants based on their weekly training frequency. Considering its growth and expansion, it is important to understand the psychological motives to successfully implement programs targeted towards an

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

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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 ($\beta = .17$, $p < .01$) with male students being more physically active. For the social ecological factors, values ($\beta = .071$, $p = .03$), efficacy ($\beta = .40$, $p < .01$), social support ($\beta = .20$, $p < .01$), and weather ($\beta = -.18$, $p < .01$) emerged as significant predictors; while media and social media ($\beta = -.057$, $p = .083$) and facilities ($\beta = -.003$, $p = .913$) 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. **Conclusions:** 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.

2057 Board #70 June 1 2:00 PM - 3:30 PM

Does Experience Matter? Enjoyment Of High Intensity Interval Exercise With Respect To Exercise History

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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 affective responses during, and 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 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; 54 ♀) 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 [$M_{diff} \pm SE = 10.40 \pm 2.40$; $P < 0.001$] and reported more positively valenced affect during HIIE [$M_{diff} \pm SE = 0.96 \pm .26$; $P < 0.001$] relative to non-exercisers. Additionally, regular exercisers enjoyed HIIE more than the MIA condition [$M_{diff} \pm SE = 6.12 \pm 1.46$; $P < 0.001$], while non-exercisers showed no difference in enjoyment between the two active conditions [$M_{diff} \pm SE = 3.43 \pm 2.35$; $P = 0.15$]. 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.

2058 Board #71 June 1 2:00 PM - 3:30 PM

The Physical, Psychological, and Behavioral Impact of Undergraduate Physical Education Courses Varies by Course Content

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BACKGROUND: Physical Activity (PA) rates are declining in college students, though many universities are moving to eliminate any Physical Education (PE) course requirements for undergraduates. Examining the impact and aspects of collegiate PE courses on health behaviors is crucial for the future implementation and support of collegiate PA.**PURPOSE**: To evaluate the impact collegiate PE classes have on undergraduate student's physical, psychological, and behavioral outcomes. **METHODS**: Participants, a volunteer sample of students enrolled in PE class at a large northeastern USA university, were asked to take an online survey at the beginning and end of their PE course. The survey examined current PA level, goal setting behaviors, self-efficacy, PA enjoyment, opinion of PE course,ci(whether) and demographic factors. Basic frequencies and descriptives described the sample. Independent sample T-Tests and One Way ANOVAs with Tukey's post-hoc were used to examine differences in end-of-semester and change-over-the-semester findings. **RESULTS**: The final sample (n=431) was 56.6%women , 83% Non-Hispanic White with an average age of 21.1±1.7y. PE Course was divided into seven types: Aerobic, Strength, Yoga, General Sport, Dance, and Aerobic/Strength with Lecture. There were significant differences between types for course impression (F=9.16, *p=0.00)*, BMI Change (F=2.77, *p*=0.02), PA Enjoyment (F=2.33, *p*=0.04), PA Goal Setting Behavior (F=2.78, *p*=0.02). Additionally, positive course impression was significantly correlated (*p*<*0.05)* with increases in goal setting behavior (r=.36), self efficacy (r=0.21), and Vigorous PA (r=0.10). Higher goal setting behavior at the end of the semester was correlated with a pre-to-post increase in PA enjoyment (r=0.36) and self-efficacy (r=0.14).
CONCLUSIONS: The current study offered insight on the impact and effectiveness of different types of collegiate PE courses. The differences found between sections and the relationships between certain behavior changes and health outcomes may prove very useful in determining how future PE course offerings and resource allocation may be optimized.

2059 Board #72 June 1 2:00 PM - 3:30 PM

Relations between Basic Psychological Needs and Health-Related Fitness Measures in Male and Female College Students

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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. **METHOD**: Participants were 564 male and 503 female college students (M_{age} = 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 z 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 all three BSNs 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.

2060 Board #73 June 1 2:00 PM - 3:30 PM

Comparing Bmi With Health Related Quality Of Life In College Freshman: The Herd Study

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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/m^2. Fifty-three percent (n=40) of the students were deemed overweight or obese (BMI > 25 kg/m^2). Students with a BMI ≥ 25 kg/m^2 were significantly less likely to record their health as very good or excellent compared to those with a BMI < 25 kg/m^2 (p=0.002). Students with a BMI ≥ 25 kg/m^2 were more likely to record that over the past four weeks, their emotional health caused them to accomplish less than usual (p=0.017). Also, students with a BMI ≥ 25 were more likely to record that their health (physical and emotional) interfered with social activities (p=0.004).
CONCLUSIONS: The BMI of 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.

2061 Board #74 June 1 2:00 PM - 3:30 PM

Cancer Survivors' Experiences Of Physical Activity: Exercise As A Vehicle For Recovery?

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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.

D-62 Free Communication/Poster - **Cycling and Soccer**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2062 Board #75 June 1 3:30 PM - 5:00 PM

Effects of Beetroot Juice Supplementation and Hypoxia on Time Trial Performance in Well-Trained Cyclists

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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% O_2). **METHODS**: Five well-trained male cyclists (VO_2max, 69.1 ± 5.2 ml·min^{-1}·kg^{-1}, $\dot{W}_{max}$ 5.7 ± 0.3 W/kg) 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 vs. 253.3 ± 33.9 Watt; P=0.003). Average oxygen uptake during the TT was higher in normoxia than hypoxia (4411.4 ± 462.9 vs. 3959.0 ± 368.7 ml·min^{-1}; P=0.008). Similarly, peak oxygen uptake during the TT was higher in normoxia than hypoxia (4885.9 ± 483.9 vs. 4204 ± 395.3 ml·min^{-1}; P=0.003). During submaximal cycling BR did not affect average steady state oxygen uptake in neither hypoxic (BR: 3239.8 ± 320.5; PLA: 3158.8 ± 406.1 ml·min^{-1}; P=0.28) nor normoxic conditions (BR: 3167.7 ± 312.5; PLA: 3069.7 ± 249.3 ml·min^{-1}; P=0.55). Further, oxygen uptake during submaximal cycling was similar in hypoxic and normoxic conditions (HYP: 3199.3 ± 360.5; NORM: 3118.7 ± 241.2 ml·min^{-1}; P=0.47).
CONCLUSIONS: These preliminary results suggest that seven days of high dose BR supplementation do not enhance cycling performance in normoxia or moderate hypoxia in well-trained cyclists.

2063 Board #76 June 1 3:30 PM - 5:00 PM

A Single Night of Sleep Restriction Following Heavy Exercise Impairs Next-Morning 3-km Cycling Performance

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(No relationships reported)

Sufficient sleep (7-9 hr) is necessary for proper physiological function. Athletes are susceptible to sleep loss due to the physical demands of heavy training and the emotional stress of competition. A single night of sleep restriction does not appear to negatively impact next-morning performance. However, this has only been assessed with subjects in a well-rested training state. **PURPOSE:** The primary goal of this project was to examine recovery from of a single night of sleep restriction following heavy exercise on cycling time trial performance (TT) and skeletal muscle function in the morning. **METHODS:** Seven recreational cyclists (age, 24 ± 7 yr; VO_{2max}, 62 ± 4 ml/kg/min) completed two phases, each consisting of an evening (EX1) and next-morning (EX2) exercise session. EX1 and EX2 were separated by an assigned sleep condition; a full night of rest (*SLP*+, 7.1 ± 0.3 hr of sleep) or sleep restriction through early waking (*SLP*−, 2.4 ± 0.2 hr). EX 1 consisted of baseline testing (muscle soreness, peak isokinetic torque at 120 deg/sec, a 20 min cycle ergometer warm-up, and subsequent 3-km TT performance) followed by heavy exercise that included 60 min of high intensity cycling intervals and resistance exercise. EX2 was performed 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 EX2 compared to EX1 following *SLP*− (-4.0%), whereas TT performance was '*possibly*' (54% LH) slower during EX2 (vs. EX1)

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.

2064 Board #77 June 1 3:30 PM - 5:00 PM

Validity of a Novel Staged Exercise Test for Measuring Maximal Steady State Lactate In Recreational Cyclist Using the Lactate Plus Analyzer(R)

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Several types of lactate threshold (T_{lac}) protocols have been developed over the years to maximize accuracy and reliability while maintaining ease of measurement and application to training and performance. PURPOSE: The purpose of this study was to determine the validity of a novel staged maximal lactate steady state exercise test (sMLSS) in predicting the MLSS using the Lactate Plus® (Nova Biomedical, Waltham, MA) analyzer. METHODS: Blood lactate concentration (BLC) was measured in duplicate for all tests. Seven trained cyclists (20 miles per week) performed a $\dot{V}O_{2max}$ test starting at 100W and increasing by 30W every three minutes until volitional fatigue. Lactate threshold was defined as the previous workload to a 2 mmol/L increase in BLC. Next, the *s*MLSS test was performed starting at the T_{lac} 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 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 *s*MLSS. MLSS was determined at the maximal workload with < 1 mmol/L increase in BLC in the final 20 minutes. Dependent 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 *s*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 sMLSS and MLSS protocols for predicting lactate accumulation. CONCLUSION: In conclusion, the *s*MLSS was a valid and reliable predictor of MLSS in trained cyclists.

2065 Board #78 June 1 3:30 PM - 5:00 PM

High-intensity Cycling Intervals Are Prescribed Accurately Using The 3-min All-out Exercise Test

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High-intensity interval training (HIIT) has been used to enhance critical power (*CP*) and the finite capacity for work >*CP* (*W'*); yet, research on prescriptions using the *CP* concept is warranted. **PURPOSE**: We investigated the validity of interval prescriptions derived using *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_{2peak}), 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_{2peak} values from a verification bout subsequent to a 3 MT were compared with end-exercise 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_{2peak} ($ml \cdot kg^{-1} \cdot min^{-1}$) 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 (55.7 ± 7.4) did not differ (F = 2.10, p = 0.25). Strong measurement agreement was observed for VO_{2peak} between measures (ICC_{α} = 0.85, typical error = 2.37 $ml \cdot kg^{-1} \cdot min^{-1}$, coefficient of variation = 4.6%). **CONCLUSION**: The 60% and 80% *W'* HIIT schemes for either 180 or 300 s durations evoked VO_{2peak} consistently, providing empirical support for the *CP* concept to standardize HIIT.

2066 Board #79 June 1 3:30 PM - 5:00 PM

Difference Of Anaerobic Capacity, Muscle Activity Of Lower Extremities In Win-gate Test According To Events Of Cyclists

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(No relationships reported)

PURPOSE:
This study examined anaerobic capacity, muscle activity of dominant lower extremities Gluteus maximus(Gmax), Rectus femoris(RF), Long head of biceps femoris(LBF), Tibialis anterior(TA), Gastrocnemius medialis(GM) with Standing start 10sec(SS-10sec) and Rolling start 30sec(RS-30sec) Wingate test between short distance cyclist group(SDC, 20±1 yrs) and long distance cyclist group(LDC, 21±2 yrs) total 12 elite cyclists to develop baseline data which can provide proper training program for each event through comparison and analysis of this experiment.
METHODS:
Independent t-test was conducted to verify the differences of anaerobic capacity, lower extremities muscle activity, isokinetic muscle strength, and paired t-test was executed to verify anaerobic capacity, muscle activity differences within each group. All the statistical significance level was set as α=.05.
RESULTS:
1. SDC group was identified as significant higher Peak/kg than LDC group during SS-10sec wingate test between the groups(p<.05).
2. SS-10sec was identified as significantly higher than RS-30sec in Peak power and Peak/kg between SS-10sec and RS-30sec wingate test within SDC group(p<.01, p<.01). SS-10sec was identified as significantly higher Peak power and Peak/kg than RS-30sec, within LDC group(p<.05, p<.05), for Mean power and Mean power and Mean/kg, RS-30sec was identified as significantly higher result than SS-10sec(p<.001, p<.001).
3. SS-10sec was identified as significantly higher Peak and Mean muscle activity than RS-30sec in long head of biceps femoris during wingate test within SDC group(p <.05, p <.01). Peak muscle activity within LDL group was identified as no significant difference between SS-10sec and RS-30sec in Peak muscle activity, for Mean muscle activity, SS-10sec was identified as significantly higher muscle activity than RE-30sec in tibialis anterior and gastrocnemius medialis(p<.01, p<.05).
CONCLUSION:
With the above results, it is identified anaerobic capacity and activated muscle groups during pedalling according to cycling events. Therefore, in the future study, it is considered that specialized training program application for specific event based on the current study could improve athletic performances.

2067 Board #80 June 1 3:30 PM - 5:00 PM

Preliminary Examination Of Stamina Sensor Device With Laboratory Testing Measures In Recreationally Trained Cyclists

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The availability of app based fitness technology has led users to a wide selection of devices to aid in their training regimes, however some do not accurately represent individual physiological characteristics. With an ever growing base of device choices, selecting a highly reliable and valid unit should be of utmost importance to the attentive athlete. **PURPOSE**: To determine the relationship of a stamina sensor device with traditional laboratory cardiorespiratory testing protocols to evaluate inter-individual physiological characteristics in trained cyclists. **METHODS**: Recreationally trained cyclists (n=6) completed a successive fixed work rate incremental cycle ergometer test to exhaustion. The testing protocol began at 85 W and increased by 15 W every 5 minutes. Inspired and expired gases were continuously recorded using a metabolic cart, heart rate (HR) using a stamina sensor device app; blood lactate levels utilizing a using a finger stick capillary sample (0.7 microliter (µL)) and a blood lactate analyzer and rate of perceived exertion (RPE) were obtained during the final 30 seconds of each stage. Individual physiological data were assessed to determine heart rate (HR), lactate threshold (LT), ventilator threshold (VT), and RPE responses between athletes. Delta values were calculated per dependent variable to assess the relationship between changes in physiological response to changes in the stamina levels. **RESULTS:** The stamina sensor device displaying stamina percentage, aerobic percentage, and anaerobic percentage has shown low correlation with laboratory testing measures such as VO2 and blood lactate values. When correlations were run on VO2 and stamina % change, stamina value, aerobic, and anaerobic values it produced r values of 0.616, -0.743, -0.861 and -0.664 respectively. When correlations were run on blood lactate values and stamina % change, stamina value, aerobic, and anaerobic values it produced r values of 0.509, -0.817, -0.914 and -0.761 respectively.

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.

2068 Board #81 June 1 3:30 PM - 5:00 PM

The Impact of Cycling Cadence On Oxygen Consumption During Maximal & Submaximal Exercise

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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 %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 submaximal exercise at different cycling rates. **METHODS**: Eleven young (21±1 yr) recreationally active males completed a continuous incremental exercise test to exhaustion (VO_{2peak}) 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 differences cadences. The mechanisms underpinning the increased metabolic demand at higher rates of muscle contraction need further examination.

2069 Board #82 June 1 3:30 PM - 5:00 PM

Adding Video Games or Music Videos to Stationary Cycling: Effects on Exercise Enjoyment.

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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 (NM: $M = 3.33$, $SD = .85$. 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: $M = 113.12$, $SD = 29.21$; MV: $M = 128.11$, $SD = 30.17$, $p < .001$, $d = .51$ and VG: $M = 113.12$, $SD = 29.21$; NM: $M = 122.75$, $SD = 33.30$, $p < .005$, $d = .33$). 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 *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.

2070 Board #83 June 1 3:30 PM - 5:00 PM

The Effect of Typical Power Variation on Cycle Time-trial Performance

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The manner in which power output is distributed during a time-trial (TT) can affect performance. However, previous studies that have compared the effect of constant and variable power outputs on performance have failed to consider the typical amplitude and period of power variations that competitive cyclists undertake.**PURPOSE**: To compare the time required to complete an indoor, self-paced 4 km TT following a 12 km constant and variable power "pre-load". **METHODS**: Eleven competitive cyclists (32 ± 10 years, 181 ± 4 cm, 78 ± 9 kg, VO_{2peak} 4.2 ± 0.7 $L \cdot min^{-1}$) initially completed a self-paced 16.1-km TT. Participants then undertook two 16.1-km experimental TT whereby the initial 10 km was either at a constant (CT) or variable (VT) power output. Mean power (MP) during this time was equivalent to the mean power from the initial 16.1-km TT but in VT, power was varied in accordance with a previously determined template which was based on the typical power variation of competitive cyclists. For each trial, a 2 km normalisation period at MP preceded a maximal, self-paced final 4 km. **RESULTS**: There was no difference in the time to complete the final 4-km (CT: 362 ± 39 vs VT: 348 ± 43 s, $t_{10} = -1.38$, $P = 0.20$) or average power (275 ± 42 vs. 287 ± 57 W, $t_{10} = 1.29$, $P = 0.23$) between trials. Power output increased during the final 4 km compared to 12 km ($P < 0.05$); the increase in power during the final 4 km was accompanied by an increase in oxygen uptake which at 16.1 km (3.7 ± 0.5 $L \cdot min^{-1}$) was greater ($P = 0.05$) than that at 12 km (3.6 ± 0.5 $L \cdot min^{-1}$). Heart rate also increased continuously throughout the final 4 km ($P < 0.001$), though was not different between trials. **CONCLUSIONS**: In using the typically displayed amplitudes and periods of variation in power output that competitive cyclists undergo during TTs in order to define VT, this study sought to replicate the typical variations which are apparent during self-paced TT. The results of the present study suggest that this typical power variation does not adversely affect performance, at least during a 16.1-km TT. The similar performance was accompanied by similar physiological responses during the final 4 km of the trial.

2071 Board #84 June 1 3:30 PM - 5:00 PM

Relationships Between A Smartphone Stamina App With The Performance And Physiological Responses To Cycling

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In order to complete an event as fast as possible an endurance athlete must select a work rate that maximizes intensity and optimizes the rate of fatigue. This pacing strategy ensures a true maximal effort without premature exhaustion and can be conceptualized as an allocation of the athlete's stamina resources. The relationship between intensity and time to exhaustion is curvilinear and dependent upon the athlete's individual fitness characteristics and current fatigue state. Therefore, an athlete's stamina level and rate of allocation should be influenced by exercise intensity, duration, and individual fitness characteristics.
PURPOSE: To determine the relationships between smartphone stamina sensor device and the performance and physiological responses to an incremental cycling test to exhaustion in trained cyclists.
METHODS: 6 trained cyclists completed a successive, fixed work rate incremental cycle ergometer test to exhaustion. Testing began at 85 W and increased by 15 W every 5 minutes. Inspired and expired gases were continuously recoded using a metabolic cart and HR using the smartphone app. RPE was obtained during the final 30 seconds of each stage. Individual physiological data were assessed to determine the individual VO_2 and metabolic cost per stage and the ventilatory thresholds. Bivariate correlations were conducted between the following variable: stamina and total mechanical work (J), stamina percent change and stage RPE, stamina and energy expenditure (kcal.), and stamina and percentage of total kcal. to exhaustion.
RESULTS: Stamina had statistically significant correlations with J, $r(140) = -.81$, $p < .01$, RPE, $r(140) = -.62$, $p < .01$, kcal., $r(140) = -.79$, $p < .01$, and percentage of kcal. to exhaustion, $r(140) = -.83$, $p < .01$.
CONCLUSIONS: The stamina variable is highly related to performance and physiological responses to an incremental cycling test to exhaustion. Stamina is able to respond to the dynamic nature of exercise to exhaustion and may prove to be a valid variable to assess endurance performance.

2072 Board #85 June 1 3:30 PM - 5:00 PM

Time Deception Affects Performance But Not Metabolic Variables In Cyclists

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(No relationships reported)

PURPOSE: Previous investigations have found that various types of deception (ie. unknown task endpoint) could alterperception and consequently affect performance. We investigated whethertime 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. Ratings of perceived exertion (RPE) were assessed with the 20-point Borg scale. Blood samples were collected before and immediately after each time trial, and analyzed for blood glucose, serum creatinine, serum urea, and serum urate. Data were analyzed with repeated measures ANOVA. Significant main effects were further analyzed using pairwise comparisons with Bonferroni post hoc tests. Statistical significance was set at the $p \leq 0.05$ level of confidence. Statistical analysis was completed using SPSS v20.0 for Windows (LEAD Technologies).**RESULTS**: Distance completed at any 10min 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 $mg.dl^{-1}$) 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 canincrease performance in a time trial, but does not affect RPE nor the measured metabolic variables in semi-professional cyclists.

2073 Board #86 June 1 3:30 PM - 5:00 PM

The Effect Of Acute Versus Accumulated Soccer Training On Postprandial Dysmetabolism

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(No relationships reported)

Playing soccer has shown to have short and long term health benefits. Whether a dose response relationship exists for soccer training over a short period (1 week) is unknown. **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 cruve (iAUC) 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 from pre to post measures (p=0.04; 95%CI=-3.45 to -0.04; ES=1.02), but not in the 3xpw. The average TG response was lower at all time points for the S compared to the C for both groups. There was no significant delta change for 2hrs insulin iAUC in both groups. **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.

2074 Board #87 June 1 3:30 PM - 5:00 PM

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 where 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 level 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.

2075 Board #88 June 1 3:30 PM - 5:00 PM

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

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(No relationships reported)

Sport behavior may be regulated through a desire to win (promotion) or a desire to avoid losing (prevention), which differentially impacts cognitive tasks. Performance facilitation may also stem from a match between an individual's self-regulatory focus and her chronic regulatory strategy, possibly due to "feeling right". This notion of regulatory fit may impact pre-performance anxiety and arousal which may impact sport performance. PURPOSE: To determine the impact of regulatory fit 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 strategy. Anxiety, measured by the Competitive State Anxiety Inventory-2 Revised (CSAI-2R) and arousal, measured by pre-ejection period (PEP), heart rate (HR), and heart rate variability (e.g. high frequency variability (HF), and the square root of the mean squared differences of successive NN intervals (RMSSD)) were determined pre- and post-manipulation. Performance, the number of successful penalty kicks out of 10, was measured post-manipulation. The impact of regulatory fit on performance and on anxiety and arousal variables were determined by ANOVA and RM ANOVA, respectively. RESULTS: There was no difference between M (3.0 + .95) 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 ln HF, HR, and ln RMSSD 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 + 1.0; 75.3 + 12.3; 3.8 + .49) to post (6.9 + .85; 74.6 + 10.5; 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 pre (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.

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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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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 30, 60, 90 and 120 min after waking from a daytime nap. **METHODS:** Twelve soccer players (18.3±1.0 yrs) completed two conditions in a randomised order. In one condition, participants had 9 hours time in bed (22:00-07:00h) without napping the next day and in the other condition, participants had 7 hours time 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 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 (219.5±20.5 ms, p=0.01) and 60 min (219.8±20.8 ms, p=0.01). There were no main effects of condition (p=0.17) or time (p=0.37), and no interaction between condition and session (p=0.84) on sprint ability. **CONCLUSIONS:** The findings suggest that a daytime nap will not affect subsequent sprint ability or reaction time. However, athletes may feel less ready to perform after napping compared with not napping.

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 running performance (shuttle run), resting heart rate and heart rate recovery throughout a soccer season to determine if these physiological parameters can be used to detect training distress in collegiate soccer players. **METHODS:** 26 women and 17 men were enrolled in the study. Data were collected at four time points throughout the season (beginning, twice during season and during post-season play). Shuttle run time, heart rate recovery time, resting heart rate values, and multi-component training distress scale (MTDS) questionnaire at each time point. Multivariate analyses were performed with the dependent variable, with time, grade in school and gender as independent variable. **RESULTS:** Shuttle run times were prolonged in the beginning and end of season compared to the two mid-season tests ($p<0.001$); heart rate recovery improved throughout the season (p=0.003); freshmen deviation from baseline MTDS was greater compared to all other grades (p=0.001). Although not statistically significant, resting heart rate values trended up at the end of the season for both genders. MTDS correlated most with shuttle run time and resting heart rate. **CONCLUSIONS:** Shuttle run time and resting heart rate appear to be possible variables that could serve as physiological measures for training distress, although it appears higher physical fitness serves as a protective effect against training distress.

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_{age}= 19 ± 1.1 yrs; $M_{\%BF}$= 11.9 ± 3.2 %) and female (N=26; M_{age}= 19 ± 1.3 yrs; $M_{\%BF}$= 20.9 ± 3.4 %) DI college soccer players participated in blood draws prior to preseason (T1), two weeks into the regular season (T2) and at season's midpoint (T3). 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. Workload (km and kcal/kg) was monitored using the Polar Pro system. **RESULTS**: There were no significant changes in TC over time. FC increased from T1 to T2 (Δ FC= 0.34 + 0.1 mcg/dL, P< .05) and remained elevated, particularly for females. There were significant Time x Sex interactions for Fe, GH, and IGF-1 (P<.05). Fe decreased from T1 to T2 (Δ Fe= -29.6 + 7.8 mcg/dL, P< .05) before returning to baseline at T3 in females. CK increased from T1 to T2 (Δ CK= 204.9 + 90.3 U/L, P< .05) before returning to baseline for females and increased from T1 to T3 (Δ CK= 141 + 57.1 U/L, P< .05) for males. GH decreased from T1 to T2 (Δ GH= -2.1 + 0.8 ng/mL, P< .05) and remained below baseline in females. IGF-1 decreased from T2 to T3 in females (Δ IGF-1= -51 + 14.4 ng/ml, P< .05) while males increased from T2 to T3 (Δ IGF-1= 50.8 + 12.5 ng/ml, P< .05). Females had greater total work load (T1-T3) than males (227.6 + 58.6 km vs. 183.2 + 49.2 km; 645.1 + 84.5 kcal/kg vs. 501.1 + 110.5 kcal/kg, P< .05, respectively). **CONCLUSIONS**: The increase in FC indicates an elevated stress response, which was particularly pronounced for females. Higher workloads for females in preseason were consistent with earlier elevations in CK compared to males. Additionally, only females had GH changes, suggesting a sex-dependent response. There were also differential changes in IGF-1 across sex. Significant changes in Fe were seen only in females, suggesting unique dietary needs during periods of increased work load. These results suggest differences in training demands and physiological responses for male and female college soccer players.

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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Reported Relationships: R.A. Huggins: *Consulting Fee; Quest Diagnostics Inc.*

Blood biomarkers signal health and performance concerns in athletes. However, serial comprehensive biomarker measurement to detect overtraining in elite soccer athletes remains unstudied. **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±6cm, body mass 77.9±6.2kg, BF% 11.9±2.4%, VO_{2max} 52.9±6.1 $mL \cdot kg^{-1} \cdot min^{-1}$) at 5 time points: prior to the start of preseason (PS), and in season at week 1 (W1), W4, W8, and W12. Blood samples from W1-W12 were obtained 32-34 hours post-match. PlayerLoad (PL) was recorded daily with GPS units. Significant changes in biomarkers over time were assessed via repeated measures ANOVA ($\alpha < 0.05$) and the degree to which biomarkers explained PL were examined using stepwise regression. **RESULTS:** Total testosterone (T, mean±SD; $ng \cdot dL^{-1}$) was lower at W1 (588±151) vs PS (665±198, p= 0.029) and W8 vs W4 (565±147, 645±170, p= 0.034). Free T ($ng \cdot dL^{-1}$) was also lower at W1 (103±24) and W12 (99±33) vs PS (127±35, p< 0.025). Free T at W1 (103±24) and W12 (99±33) were decreased vs W4 (125±32, p< 0.022). No differences over time occurred for free cortisol (FC) and total cortisol (TC); however, FC ($\mu g \cdot dL^{-1}$) was elevated at PS, W1, and W4 (1.02±0.41, 1.09±0.17, 0.94±0.35) compared to the reference range (ref.) (0.07-0.93 $\mu g \cdot dL^{-1}$) and TC was elevated W1 (22.1 ± 2.1) vs the ref. (4.6-20.6 $\mu g \cdot dL^{-1}$). Growth hormone (GH), lactate

dehydrogenase, SHBG, IGF1, and TSH remained unchanged over time. Creatine kinase (CK) was elevated at W1 (820± 899 U·L^{-1}; ref. 44-196 U·L^{-1}) and exhibited a main effect for time (p= 0.001) while myoglobin did not change. IL-6 (pg·mL^{-1}) was increased W8 vs W1 (1.61±.87, 0.83±0.20, p= 0.007), however IL-1β remained unchanged over time. Changes in PL were explained by T4, A1C, Free T, glucose, GH, and CK (R^2=0.39, β=-0.490, p=0.001). **CONCLUSION:** Comprehensive biomarker testing detected reduced FT, elevated TC, and increased CK after PS, consistent with a net catabolic state after PS, without apparent overtraining. Variation (39%) in PL was explained by routine monitoring indicating that these biomarkers track training progression.

2080 Board #93 June 1 3:30 PM - 5:00 PM

Monitoring Markers of Nutrition Status Throughout a Collegiate Soccer Season

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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±6cm, body mass: 77.9±6.2kg, BF%: 11.9±2.4%, VO_{2max}: 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, W8 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 biomarker 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 non-clinical but 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.
Characters= 1,036/2000

Nutritional Biomarkers Over A Competitive Soccer Season

Biomarker	Units -10^1	Ref. Range	PS		W1		W4		W8		W12		Season	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Avg	SD
Chromium	mg-dL	<1.3	0.2	0.0	0.2	0.0	0.8	2.2	0.2	0.0	0.2	0.0	0.3	0.4
Mercury	µg-L	<11	2	1	2	1	2	0	2	0	2	0	2	0
Zinc	µg-L	60-130	93	8	84.9ρ	10	91.25ρ	8	102 †	15	101 † ω	13	94	11
Selenium	µg-L	63-160	145	14	131*	11	123*ρ	15	144ω	34	144ω	11	145	13
Total Vitamin D	ng-L	30-100	39ρ	10	36ρ	8	35ρ	8	34ρ	8	31* † ω #	7	35	8
Ferritin	ng-L	11-172	53	28	49	31	53	33	56	38	53	35	53	33
Serum Folate	ng-mL	>8.0	16.5	5.3	14.7	4.6	15.9	3.4	17.2	3.6	15.4	3.2	15.9	4.0
Vitamin B12	pg-mL	200-1100	630	188	678	218	705	204	681	210	688	194	676	203
Vitamin E (Alpha)	µg-L	5.7-19.9	9.4	2.1	9.2	1.6	9.8	2.0	9.4	2.1	9.8	2.1	9.5	2.0
Vitamin E (Beta-Gamma)	µg-L	<4.3	1.1ρ	0.4	1.1ρ	0.3	1.3	0.5	1.4	0.4	1.5* †	0.4	1.5	0.4
Sodium	mmol-L	135-146	139ρ	2	139ρ	2	140ρ	2	142* † ω	2	142* † ω	2	140	2
Chloride	mmol-L	98-110	101.6ρ	2.3	103.5*	1.6	102.6	1.5	103.6	2.2	103.3*	1.6	102.9	1.9
Magnesium	g-dL	1.5-2.5	2.0ρ	0.1	2.1	0.1	2.0ρ	0.1	2.1	0.1	2.1*ω	0.1	2.1	0.1
Calcium	mg-dL	8.9-10.4	9.8	0.4	9.6ρ	0.3	9.5*ρ	0.2	9.8ω	0.3	9.9 † ω	0.3	9.7	0.3
Uric Acid	mg-dL	4.0-8.0	5.1	0.8	5.7*	0.9	5.3	0.8	5.3	0.7	5.1 †	0.8	5.3	0.8
Total Iron	µg-L	27-164	83	35	90	30	76	23	98	40	83	38	86	33
TIBC	µg-L	271-448	305ρ	29	313ρ	28	317ρ	32	333 †	33	339* † ω	30	322	30
Saturation	%	9-52	26	10	29	11	24	9	30	12	25	12	27	11
Omega-3 Index	%	1.4-4.9	2.5	0.7	1.6*ρ	0.4	1.8*ρ	0.2	1.7*ρ	0.3	2.3 † ω #	0.5	2.0	0.4
Omega-6/Omega-3 Ratio	Ratio	5.7-21.3	7.1ρ	2.2	12.6*	1.7	11.9*	1.7	14.3*ρ	2.2	13.1* #	2.4	12.2	2.0
EPA	%	0.2-1.5	0.4	0.1	0.3	0.1	0.4	0.1	0.4	0.2	0.5	0.3	0.4	0.2
DHA	%	1.2-3.9	2.0	0.6	1.3*ρ	0.3	1.4*ρ	0.2	1.3*ρ	0.2	1.8 † ω #	0.4	1.6	0.3
Carotene	µg-L	4-51	28	56	31.1ρ	31	17	13	16ρ	10	23ω #	15	23	25

TIBC=Total Iron Binding Capacity; EPA=eicosapentaenoic acid; DHA= docosahexaenoic acid; NE= Not Established
* Different (p<0.05) than PS; † Different (p<0.05) than W1; ω Differentip<0.05) than W4; # Different (p<0.05) than W8; ρ Different (p<0.05) than W12

2081 Board #94 June 1 3:30 PM - 5:00 PM

Inspiratory Performance is Significantly Related to Isokinetic Knee Power in Collegiate Women Soccer Players

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Sport specific tasks (SST) and exercise training are known to elicit specific changes in peripheral skeletal muscles (PSM), but adaptations to inspiratory muscles (IM) are poorly understood. **PURPOSE**: To examine the relationship of the PSM and IM in Division 1 collegiate women soccer players (D1CWSP). **METHODS**: Thirteen D1CWSP underwent maximal tests of PSM and IM via isokinetic dynamometry (ID) and the Test of Incremental Respiratory Endurance (TIRE), respectively. Standard ID measurements were obtained during maximal extension (EXT) and flexion (FLEX) of the dominant knee 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 D1CWSP was 19.5±1.0 years, 172±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 115±17 and 75±13, 85±9 and 55±10, and 65±8 and 47±10 ft-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

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Measures of internal and external load are used to quantify training volume and stress in athletes, however, differences in loads experienced between starters and non-starters is not well quantified in collegiate soccer. **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 ± 1yrs, height 181 ± 6cm, body mass 77.9 ± 6.2kg, BF% 11.9 ± 2.4%, VO_{2max} 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 (Vel_{max}), velocity load (VL), heart rate (HR), time spent >95%HR (HR>95%), and sprint efforts (SP_E) 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, p< 0.05). **RESULTS:** Significant group by time interactions were found for ST ($F_{3,27}$=5.398, p= 0.005), DST ($F_{3,27}$=4.607, p=0.010), PL ($F_{3,27}$=3.183, p=0.050), Vel_{max} ($F_{3,27}$=8.918, p=0.001), VL ($F_{3,27}$=7.257, p=0.001), HR>95% ($F_{3,27}$=5.296, p=0.005), and SP_E ($F_{3,27}$=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, PL×min^{-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). Vel_{max} was lower W1-4 (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=0.025, p=0.006). HR was elevated W4-8 (145±2bpm) than PS-W1 (135±2bpm, p=0.004) and W1-W4 (133±2bpm, p=0.001). **CONCLUSION:** 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.

2083 Board #96 June 1 3:30 PM - 5:00 PM

Comparison between Anthropometry and Bioelectrical Impedance in Estimating Fat and Muscle Masses in Soccer Players

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(No relationships reported)

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 yr, Body mass = 75.8 ± 6.7 kg, BMI = 24.9 ± 1.6 $kg \cdot m^{-2}$; mean ± SD). The anthropometry-based estimations of fat and muscle masses were obtained by means of the four-compartment model of De Rose and Guimaraes (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.

2084 Board #97 June 1 3:30 PM - 5:00 PM

FIFA 11+ Warm-up: Effects On Movement Control And Performance In Young Female Soccer Athletes

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(No relationships reported)

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 remains a challenge despite its effectiveness, but may be increased if positive impacts on physical performance as well as injury risk factors such as neuromuscular control are shown. Effects of the program on physical performance measures and movement control have not been investigated in young female soccer athletes. **PURPOSE**: To determine the effect of the FIFA 11+ program, compared to a standard warm-up, on movement control, agility, vertical jump (VJ), and core stability in young female athletes after a 5 month indoor soccer season.
METHODS: Forty-seven girls from the U10 and U11 divisions of a developmental soccer club were randomized by team to the intervention group (IG) or the control group (CG). IG teams were taught the 11+ warm-up, consisting of 15 exercises broken into 3 sections: 1) slower running drills, 2) strength and plyometric exercises, and 3) faster sprints. The CG continued with their previously planned warm-up. Teams practiced and played 2-3x/week. Blinded assessors conducted pre- and post-season testing of movement control (Landing Error Scoring System), and physical performance (T-test, VJ, and static plank). Two-way Repeated Measures ANOVA analyses were used to compare movement control and physical performance of the groups over time. **RESULTS**: The IG demonstrated a significantly greater increase in static plank hold time compared to the CG (26.1 ± 38.5 vs. 2.1 ± 37.1 seconds, p=.047). All athletes, regardless of group, improved their LESS score (pre- 6.8 ± 1.6; post-season 6.2 ± 1.4, p=.005) and agility T-test time (pre- 14.2 ± 1.2; post-season 13.8 ± 1.0 seconds, p=.001). No differences were found for the VJ.
CONCLUSIONS: The 11+ program, performed over a 5 month indoor soccer season by 9-11 year old soccer players, resulted in improved core stability compared to a regular warm-up, but this did not translate into a significantly greater change in LESS score in the IG. The 11+ program may not be more effective than other dynamic warm-ups at improving neuromuscular control and agility. However, time and space limitations inherent in the indoor soccer environment may have negatively impacted the program's ability to reach its full potential.

2085 Board #98 June 1 3:30 PM - 5:00 PM

Implication Of Dynamic Balance In Change Of Direction Performance In Young Elite Soccer Players Is Angle Dependent?

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PURPOSE: Team sports require rapid whole body change of direction (COD) in order to regain, maintain possession of the ball or to avoid opponent. These actions are often performed through unilateral process, with the contralateral leg incurring no ground contact. As a result, maintaining unilateral dynamic balance remains important. The aim of this study was to examine the relationship between dynamic balance (DB) and COD performance in young elite soccer players.
METHODS: 20 right-footed young elite soccer players (age=16.42±0.55 year, height=176±2.5cm; leg length=95.70±3.34cm, body-mass=67.03±5.20kg) participated in this study. All players performed star excursion balance test (SEBT) with dominant (DL) and nondominant leg (NDL). 10m sprint with COD of 45°, 90°, 135° or 180° after 5m were also assessed with COD on both right and left sides.
RESULTS: Correlations analysis showed significant negative relationships between COD tests (with DL and NDL) and SEBT. Stepwise multiple regression analysis showed that DB performance explained between 20% and 75% of the variance of COD tests. Likewise, dynamic balance contribution was dependent upon the angle of COD and the leg used to turn.
CONCLUSIONS: Dynamic stability performance was significantly correlated with COD's performance in young elite soccer players which, possibly due to similarities in movement demands and muscle recruitment. Furthermore, the contribution of dynamic balance on COD performance was angle dependent. Individualized specific dynamic stability exercises may be required to compensate players' deficit in each COD angle.

2086 Board #99 June 1 3:30 PM - 5:00 PM

Relationship Between Physiological Load, Body Composition, And Performance Across Season In Female Soccer Athletes

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(No relationships reported)

Body composition has been widely recognized as one of the many factors that could affect performance in the collegiate athlete, including body fat percentage and its changes across the competitive season. Zephyr Performance Systems have been used as a tool to measure physiological load in competitive athletes. Changes in body composition and fitness measures have been reported in female soccer athletes, but few have 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 (YYIR2) 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 (AVEPL). Athletes completed a second YYIR2 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 YYIR2 or body fat percentage between pre and post-season. However, AVEPL 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 AVEPL ($\beta = -0.448$, $p = 0.048$). When adjusted for age and pre to post-season change in body fat percentage (ChangeBF), AVEPL remained inversely related to ChangeDist ($\beta = -0.446$, $p = 0.037$).
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.

2087 Board #100 June 1 3:30 PM - 5:00 PM

The Effect of a Concurrent Strength and Conditioning Program in Female Soccer Players

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(No relationships reported)

BACKGROUND: Due to the high metabolic and physical demands involved in soccer, an optimal strength and conditioning program for female high school soccer players 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 yrs) 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 power clean. 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.

2088 Board #101 June 1 3:30 PM - 5:00 PM

Physiological Performance Measures in Female Collegiate Soccer Players

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(No relationships reported)

Although participation in women's soccer has increased dramatically in the last two decades, the research into the physiological demands and physical characteristics of players is limited.
PURPOSE: To compare anaerobic and aerobic power in female intercollegiate soccer players with a reference group of elite international players.
METHODS: Subjects were 28 members of a division I university women's soccer team. Maximal aerobic power (VO_2 max) was determined during an incremental treadmill run using a MOXUS metabolic measurement system. The Margaria-Kalaman power test was timed using switch mats to determine anaerobic power. Bone mineral density and percent body fat were determined by dual-energy X-ray absorptiometry (DEXA). Anaerobic power comparisons were made by converting literature values for vertical jump heights to watts by the Lewis formula.
RESULTS: VO_2 max was similar between the collegiate players and the reference group of international players (52.7 ± 5.8 vs 51.5 ± 3.3 ml/kg/min for collegiate and reference players respectively). Similarly, anaerobic power was not different between the collegiate and the international players (841.2 ± 112.4 vs 808.8 ± 109.5 watts). Height (165 ± 6 vs 169 ± 2 cm) and mass (61 ± 7 vs 61 ± 2) were similar between the two groups; however the collegiate players had a higher percent body fat than the reference players (25.9 ± 5.2 vs 17.5 ± 2.6 %).
CONCLUSION: These results suggest that the female collegiate players have aerobic and anaerobic power comparable to that reported for international (primarily European) elite female soccer players. Although the collegiate players were of similar height and body mass as the international players, the collegians had considerably higher percent body fat.

2089 Board #102 June 1 3:30 PM - 5:00 PM

Effect of Ages and Jump Types on Lower Limb Explosivenss in Elite Female Soccer Players

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(No relationships reported)

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 (F_{max}) and force difference between preferred and non-preferred leg (F_{diff}). All parameters were processed using MANOVA and Bonferroni post-hoc test, effect size (η^2).
RESULTS: Players achieved the following values: (U15: CMJFA = 32.58±3.25 cm, CMJ = 28.19±3.81 cm, SJ = 25.38±3.33, 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). Bonferroni's post hoc test revealed significant differences in explosiveness between U15 and U17 as well as U15 and U19 (p<.05). The MANOVA analysis revealed a significant age effect on JH($F_{2,147}$ = 12.61; p<.01, η^2 = 0.16) and F_{max} ($F_{2,147}$ = 4.19; p<.05, η^2 = 0.06). Also, significant effect was detected by different type of jump on JH($F_{2,147}$ = 33.28; p<.01, , η^2 = 0.33) and F_{max} ($F_{2,147}$ = 24.2; p<.01, η^2 = 0.26). We also found significant effect of jump types on F_{diff} ($F_{2,147}$ = 6.49; p<.01, η^2 = 0.09). Players achieved significantly higher F_{diff} in CMJ = 9.59 ± 6.79 % compare to SJ = 5.56 ± 3.89 cm (p<.01). Thirteen players (26.5 %) had a F_{diff} higher 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 F_{diff} with respect to the type of jump. More than 25% of female soccer players had F_{diff} greater than 10%.

2090 Board #103 June 1 3:30 PM - 5:00 PM

The Lower Extremity Strength, Bilateral And Ipsilateral Strength Assymetries In Elite Female Soccer Players

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(No relationships reported)

BACKGROUND
Soccer frequently involves one-sided activities such as kicking, tackling and passing, which may lead to strength asymmetries (SA), and effect of the age is not well studied.
PURPOSE
The aim was to investigate effect of limb-dominance and ages through relative strength measures of knee extensors (KE), knee flexors (KF), bilateral strength ratio (QQ, HH), and ipsilateral strength ratio (HQ) in youth elite female soccer players.
METHODS
National level female soccer players of three age categories (Under 16 years =17, Under 17 years =16, Under 18 years =16 players) performed isokinetic strength testing for KE, KF at three velocities (60, 180, 300 $°.s^{-1}$) for the dominant (DL) and non-dominant leg (NL). Mean peak torque of extensors (PTE) and flexors (PTF) values were calculated in Newton-meters relatively to body weight ($N{\cdot}m{\cdot}kg^{-1}$) and strength ratios were derived from peak torques. Three-way Mixed-design ANOVA with two between subject effect (age, limb dominancy) and one within subject effect (angular velocity) were used. Bonferonni's *post-hoc* test was employed due to the multiple comparisons. Effect size was assessed using the η_p^2 coefficient.
RESULTS
Significant age effect was observed in PTE and PTF (PTE: $F_{2,91}$ = 4.60, p = 0.013, η_p^2=0.09, PTF: $F_{2,91}$ = 11.31, p = 0.001, η_p^2=0.20). Conversely, age did not indicate significantly effect on bilateral strength ratio (QQ, HH) ($F_{2,91}$ = 2.00, p = 0.141, η^2=0.04) a HQ (HQ: $F_{2,90}$ = 1.03, p = 0.361, η^2=0.02). Significant limb dominance effect was not identified in PTE, PTF and HQ (PTE: $F_{1,91}$ = 0.06, p = 0.810, η^2=0.01, PTF: $F_{2,91}$ = 0.30, p = 0.587, η_p^2=0.00, HQ: $F_{2,91}$ = 3.50, p = 0.065, η^2=0.04). We found significantly higher strength asymmetries in KF compare to KF ($F_{1,91}$ = 15.89, p =

0.000, η^2=0.15). Post-hoc analysis showed a significant difference in PTE between U15 vs. U19 and in PTF between U16 vs. older age category (U17, U19). The higher bilateral strength differences (QQ > 10%) we found in following age categories (U16 = 53%, U17 = 50%, U19 = 56%). Moreover in knee flexors (HQ>10%) were even higher strength asymmetries (U16 = 71%, U17 =75%, U19=79%).

CONCLUSIONS

The current results indicated effect of age on PTE, PTF but not in limb dominance. More attention should be paid to knee flexors where higher occurrence of strength asymmetries were found.

2091 Board #104 June 1 3:30 PM - 5:00 PM

Multicomponent Training Distress Scale (MTDS) Questionnaire to Detect Training Distress in Collegiate Soccer Players

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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.

2092 Board #105 June 1 3:30 PM - 5:00 PM

Stress and Mood Affect Sleep Quality and Quantity in College Female Soccer Players

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Despite a growing number of studies indicating that reduced sleep duration and quality have a negative influence on recovery and performance in many sports, data regarding the sleep habits of collegiate athletes is lacking. Highlighting factors that have a negative influence on sleep in collegiate athletes could lead to interventions that may increase sleep duration and quality, which could lead to increased performance and reduced injuries. College level athletes balance many physical and mental stressors, in order to be successful as student-athletes, and given the close relationship between mental states and sleep, these stressors may interfere with their sleep. **PURPOSE**: To explore associations between stress, mood, sleep quality, and sleep duration in a college female soccer team across an entire season.

METHODS: Twenty-one Division I female soccer players (18.9±1.28 years; 167.5±4.91 cm; 63.8±6.9kg) participated in this study. Each participant was asked to record their levels of stress, mood, and sleep quality using a 7-point scale into a smartphone application, every day for an entire competitive season. Stress was rated from -3: Very anxious to 3: Very Calm; mood was rated from -3: Very Unpleasant to 3: Very Pleasant; and Sleep Quality was rated from -3: Very Restless to 3: Very Restful. Subjects were also asked to record the duration of their sleep. Pearson's correlations were conducted to test associations between stress, mood, sleep quality, and sleep quantity.

RESULTS: There was a positive relationship between mood and sleep quality ($r=0.230$, $p<0.01$), and stress and sleep quality ($r=0.305$, $p<0.01$). There was also a correlation between mood and sleep duration ($r=0.052$, $p<0.05$), and stress and sleep duration ($r=0.076$, $p<0.01$).

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.

2093 Board #106 June 1 3:30 PM - 5:00 PM

Monitoring Markers of Oxygen Transport Throughout A Collegiate Soccer Season

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Consistent tracking of oxygen transport blood biomarkers may help inform coaching decisions to help reduce risk of overtraining. **PURPOSE:** To characterize changes in oxygen transport markers over the course of a collegiate soccer season. **METHODS:** A panel of 9 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean ± SD; height 181 ± 6cm, body mass 77.9 ± 6.2kg, BF% 11.9 ± 2.4%, VO_{2max} 52.9 ± 6.1 $mL \cdot kg^{-1} \cdot min^{-1}$) at 5 time points: before preseason (PS) and during season at week 1 (W1), W4, W8, and W12. Blood specimens from W1-W12 were obtained 32-34 hours post-match. Significant changes in biomarkers over time were assessed via repeated measures ANOVA ($\alpha < 0.05$, Bonferroni post hoc). **RESULTS:** Post season VO_{2max} (53.9±5.3 $mL \times kg^{-1} \times min^{-1}$) was similar to PS ($p=0.064$). Hematocrit (HCT) levels were lower at W1 vs PS (mean±SD, 45±1%, 47±1%, $p=0.015$). Total iron binding capacity (TIBC) was higher W12 (314±26$\mu g \cdot dL^{-1}$) vs PS (339±30$\mu g \cdot dL^{-1}$, $p= 0.006$), W1 (315±6$\mu g \cdot dL^{-1}$, $p= 0.004$) and W4 (320±7$\mu g \cdot dL^{-1}$, $p=0.005$). TIBC W8 (333±8$\mu g \cdot dL^{-1}$) and W12 (339±7$\mu g \cdot dL^{-1}$) were higher than W1 (315±6$\mu g \cdot dL^{-1}$, $p<0.048$). Total 25-hydroxy vitamin (VitD) decreased throughout the season. VitD at W12 (31±2$ng \cdot mL^{-1}$) was lower than PS (39±2$ng \cdot mL^{-1}$, $p=0.004$), W1(36±2$ng \cdot mL^{-1}$, $p=0.007$), W4 (35±2$ng \cdot mL^{-1}$, $p=0.028$), and W8 (35±2$ng \cdot mL^{-1}$, $p=0.007$). Percent saturation, total iron, red blood cells, ferritin, and vitamin D2 did not change significantly over time throughout the season. **CONCLUSION:** Select measures of oxygen carrying capacity (HCT, TIBC) were reduced after PS. However, assessment of the panel in a more inclusive approach determined that there was no consistent evidence of reductions in oxygen carrying capacity. Assessment of VitD as part of a panel assessing oxygen transport capacity is novel, given the putative role of VitD in VO2max. Ongoing research aims to further characterize any relationship of oxygen carrying capacity biomarkers to performance during long training seasons.

Funding for this study in part by Quest Diagnostics Inc.

2094 Board #107 June 1 3:30 PM - 5:00 PM

Body Composition Changes In Female Collegiate Soccer Athletes From Preseason To Postseason

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(No relationships reported)

Previous studies have suggested that percent body fat (%BF) and lean mass do not change from pre- to postseason in female collegiate soccer athletes even though changes may be seen in athletes competing in other sports.

PURPOSE: To document changes from pre- to postseason in body mass, %BF, fat distribution, and lean mass in female collegiate soccer athletes using readily available skinfold measures.

METHODS: Twenty-four healthy female collegiate soccer athletes with a mean age of 19.6 ±1.2 years participated. Participants were screened pre- and postseason using standard anthropometric measurements that included: height, weight, and skinfold measure of the triceps, suprailiac, and thigh areas. The measurements were conducted by an exercise physiologist with 25 years of experience and the skinfold technique was selected for collection convenience. The measurements allowed for calculation of the BMI, lean body mass, lean body mass index (LBMI), and %BF, and for comparison from pre- to postseason. The individual skinfold sites were also compared from pre- to postseason.

RESULTS: There were no differences between the measurements obtained on the two testing dates for body mass (62.18 & 62.26 kg; $t=-2.29$; $p\geq 0.05$), BMI (22.07 & 22.35; $t=-1.96$; $p\geq 0.05$), lean body mass (46.94 & 46.57 kg; $t=1.65$; $p\geq 0.05$), LBMI (16.75 & 16.62; $t=1.44$; $p\geq 0.05$), and %BF (24.38 & 25.25; $t=-1.79$; $p\geq 0.05$). There were differences in skinfold thickness at the triceps (19.5 & 20.5 mm; $t=-2.102$; $p< 0.05$) and suprailiac (15.98 & 17.70 mm; $t=-2.57$; $p< 0.05$) assessment sites. The covariate of field position was not a significant factor in the changes noted in triceps [$F(1,22) = 0.55$ $p = 0.47$] and suprailiac [$F(1,22) = 0..55$ $p = 0.47$] thickness.

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

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PURPOSE: The use of monitoring systems (e.g. Global Positioning Systems (GPS), heart rate monitors) to determine metabolic and physiological requirements within different sports is increasing in popularity. However, little to no information exists on the metabolic and physiological needs during Division I women's soccer. The purpose of this project was to measure heart rate data and energy expenditure in Division I college soccer players during the regular competitive season.**METHODS**: 12 college female soccer players (19.3 ± 1.6 yrs, 167 ± 3.0 cm, 62.4 ± 4.9 kg) were included based on playing time criteria (>60%). Measures recorded for all players included average heart rate (AvHR), average heart rate percentage (AvHR%), peak exercise heart rate (HR_{peak}), percentage of time spent in predetermined zones (%TM1, %TM2, %TM3) and energy expenditure per kilogram (EE). Differences between positions, center backs (CB), full backs (FB), midfielders (MF) and forwards (FW), were assessed.
RESULTS: Significant differences ($p \leq 0.05$) were observed across positions for parameters measured. AvHR for CB and MF was significantly lower than FW (168.9 ± 5.8 vs. 179.6 ± 6.9 bpm, 172.7 ± 7.8 vs. 179.6 ± 6.9 bpm). CB AvHRs were also significantly lower than FB (168.9 ± 5.8 vs. 177.3 ± 5.9 bpm). MF HR_{peak} was significantly lower than all groups. CB HR_{peak} was also significantly lower than FW (195.5 ± 3.6 vs. 200.2 ± 5.0 bpm). AvHR% was significantly lower and %TM1 was significantly higher for CB compared to all groups. For %TM2, 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%). FW were significantly higher than MF for %TM3 (27.7 ± 17.4 vs. 11.1 ± 14.3%). 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

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(No relationships reported)

Adequate recovery from stressors is an essential aspect of an athletes training program. Insufficient recovery can present itself in the form of psychological and physiological changes that manifest as performance decrements. **Purpose:** To assess the influence of training demands on mood, sleep, biomarkers, and performance in D1 collegiate female athletes during a competitive season. **Methods**: Female D1 college soccer players (N=25; M_{age}=19.4 + 1.4 yrs; M_{weight} = 66.1 + 1.3 kg) participated in blood draws prior to preseason (T1), and at weeks 2 (T2), 6 (T3) and 10 (T4) of the regular season. Athletes arrived for blood draws fasted and euhydrated. T2, T3, and T4 draws occurred ~18 hours after a game. Creatine Kinase (CK), Free Cortisol (CF), Total Testosterone (TT), Estrogen (E), and Growth Hormone (GH) were analyzed. The Multi-Component Training Distress Scale (MTDS; Main & Grove, 2009), the Pittsburgh Sleep Questionnaire Index (PSQI; Buysse et al., 1989), and vertical jump (VJ) were also assessed at each time-point. Workload per session (km and kcal/kg) was monitored using the Polar Pro system. **Results:** Workload was at its highest from T1-T2, decreased from T2 to T3 (Δkm=-36.9 ± 2.0 km, P<.05; Δ kcal=-7903.9±436.2 kcal, P<.05), and remained stable through T4. VJ remained consistent from T1-T3, before beginning to modestly decline (ΔVJ=-0.87 ± 0.59 cm) at T4. CK increased from T1-T2 (ΔCK=206.2 ± 94.1 U/L, P<.05), then returned to baseline. CF increased from T1-T2 (ΔCF=0.32±0.1 mg/dL, P<.05) and returned to baseline by T4. TT increased from T1 to T2 (Δ TT=39.5±17.3 ng/dL, P<.05) and returned to baseline by T4. No differences in E were seen (P>.05). GH decreased from T1-T2 (ΔGH=2.1±0.8 ng/mL, P<.05) and remained depressed. Total mood disturbance increased from T2-T3 (ΔMood=6.4 ± 1.9, P<.05) and remained elevated. Sleep quality (SQ) did not change from T1-T4 (P>.05), but sleep duration (SD) increased from T3-T4 (ΔSD=0.4±0.1, P<.05). **Conclusion:** Biomarkers showed the greatest change following the period of highest workload. Mood disturbances occurred after observed biomarker changes despite increased SD. SQ may be more important for full recovery than SD, as increased SD did not mirror GH or VJ changes. Changes in biomarkers preceded decrements in mood, suggesting that they may be the earlier indicators of performance status.

2097 Board #110 June 1 3:30 PM - 5:00 PM

Range Of Motion In Lower Limbs: Comparison Between Dominant And Non-dominant Side In Young Soccer Players

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BACKGROUND: The mechanics of sports abilities in professional soccer development requires extensive bilateral joint control of the lower limbs. The differences in the range of motion (ROM) from side to side in the lower limbs could imply a risk of musculoskeletal injury, especially for young athletes who are still during growing period. ***PURPOSE:*** The purpose of this study was to describe the range of motion and muscle length of the lower limbs, and to identify side to side differences, in young soccer players who belong to Rosario Central soccer club, Argentina. ***METHODS:*** Twenty young and healthy males soccer players participated in a cross-sectional cohort study (age: 14.18 ± 0.61 yr; weight: 58.74 ± 6.73 kg; height: 170.38 ± 6.20 cm). We included asymptomatic subjects, with no history of lumbar spine, hip, knee or ankle injuries. Three tests were performed for the active range of movement (hip flexion and extension, and knee flexion), and three tests for muscle length (iliopsoas, rectus femoris and hamstrings). Mean and standard deviation (SD) values were calculated by dominant and non-dominant leg, for all ROM measurements. We applied paired t-test differences to determine statistical differences (sd) between dominant and non-dominant leg at p<0.05 level. ***RESULTS:*** Analyzing ROM we have found sd ($p \leq 0.01$) for active hip flexion between dominant (111.73 ± 5.72) and non-dominant (108.55 ± 6.97) limb values. No sd were found in ROM for active knee flexion between dominant (138.00 ± 4.03) and non-dominant (138.18 ± 4.67) limb; active hip extension between dominant (17.98 ± 7.11) and non-dominant (16.23 ± 6.69) limb; muscle length for dominant (8.08 ± 4.50) and non-dominant (7.88 ± 4.82) iliopsoas, dominant (133.40 ± 4.84) and non-dominant (131.68 ± 5.87) rectus femoris and dominant (55.28 ± 7.47) and non-dominant (52.53 ± 8.11) hamstrings. ***CONCLUSIONS:*** Based on the results of the present study, we have found symmetrical ROM and muscle lengths of the lower limbs for young soccer players, with the exception of active hip flexion. In view of these results, it is recommended that professionals who work with this population assess symmetry of mobility, especially of the lower limbs, in order to guide active-passive stretching programs that maintain joint dynamic balance.

2098 Board #111 June 1 3:30 PM - 5:00 PM

The Impact of Two Games in One Weekend on Soccer Performance in DI Female College Athletes

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(No relationships reported)

PURPOSE: Women's college soccer requires athletes to play two games in one weekend. Insufficient recovery due to the close proximity of the games may lead to an increased risk of injury, fatigue and decreased performance. To date, no study has investigated the effects of playing two games within a 48 hour period on measures of performance in women's college soccer. The purpose of this project was to investigate changes in performance parameters from Friday to Sunday games during a competitive playing season.
METHODS: 12 NCAA Division I female soccer players (19.3 ± 1.6 yrs, 167 ± 3.0 cm, 62.4 ± 4.9 kg) were included based on playing time criteria (>60%). Global positioning system (GPS) data was collected for Friday (Game 1; (G1)) and Sunday (Game 2; (G2)) games over 5 weekends during the competitive season. Total distance (TD), high speed distance (HSD; 15.5km-19.9 km/h), sprint distance (SD; >20 km/h), meters per minute (m/min), high speed distance per minute (HSD/min), sprint distance per minute (SD/min), percentage HSD (%HSD), percentage SD (%SD), high-intensity efforts/min (HIE/min) and bodyload per minute were analyzed.
RESULTS: **:** There was a significant decrease (p<0.05) in m/min from G1 to G2 for weeks 1, 2, 3 and 4. A significant decrease was observed for TD, HSD and HSD/min from G1 to G2 for weeks 1 and 2. There was also a significant decrease in SD and SD/min from G1 to G2 in week 2. SD/min and %SD were significantly greater during G2 compared to G1 in week 5. There were no significant differences between G1 performance parameters across the five weeks.

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.

Table1. Performance parameters.

	Week 1		Week 2		Week 3		Week 4		Week 5	
	Game		Game		Game		Game		Game	
	1	2	1	2	1	2	1	2	1	2
Distance (m)	8609*	7912	9109*	7734	8770	8543	9294	9374	8492	7577
HSD (m)	727*	563	843*	670	708	608	640	673	731	707
SD (m)	214	225	308*	212	254	227	170	146	247	280
M/min (m)	114*	107	119*	110	118*	114	120*	113	113	100
HSD/min (m)	9.9*	7.8	11.4*	9.8	9.8	9.1	8.8	8.5	10.0	10.5
SD/min (m)	3.0	3.1	4.5*	3.2	3.7	3.3	2.6	1.9	3.5	4.3*
%HSD	8.6	7.2	9.4	8.8	8.1	7.9	7.1	7.4	8.6	9.4
%SD	2.7	2.9	3.7	2.9	3.1	2.9	2.1	1.7	3.1	3.9*
HIE/min	1.3	1.1	1.7	1.6	1.3	1.2	1.3	1.4	1.4	1.5
Bodyload/min	2.0	1.9	2.0	2.0	1.9	1.8	1.9	1.7	1.8	1.7

Significant difference ($p<0.05$).

*denotes significant difference between games 1 and 2 within a week.

2099 Board #112 June 1 3:30 PM - 5:00 PM

Acute Effects Of Custom Orthotics On Sprint Power And Steady State Cycling

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(No relationships reported)

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 acutely 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% VO_{2max} for 10 min (two trials with standard insoles (S) and two with O) in randomized order. SS cycling VO_2 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 O vs S using SPSS. RESULTS: Steady state $\%VO_2$ (S=66.70±1.33; O=67.13±1.41) HR bpm (S= 151.6±2.29; O=153.6 ±2.33; RER (S=.91±0.02; O=.90±0.01) with no difference with condition (p = > .6). Peak power was also not significantly different (S= 1109±54.9; O=1115± 47.6 W) in the sprints. CONCLUSION: Acute use of custom orthotics did not alter VO_2, HR or RER during steady state cycling nor peak power. It is suggested that follow-up to orthotic usage should be analyzed as it usually takes time (several weeks) to alter the mechanics with orthotic usage.

D-63 Free Communication/Poster - **Energy Metabolism and Expenditure**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

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 Gymnasts

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(No relationships reported)

PURPOSE:Energy deficiency affects many physiological aspects. The purpose of this study was to examine the status of energy deficiency in Japanese female collegiate rhythmic gymnasts and the factors that affect energy deficiency.
METHODS:The subjects were Japanese female collegiate rhythmic gymnasts (RG group: n=7, age : 20.4±1.1yr, height : 159.0±5.9 cm, body weight : 48.6±3.4kg, BMI : 19.3±1.6 kg/m^2, fat free mass : 37.7±2.9kg, percent body fat : 22.4±2.9%). As a control group, Japanese female collegiate sprint runners (CON group: n=8, age : 19.4±0.8yr, height : 162.8±5.8cm, body weight : 53.7±6.2kg, BMI : 20.2±1.1 kg/m^2, fat free mass : 44.8±4.7kg, percent body fat : 15.8±2.5%). The evaluation index of energy deficiency was energy balance (EB), which was calculated by subtracting the total energy expenditure (TEE) from energy intake (EI). TEE was determined by using the double-labeled water method, and the physical activity level (PAL) was TEE divided by resting energy expenditure (REE), which was measured by using a gas analyzer. Physical activity energy expenditure (PAEE) was calculated by subtracting REE plus dietary-induced thermogenesis from the TEE. EI was determined by using self-reported dietary records; and body composition, by using the dual-energy x-ray absorptiometry scan method.
RESULTS:The EB was −2065 ± 598 kcal/day in the RG group and −1230 ± 1003 kcal/day in the CON group. Therefore, both groups had a large negative balance, and the EB in the RG group was lower than that in the CON group. PAL was higher in the RG group (3.2 ± 0.4) than in the CON group (2.5 ± 0.8; $p < 0.05$). Although the EB in both groups did not correlate with REE, it negatively correlated with PAL and PAEE ($p < 0.01$). Therefore, high PAL and PAEE can be considered factors of energy deficiency.
CONCLUSION:Our results indicate that the status of the energy deficiency of the Japanese female collegiate rhythmic gymnasts was severe because the EB in the group was lower than that in the CON group. Furthermore, high PAL and PAEE affected the energy deficiency status of the Japanese female collegiate rhythmic gymnasts.

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

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PURPOSE: We previously found that cognitive function was not impaired during prolonged exercise, despite a conflict between an increase in cerebral metabolism and a decrease in cerebral blood flow (CBF), and suggested that improved cognitive function during exercise may be due to the augmented cerebral neuronal activation and metabolism associated with exercise, rather than cerebral perfusion. On the other hand, previous studies have demonstrated that during heavy exercise, compensatory increases in the uptake (the difference between arterial and venous concentration) of lactate, glucose and oxygen support elevated brain neuronal activity and metabolism. The purpose of this study was to examine the relationship between cerebral metabolism (e.g., lactate, glucose, oxygen) and executive function (EF) to a repeated high-intensity interval exercise (HIIE), which decreases systemic lactate concentration and post-exercise EF in a later HIIE session. **METHODS:** 14 healthy male subjects performed two HIIE protocols (4 sets of high-intensity exercise for 4-min with 3-min active recovery) separated by a 60 min resting period. Blood samples were obtained from the bulb of the right internal jugular vein and a brachial artery to determine concentration differences (a-v diff) for lactate, glucose, and oxygen across the brain. Transcranial Doppler determined middle cerebral artery blood flow velocity (MCA V_{mean}) as an index of regional CBF. Cerebral metabolic rates of lactate ($CMR_{lactate}$), glucose ($CMR_{glucose}$), and oxygen ($CMRO_2$) were calculated as MCA V_{mean} × a-v diff, respectively. To evaluate EF, color-word Stroop tasks were performed. **RESULTS:** Post-exercise EF improvement, a-v $diff_{lactate}$, and $CMR_{lactate}$ analyses showed a significant main effect for condition ($P < 0.05$, respectively), indicating that both EF improvement and brain lactate uptake were attenuated after 2nd HIIE compared to 1st HIIE. While a-v $diff_{glucose}$, $CMR_{glucose}$, and a-v $diff_{oxygen}$ were no significant main effects for condition, chronological reduction in a-v $diff_{lactate}$ and EF after HIIE were associated with decrease in $CMRO_2$ ($P < 0.05$, respectively). **CONCLUSION:** These results suggest that the reduction in brain lactate uptake concomitant with the decrease in $CMRO_2$ after repeated HIIE might be involved in the decline in EF improvement.

2102 Board #115 June 1 2:00 PM - 3:30 PM

Accuracy of Indirect Calorimetry and Predictive Equations for the Measurement of Resting Metabolic Rate

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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 VO_2 Lab metabolic measuring system. 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.
PURPOSE: The purpose of this study was to compare the RMR of college-aged participants measured using a BodyGem® indirect calorimeter, a Vacumed VO_2 Lab metabolic cart, and the aforementioned prediction equations.
METHODS: Each participant (male = 15; female = 15; age = 22.7 + 3.3 yrs; wt = 77.5 + 14.5 kg; ht = 173.5 + 9.6 cm) completed a thirty-minute supine resting session in a quiet environment. Five minutes of resting data were then collected using the Vacumed while in the supine position. Immediately thereafter, five minutes of resting data was collected using the BodyGem® indirect calorimeter while in the seated position. The RMR values for the HB and Fleisch prediction equations were calculated using the proprietary software utilized by the Vacumed metabolic system, while the MSJ estimate of RMR was hand-calculated.
RESULTS: A repeated measures ANOVA showed a significant difference among the measurement methods (BodyGem® = 1995.0 + 540.5 kcal; Vacumed = 1520.9 + 452.5 kcal; MSJ = 1669.3 + 242.9 kcal; HB = 1749.0 + 275.1 kcal; Fleisch = 1690.3 + 220.7 kcal) (p<.001). A *post hoc* paired samples t-test showed that the BodyGem® measured RMR significantly higher than the Vacumed, HB, Fleisch, and MSJ (p<.01). The HB estimation of RMR was greater than that of the Vacumed measurement (p<.025). For the equations, the RMR estimate of the Fleisch was higher than the MSJ (p<.025), while the HB was greater than both the Fleisch and the MSJ (p<.01).
CONCLUSION: The Vacumed VO_2 Lab metabolic cart measured RMR closer to the prediction equation estimates compared to the BodyGem® indirect calorimeter. Further research needs to be conducted comparing laboratory instruments to established prediction equations, on various populations, before the estimative methods can be deemed accurate for measuring RMR.

2103 Board #116 June 1 2:00 PM - 3:30 PM

The Comparison Of Energy Expenditure Between Continuous And Intermittent Exercise During And Post Exercise

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PURPOSE: Intermittent training has been applied in athlete training for 100 years more. In the last 10 years, it attained additional application in the enhancement of physical fitness and the rehabilitation of multiple chronic diseases. Moreover, many evidence suggests that when compared with steady state exercise, intermittent training can result in comparable or greater improvement in heart failure, diabetes, obesity and other chronic diseases. However, due to the differences of exercise workload (exercise duration, intensity and pattern) in most of researches, it is hard to assert which one is better between continuous and intermittent exercise when faced to some certain of health issues. Therefore, this study aimed to compare the energy consumption and substrate utilization between continuous and intermittent exercise with equal workload during and post exercise, and analyze their relationship with the activity of autonomic nervous system.
METHODS: 12 male students (24.2±1.2 years old), randomly performed 3 tests with 1 week interval: Control (C; rest), continuous exercise (CE; 65% VO_2max, 40 min), and intermittent exercise (IE; 85% VO_2max, 4min; 45% VO_2max, 4min; 5 sessions). Exercise is performed on treadmill with equal workload. In the period of pre- (30 min), during- (40min) and post-exercise (every 1 hour for 8 hours), respiratory metabolism, heart rate variability (HRV), blood pressure, and body temperature were monitored. Paired simple t-tests were used for statistical analysis. This study was funded by two fund from Guangdong (2013B031600003) and Guizhou (2014-7455) Science and Technology Department.
RESULTS: The energy expenditure (EE) and substrate utilization during exercise showed no significant difference between IE and CE. However, IE had higher total 8-hour's EE during post-exercise (1.1-fold, p<0.05, ES=1.85) with much fat oxidation (1.2-fold, p<0.05, ES=2.63) and significant rising value of LF/HF of HRV analysis (1.7-fold, p<0.01, ES=4.34). The total energy consumption (during exercise plus post-exercise) in IE is higher than CE (1.05-fold, p<0.05, ES=2.17).
CONCLUSIONS: High intensity intermittent exercise can induce much fat oxidation during the period of post-exercise and raise total exercise consumption, which is probably relevant to enhanced sympathetic regulation.

2104 Board #117 June 1 2:00 PM - 3:30 PM

Measurement Of Daily Energy Expenditure In Humans Using A Body-worn Calorimter

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(No relationships reported)

PURPOSE: Previous approaches using body-worn devices to measure free-living daily EE in humans using direct calorimetry have been limited by the inability to accurately measure evaporative heat loss. The Personal Calorie Meter (PCM) is a device that uses a heat flow gauge embedded in a permeable membrane, permitting the measurement of both dry and evaporative heat loss. Total heat flux and estimated body surface area are then used to estimate minute by minute EE. In this ongoing study, we are comparing daily EE measured using the PCM with simultaneous measurements using whole-room indirect calorimetry (WRC). ***METHODS:*** Subjects were studied on two separate days under low and high physical activity levels (PAL, ~1.4 and 1.7 x resting metabolic rate, respectively) in the WRC. During the low PAL condition, subjects performed 20 minutes of various housecleaning activities. During the high PAL condition, subjects performed 30 minutes of walking on a treadmill, 30 minutes of stationary cycling, and resistance exercises using dumbbells. Daytime EE was calculated as the total EE from the time the subject entered the WRC until bedtime. ***RESULTS:*** 14 subjects (10 F/4 M, 44±18 yrs., body mass index=26±6 kg·m^2, mean±SD) have completed at least one study visit in the room calorimeter. During the low PAL condition (N=11), average daytime EE measured by the PCM (1369±220 kcal, mean±SD) did not differ from WRC (1304±757 kcal), but the range of intra-individual differences was large (-899 to +452 kcal). Five measurements were within ±150 kcal, and the minute-to-minute values corresponded closely in these cases. During the high PAL condition (N=9), average daytime EE measured by the PCM (1834±344 kcal) did not differ from WRC (1880±757 kcal), but there was a wider range of intra-individual differences than during the low PAL condition (-1188 to +1075 kcal). ***CONCLUSION:*** These preliminary data demonstrate the feasibility of measuring EE in humans using portable direct calorimetry. Further studies and refinements are needed to improve the accuracy of the PCM on an individual level.

2105 Board #118 June 1 2:00 PM - 3:30 PM

Determination of Metabolic Pathway in Response to Cycling Versus Vinyasa Yoga

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PURPOSE: The purpose of this experiment is to determine whether there is a difference in metabolic response to Cycling & Vinyasa Yoga.
METHODS: Six male and six female participants aged 19-35 participated in two exercise sessions spaced 1 week apart. The participants fasted 12 hours prior to a one hour Vinyasa yoga session, and again prior to a 1-hour session of stationary cycling the following week. Heart rate was collected at predetermined time points during the Vinyasa yoga session. In order to normalize the level of intensity in both exercise bouts, participants pedaled at a pace that matched their individual heart rate during the yoga session. Urine samples were collected from participants before and immediately after the yoga and cycling exercise bouts. Urine samples were frozen at -80 Fahrenheit, and later analyzed using a Bruker 600 ^{1}H-NMR running TopSpin 2.0 software. We were able to determine the identity of 13 metabolites with certainty. These metabolites are as follows: phelylalanine, creatinine, creatine, creatine/creatinine, glycine, choline, taurine, dimethylamine, citrate, pyruvate, alanine, lactate, and beta hydroxybutyrate. The data was analyzed using a combination of analytical techniques, including paired t-test, a bucketing strategy, and MetaboAnalyst 2.0.
RESULTS: We found no significant difference in the metabolites excreted in the urine between different exercise regimens.
CONCLUSION: Exercise intensity and/or lack of adequate sampling may have influenced the lack of significant differences with regard to urine metabolite levels in this study. Although our study did not find any significant change in metabolites, the application of this methodological approach has merit. For example, this methodology

could be used to study changes in metabolic pathways in many different environments that include logistical and/or cultural considerations, where urine samples could be collected and then transported for analysis via ^{1}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

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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; 182.0 ±9.8cm; 85.2 ±10.0 kg) were examined during a one hour hot hatha yoga class (39.7 ºC ± .53ºC, 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 ±.46 L·h-1 and mean actual sweat loss was 1.05 ± 0.6 L·h-1.**Conclusion:** These finding, 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 - **Ergogenic Aids IV**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall 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

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PURPOSE: To determine if supplementation with omega-3 polyunsaturated fatty acids (omega-3 PUFA) either as enriched milk or capsules would improve the benefits of an aerobic exercise training program in the health of metabolic syndrome (MSyn) patients.
METHODS: Four groups of MSyn 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 MSyn 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 MSyn patients received capsules containing either 846 mg of omega-3PUFA or soybean oil as placebo. Before and after intervention, MSyn components (i.e., waist circumference, blood pressure, blood glucose, triglycerides and HDL concentrations), composite MSyn *Z*-score, cardiovascular risk factors (total cholesterol (TC) and LDL), glucose metabolism markers (HbA1c and HOMA), body weight and composition, and cardiorespiratory fitness (peak oxygen consumption; VO_{2PEAK}) and maximal rate of fat oxidation (FO_{MAX}) were assessed. Data was analyzed using split plot ANCOVA (Time x Treatment) controlling for body weight loss.
RESULTS: From the MSyn components, only blood pressure decreased significantly (P<0.001) after the exercise program without further benefit from omega-3 PUFA in any ingestion modality (P=0.340). MSyn 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= 0.091, 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). VO_{2PEAK} and FO_{MAX} 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 PUFA supplementation either administered 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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Mouth rinsing with carbohydrate may improve 60-min endurance cycling or running performance in males. However, no data exist regarding the effect of mouth rinsing on endurance performance in females. **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 h 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 premenopausal runners, or 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 euhydration was insured by ingestion of 6 $ml \cdot kg^{-1}$ 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(5; 74.1) $pg \cdot ml^{-1}$ vs RP: 26.0(5; 61.1) $pg \cdot ml^{-1}$, z= -0.533, (p= 0.59) and Progesterone (RCHO: 0.75(0.61; 1.64) $ng \cdot ml^{-1}$ vs RP: 0.74(0.64; 0.9) $ng \cdot ml^{-1}$, z= -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 (VO_{2max}: 62 ± 6 $mL \cdot kg^{-1} \cdot min^{-1}$) completed two trials consisting of 120 min of constant load cycling at 55% W_{max}, 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 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

between S3 and S4 (219 ± 43 W), but remained lower than S1 levels. By contrast, power output during the CHO trial showed no clear changes from S1 (246 ± 41 W) to S2 (242 ± 28 W). Thereafter, power output '*possibly*' decreased during S3 (232 ± 27 W), followed by a '*likely*' increase in power during S4 (249 ± 32 W), resulting in power levels during S4 that were similar to S1. Power output during the period immediately following each PL ingestion (210 ± 40 W) was not clearly different from the period prior to PL ingestion (213 ± 39 W); whereas power output immediately following CHO ingestion (244 ± 27 W) was '*possibly*' increased versus pre-ingestion (236 ± 31 W).
CONCLUSIONS: CHO ingestion increased average power output during a cycling TT and attenuated declines in power output over the duration of the trial, compared to PL. In addition, improvements in power output with CHO were possibly greater in the periods immediately following each feeding, potentially due to effects of CHO on the central nervous system.

2110 Board #123 June 1 3:30 PM - 5:00 PM

The Effects Of Pre-exercise Protein Vs. Carbohydrate Consumption On Energy Expenditure After High-volume Resistance Exercise

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During the recovery period following a bout of resistance exercise, oxygen consumption remains elevated for a variable timeframe, reflecting an acute enhancement in resting energy expenditure. What remains uncertain is whether pre-exercise nutrient consumption further promotes these acute metabolic responses to a bout of resistance exercise and if the type of nutrient influences these effects. **Purpose:** Therefore, the objective of this study was to determine, in college-age, resistance trained male subjects, the extent by which pre-exercise supplementation of whey protein or carbohydrate modulates 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 (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 (VO_2), 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 VO_2, RER, and HR. PRO (p=0.019) and CHO (p=0.003) demonstrated equivalently greater post-exercise EE than CON. Post-exercise VO_2 was significantly greater in PRO vs. CON (p=0.034) while CHO did not differ from PRO or CON. **Conclusion:** Overall, nutrient consumption prior to resistance exercise may augment the post-exercise elevation in EE. Consumption of whey protein pre-exercise may enhance excess post-resistance exercise oxygen consumption (i.e EPOC) to a greater extent than carbohydrate intake.

2111 Board #124 June 1 3:30 PM - 5:00 PM

The Effects of Carbohydrate Mouth Rinse Concentration on Cycling Time Trial Performance

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Mouth rinsing with a carbohydrate (CHO) solution during exercise has been shown to improve endurance exercise performance. Research suggests that the sensation of CHO in the oral cavity may stimulate neural pathways that attenuate the drop in motor output during exercise. However, it is unclear if performance is improved to a greater extent with different CHO concentration mouth rinses. **PURPOSE:** 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:** Fifteen male participants, aged 18-45 years old, who cycled a minimum of 30 miles per week, were recruited for this study. Participants completed five, one-hour time trials on a cycle ergometer, each separated by at least five days. During the first visit, participants completed a familiarization trial during which they rinsed with 25ml of water every 15 minutes of the time trial, beginning at time zero. In a randomized, double-blind fashion, participants then completed trials during which a 0%, 3%, 6%, or 12% CHO solution was rinsed for five seconds in 15-minute intervals during each of the four experimental time trials. Average power (W), work completed (kcal), heart rate (HR), and rating of perceived exertion (RPE) were recorded during each trial and compared at each 15-minute time point using a repeated measures ANOVA. **RESULTS:** A total of 14 participants completed all five time trials. Participants had 7.6±5.9 years of cycling experience and rode 111±66 miles per week in the six months prior to study participation. The results indicated that there were no significant differences (p>0.05) between 0%, 3%, 6%, or 12% CHO solutions in total work performed (777±182, 766±187, 767±159, 752±187 kcal, respectively), average power (236±56, 233±56, 233±48, 226±53 W, respectively), average HR (155±14, 155±13, 152±12, 153±14 BPM, respectively), or RPE (8.3±1.1, 8.4±1.3, 8.1±1.5, 8.4±1.2, respectively). **CONCLUSIONS:** The results of this study suggest that there is no ergogenic benefit of a CHO mouth rinse for a one-hour cycling time trial. Furthermore, there was no dose-response effect of CHO mouth rinse concentration on time trial performance.

2112 Board #125 June 1 3:30 PM - 5:00 PM

Carbohydrate Mouth Rinse Improves Mean Power During Multiple Sprint Performance

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Multiple investigations have confirmed carbohydrate mouth rinse (CMR) enhances high intensity endurance performance lasting under 1 hour, but the effects of CMR on high intensity intermittent exercise have received little attention. **PURPOSE**: To determine the effect of a CMR on high intensity multiple sprint performances. **METHODS**: Competitive, male, athletes (n = 8) (31.1 ± 7.1 years, 185 ± 9 cm, 87.4 ± 15.3 kg, VO^2peak 49.9 ± 7.8 ml/kg*min-132) completed two, 48 min high intensity intermittent cycling protocols that consisted of 6 bouts of 5 min cycling at 50% VO2 peak 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 896 ± 161 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, fatigue 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

2113 Board #126 June 1 3:30 PM - 5:00 PM

The Impact of Glucose Supplementation on Barbell Velocity and Fatigability in Weightlifters: A Pilot Study

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PURPOSE: Fatigue has been shown to decrease velocity in training, decrease repetitions able to be performed while lifting weights, and increased 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 sessions. 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 EMOMs where peak velocity (PV), average velocity (AV), heart rate (HR) and rate of perceived exertion were recorded for each lift. A posttest (POST) mimicked the PRE and the recorded differences were compared between the PL and GL. Blood lactate (BL) and glucose (BG) were also 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}, p=.0001) and 20% in PL (PRE: 3.5±1.2 mmol·L^{-1}, POST: 2.9±1.8 mmol·L^{-1}). PV of ST increased 4% in GL (PRE: 1.51±0.10 m·sec^{-1}, POST: 1.56±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: 1.56±0.51 m·sec^{-1}, POST: 1.61±0.69 m·sec^{-1}) and decreased 4% in PL (PRE: 1.65±0.45 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%, PRE: 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 Expectoration: When a Carbohydrate Rinse Becomes Detrimental to Performance

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(No relationships reported)

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 = 4.210 VCO_2 – 2.962 VO_2 (Jeukendrup 2005) and then applied to previously established values of CHO stores in glycogen loaded individuals (Rapoport 2010) in order to estimate when stores would be exhausted.
RESULTS: Time to completion was statistically faster (P<0.05) for GLC (67.1 ± 1.1 sec) compared to PLA (67.9 ± 1.0 sec). CHO oxidation rates were not statistically different (P=0.06) between the GLC (3.43 ± 0.80 g/min) and PLA (2.98 ± 0.18 g/min) groups. 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.
CONCLUSIONS: Rinsing the mouth with a CHO solution prior to and during exercise does not result in a more rapid depletion of muscle glycogen stores despite improved performance. However, when using a CHO rinse glycogen stores will be depleted in approximately 3 h and recommending this ergogenic approach for longer duration exercise should therefore be approached with caution.

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

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(No relationships reported)

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 are linked with perceived muscle soreness. The omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), commonly found in fish oil supplements, 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, resistance-trained males (n = 16; 23.8 ± 2.7 years, 81.5 ± 9.9 kg, 175.7 ± 4.5 cm, 16.3 ± 3.6 %) and females (n = 16; 23.4 ± 3.1 years, 61.7 ± 7.2 kg, 170.4 ± 6.2 cm, 23.6 ± 5.0 %) completed a double-blind placebo controlled 7-week supplementation period of either: 2.0, 4.0, or 6.0 $g \cdot d^{-1}$ FO or placebo (PL). Subsequently, participants completed a muscle damaging resistance exercise protocol (10 sets of 8 four-second eccentric squats at 70% one-repetition maximum and 5 sets of 20 split-squat jumps). Perceived muscle soreness (PS; 0–10 cm scale) was measured pre-exercise (PRE), immediately post (IP), as well as 1, 2, 4, 24, 48, and 72 hours (h) post-exercise.
Results: Repeated measures analysis of variance revealed a group x time interaction for PS ($p < 0.001$), where compared to PL, lower PS scores were observed at IP for 6 $g \cdot d^{-1}$ (mean difference: 4.0 cm, $p = 0.024$), at 1h for 6 $g \cdot d^{-1}$ (mean difference: 2.74 cm, $p = 0.046$), at 24h for 4 $g \cdot d^{-1}$ (mean difference: 2.38 cm, $p = 0.023$), and 6 $g \cdot d^{-1}$ (mean difference: 3.45 cm, $p < 0.001$), at 48h for 6 $g \cdot d^{-1}$ (mean difference: 4.45 cm, $p < 0.001$), and at 72h for 6 $g \cdot d^{-1}$ (mean difference: 3.0 cm, $p = 0.003$). Other group differences were variable by time point. **Conclusions**: These data indicate that supplementation with 6 $g \cdot d^{-1}$ of FO is effective at attenuating PS following damaging eccentric resistance exercise for up to 72h. Supported by the International Society of Sports Nutrition and MusclePharm Grant

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 (28.13 ± 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:** No differences were found between Baseline and POST. There was a trend for smaller increase of CK levels (pre vs 48-h 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.

2117 Board #130 June 1 3:30 PM - 5:00 PM

Fish-oil Supplement and Eccentric Exercise on Lipid Profiles during Different Phases of Menstrual Cycle

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(No relationships reported)

Fish oil supplement has been widely recognized as a wholesome regimen, which may positively affect blood lipid and lipoprotein profiles and muscle damage caused by eccentric exercise. **PURPOSE:** To examine the effects of dietary fish oil supplement and acute eccentric exercise on blood lipids and lipoproteins including (TC, HDL-C, Lp(a), LDL-C, and VLDL-C) during two different phases of menstrual cycle (mid-follicular vs. mid-luteal phase). **METHODS:** As a randomized, double-blind design, 22 college-aged women (fish oil = 11, placebo = 11, age = 20.86 ± 1.39 years) participated in the study. Participants in the fish oil group ingested 6 capsules 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 30^0/sec) during both mid-follicular (MF) and mid-luteal (ML) phases. The leg exercised for the MF phase was randomly selected and the opposing leg exercised during the ML phase. Blood samples were collected at baseline, 6-hr post-exercise, and 24-hr post-exercise for each phase. Data were analyzed by a 2 x 2 x 3 analyse of variance with repeated measures along with the Sidak's multiple comparisons for any significant interactions to compare means differences ($p < .05$).
RESULTS: There were no significant differences in blood lipids and lipoproteins between fish oil and placebo groups or baseline, mid-, and post-exercise. However, HDL-C was significantly higher ($p = 0.041$) during the ML (61.66 ± 2.44 mg/dL)

phase than that of the MF (54.53 ± 2.44 mg/dL) phase. **CONCLUSION:** Although overall lipid and lipoprotein profiles tended to improve with a short-term fish oil supplement, it didn't reach a statistical significance. In addition, acute eccentric exercise did not negatively affect blood lipids and lipoproteins. However, HDL-C was significantly influenced by the different phases of menstrual cycle, where HDL-C increased during the mid-luteal phase possibly due to elevated estradiol levels. It is recommended that an extended period of fish oil supplement be implemented in different sample groups including both pre- and post-menopausal women for the future studies.

2118 Board #131 June 1 3:30 PM - 5:00 PM

Six Grams Of Fish Oil Supplementation Improves Vertical Jump Performance Following Acute Eccentric Resistance Training

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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 ± 2.7 years, 81.5 ± 9.9 kg, 175.7 ± 4.5 cm) and females (n = 16; 23.4 ± 3.1 years, 61.7 ± 7.2 kg, 170.4 ± 6.2 cm) supplemented with 2.0, 4.0, 6.0 $g \cdot d^{-1}$, 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 20 split-squat jumps). All PRE-assessments were repeated immediately post (IP), 1, 2, 4, 24, 48, and 72 hours (h) post-exercise. **RESULTS**: Repeated measures analysis of variance indicated a treatment x time interaction ($p < 0.001$) for VJ. Although VJ was decreased from PRE (53.8 ± 8.7 cm) at IP (47.4 ± 9.3 cm) for all groups, VJ returned to PRE-values at 1h for the 6 $g \cdot d^{-1}$ supplementation group (51.8±6.5 cm, $p = 0.112$), while no other groups returned to baseline until 48h. No other differences were observed. **CONCLUSIONS**: These data indicate that supplementation with 6 $g \cdot d^{-1}$ of FO is effective for enhancing recovery in jump performance following a damaging bout of exercise. Supported by the International Society of Sports Nutrition and MusclePharm Grant

D-65 Exercise is Medicine®/Poster - **EIM - Chronic Health Conditions**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2119 Board #132 June 1 2:00 PM - 3:30 PM

Mobility Outcomes From Resistance Training Delivered via Flash Drive to Overweight/obese Patients In A Clinical Setting

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Elastic and isotonic resistance training can improve health and fitness. Little is known about the impact of a home-based, structured program delivered via flash drive videos to weight management patients in a clinical setting. **PURPOSE**: To measure functional fitness/mobility after 12 weeks of a home-based, video led resistance-training program (Mini BIRST) designed as short interval workouts using dumbbells or Theraband CLX elastic resistance bands. **METHOD**: Overweight/obese participants (n=21, 51.5 yrs, BMI 33.2 $kg \cdot m^{-2}$) enrolled in the Health Management Resources (HMR) weight management program, self-selected to join the study and were assessed for baseline health and mobility. They were randomized into 2 groups: 3 weeks of isotonic resistance followed by 3 weeks of elastic resistance (10-20 min/day, 2-3 days/wk, 6 wks) using a cross-over design. Participants then performed full body CLX-only circuit exercises (20 min/day, 2-3 days/wk, 6 wks). Both home-based programs were delivered via written handouts and flash drive videos. Functional fitness/mobility was assessed using standardized tests. Repeated measures ANOVA were conducted and a p-value of <0.05 was used to indicate significant changes. An opinion survey was conducted to determine attitudes about the program and delivery. **RESULTS:** Participants exercised 3 days/wk for 12 weeks with 83% compliance. Mobility improved for chair stand (26%), arm curl (35%), aerobic endurance (25%), and flexibility in both legs (4% right, 2% left). Participants showed no changes for weight or BMI, but successfully maintained "weight neutral" during the 12-week. Participants trended toward an increase in physical activity (9%), over baseline. " Participant opinions revealed they "Liked" the program overall" (75%), said they "Felt good" (70%), was "Convenient to do" (85%), "Liked the flash drive delivery" (85%) and would "Continue the program" (85%). **CONCLUSIONS:** Participants complied to and enjoyed the home-based, dumbbell and CLX resistance band short-burst workouts delivered via flash drive videos and illustrated handouts, resulting in improved mobility and aerobic endurance. Further study is needed to determine long-term impact on adherence, weight and health. **Support for this study provided by Performance Health, Akron, OH.**

2120 Board #133 June 1 2:00 PM - 3:30 PM

A Two-minute, Energy-surge Exercise For Weight Loss: A Randomized, Controlled Trial

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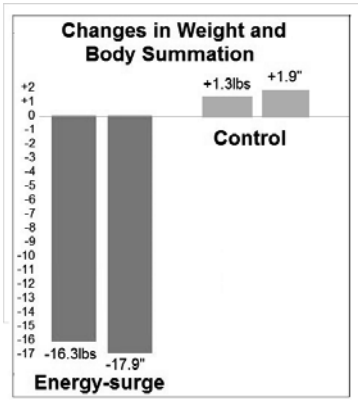
The Center for Disease Control has reported that 70% of the US population are overweight and almost 40% are categorically obese, based on Body Mass Index (BMI). There are numerous programs, diets, and exercise regimes, but these are inadequate because of the continuous rise in obesity. A unique 2-minute 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 in fat reductions. Future studies should measure this protocol for longer durations, including other variables such as diet changes (portion size and frequency) with body composition testing as the dependent variable.



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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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 a 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). Fitness performance was determined by trunk flexibility, handgrip test, cardiorespiratory 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 (c^2), 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 with altered HOMA-IR. Nevertheless, there was no reclassification for body or abdominal obesity.
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

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PURPOSE: To examine changes (Δ) 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±8.1y; BMI=34.4±5.8kg/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:** ΔHbA1c 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 (-0.00%, -0.36 to 0.35; p<0.04). A trend for greater ΔHbA1c was noted between AER-HI and AER-LO (P=0.05). ΔCRF was higher in COMB-HI and AER-HI (1.2 METs, 0.8 to 1.5; 1.3 METs, 0.9 to 1.6) compared to all other groups (range ΔCRF= -0.2 to 0.5 METs; all P≤0.007). Δstrength was higher in COMB-HI and RES (14.0N, 5.8 to 22.2; 16.2N, 10.6 to 21.8) compared to AER-LO and AER-HI (-2.0N, -10.6 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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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 intervention 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 1.54mmol/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.

2124 Board #137 June 1 2:00 PM - 3:30 PM

Methods To Evaluate An Introductory Motivational Interviewing Workshop For Healthcare Professionals That Promote Weight Management

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PURPOSE: To evaluate the effect of a behavior change counseling training intervention on clinician proficiency.
METHODS: In this observational study, a self-selected group of 13 female clinicians (62% physicians/mid-levels) were evaluated before and after an introductory training in motivational interviewing (MI). Two experienced trainers conducted a standard 2-day workshop that focused on weight management. The clinicians were evaluated with the CARE Measure for 4-wks before and 6-wks after the workshop. This confidential 10-item questionnaire assessed relational empathy from the patient perspective on completion of clinical visits (n=531). The CARE Measure was scored on a 1-5 Likert scale. The clinicians provided an audio-taped recording of a clinical visit of their choice pre and post workshop (PW). The recording was anonymously analyzed by a coding expert. The MITI 4.2 Coding Instrument scored the visits on global ratings that used a 1-5 scale and an objective behavioral count to determine MI proficiency. A pre and PW clinician self-evaluation measured perceived proficiency and intent to use MI.
RESULTS: The overall mean score for the CARE Measure was 48.8 (SD=3.1) out of a maximum of 50 at baseline (BL) and 48.9 (SD=3.0) PW (p>0.05). The overall mean global rating for the MITI was 3.6 (SD=1.2) out of a maximum 5 at BL and 3.8 (SD=0.9) PW (p>0.05). For the behavioral count, the mean reflection-to-question ratio was 0.4 (SD=0.3) at BL and 0.5 (SD=0.3) PW (p>0.05). The mean MI adherent behavior count was 7.5 (SD=6.6) at BL and 8.3 (SD=3.8) PW (p>0.05). The mean MI

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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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 m/kg^2) 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 (physician 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/m^2. 293 control, with a mean starting age of 71 years and starting BMI of 34.8 kg/m^2. 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
217 lbs). Fitness levels were also significantly increased in the intervention group (22 v 26 ml/kg/min).
Conclusion:
In obese, pre diabetic patients, preliminary data reported shows a significant improvement in health markers and fitness levels following a comprehensive 12-week program utilizing trained exercise and nutritional professionals, individualized coaching and goals, and health education. This data suggests that this inclusive model of health intervention may be beneficial for at risk patients, and is promising for individuals choosing between various treatment modalities.

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 -29 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±16.1yr), overweight (27.3±3.8kg/m^2) adults with prehypertension (systolic BP [SBP]/diastolic BP [DBP], 129.3±14.0/ 80.9±9.1mmHg). 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%*CIs*: -0.63, -0.33; -4.3mmHg) and DBP (d_+=-0.50, 95%*CIs*: -0.64. -0.35; -3.4mmHg) compared to control (*ps*<0.001). Yoga produced greater SBP reductions among: samples with hypertension (-11.8mmHg, *k*=13) than prehypertension (-6.6mmHg, *k*=20) and normal BP (-2.9mmHg, *k*=14, *p*=0.001); interventions located in India (-9.9mmHg, *k*=21) than non-India Asian (-7.0 mmHg, *k*=9) and non-Asian (-4.2mmHg, *k*=17, *p*=0.012) countries; and interventions with the largest variance (i.e., standard error) in the BP response (-20.0mmHg, *k*=15) than moderate (-6.5mmHg, *k*=16) and small (-1.6mmHg, *k*=16, *p*=0.001). Yoga produced greater DBP reductions among: samples with hypertension (-10.2mmHg, *k*=5) than prehypertension (-5.4mmHg, *k*=14) and normal BP (-2.1mmHg, *k*=24, *p*<0.001); interventions located in India (-4.0mmHg, *k*=20) than non-India Asian (-2.3mmHg, *k*=8) and non-Asian (-0.8mmHg, *k*=15, *p*=0.019) countries; and samples that practiced Yoga with a balanced combination of breathing, postures, and meditation/relaxation (-5.8mmHg, *k*=25) than Yoga largely focused on a single practice (e.g., left nostril breathing) (-2.3mmHg, *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 subjects at baseline. Next, a sub-sample(n=453) were submitted to a 10-wk LSM and repeated assessments. Statistical comparisons were defined by p=0.05.
RESULTS: The BP rate(higher than 140/90mmHg) was 51.2% for SBP and 42.7% for DBP. The top quartile of bood pressure(142.2/88.5mmHg) differed from the lower quartile (120.6/69.2mmHg) 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 applyied 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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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, even several years post-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 VO_2 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 care of 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 once a week, completing 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), waist circumference) and functional capacity (six-minute walk distance (6MWD), timed up and go, grip strength) assessments completed after 10 sessions (10 weeks).
RESULTS: Reductions in resting SBP (136.30±14.40 mmHg vs 150±14.19 mmHg p=0.006) and DBP 76.50±10.91 mmHg vs 83 mmHg p=0.035). 6MWD increased (392±112.29 m vs 321.90±106.88 m p=0.001). **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 $m.min^{-1}$ (3.2 kph) to 65.33 $m.min^{-1}$ (3.9 kph); improved walking speed ≈3.0 METs (≈2.5mph). This study emphasises 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 Artery Disease

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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 adaptions 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 $W \cdot kg^{-1}$, without AFO=2.6±0.3, p<0.001). Reduced propulsion power was coupled with 4.5° less dorsiflexion during the terminal phase of stance (with AFO=8.6±0.7°, without AFO=13.6 ± 0.9°, 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 $m \cdot sec^{-1}$, pooled 12 weeks=1.06 $m \cdot sec^{-1}$). **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 NIGMS 5U54GM104944.

2130 Board #143 June 1 2:00 PM - 3:30 PM

The Acute Arterial Stiffness Response to Interval vs. Continuous Exercise in Postmenopausal Women

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High Intensity Interval Exercise (HIIE) has been associated with greater reductions in cardiovascular disease (CVD) risk factors when compared to continuous moderate 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 a single bout of HIIE versus a single bout of moderate continuous endurance exercise (MCE) in postmenopausal women. **METHODS:** A total of 13 women (age = 60.85 ± 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 for the average number of heart beats obtained 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; M_{pre} = 33.91, M_{15post} = 27.40) and from pre exercise to 30-min post exercise (p = .035; M_{pre} = 33.91, M_{30post} = 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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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 ($\bar{X}_{age}$ = 44.8 ± 7.9 years; $\bar{X}_{BMI}$ = 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 included total cholesterol, triglycerides, high- and low-density lipoproteins (HDL and LDL, respectively), two-hour postprandial blood glucose (2HrBG) change, carcinoembryonic antigen (CEA), and cancer antigen 15-3 (CA 15-3). Descriptive statistics were conducted for all variables while regression analyses assessed if average steps/day predicted the aforementioned biomarkers.
RESULTS: Chinese BCS were observed to take an average 10,635 steps/day. Null to weak correlations between average steps/day and biomarkers (range r = -.18 to .24) were observed. Regression analyses indicated average steps/day to only be significantly predictive of HDL, r^2 = .06, p = .04, with marginal predictive utility of average steps/day seen for CEA, r^2 = .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.

2133 Board #146 June 1 2:00 PM - 3:30 PM

Cardiorespiratory Fitness And Muscle Strength In Pancreatic Cancer Patients

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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 on 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 fitness with 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 Caner Aid (SUPPORT-Study; Grants No. 110513 and 110552)

2134 Board #147 June 1 2:00 PM - 3:30 PM

Aerobic Exercise And Cancer-Related Fatigue In Adults: A Re-examination Using The Ivhet Model

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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 results 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

2135 Board #148 June 1 2:00 PM - 3:30 PM

Examining The Relationships among Chinese Breast Cancer Survivors' Psychosocial Outcomes and Physical Fitness

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(No relationships reported)

Purpose: A decline in physical fitness has been evident among breast cancer survivors (BCS) following diagnosis. Yet, the relations among psychosocial beliefs and fitness in this population remains unexplored. This study investigated the correlates of psychosocial outcomes and fitness in Chinese BCS while determining the extent to which whether patients' fitness can be predicted by psychosocial factors.
Methods: A total of 135 BCS (M_{age} = 44.3, SD = ± 8.1) were recruited from Southern region of China. Selected psychosocial outcomes were assessed by validated Patient-Centered Assessment and Counseling for Exercise Scale (2001), including physical activity confidence (PAC); physical activity family support (PAF); physical activity friend support (PASF); and physical activity environment factors (PAEF). Patients' fitness testing consisted of leg strength and endurance (LSE; 30-second chair stand test); upper body strength and endurance (UBSE; 30-second arm curl test); lower body flexibility (LBF; chair sit and reach test); shoulder range of motion (SRM; measured by back scratch test); aerobic endurance (AE; 2-minute step test); and mobility and balance (MB; up and go test).
Results: Correlation analyses revealed no significant relationships were observed among psychosocial outcomes and overall fitness (p > .05). However, PAC was positively correlated with LBF (r = .18, p < .05), despite correlation was low. Regression analysis indicated the overall model was statistically significant when PAC was used to predict LBF [F (1, 133) = 4.1, p < .05, r^2 = .03], suggesting PAC was a significant predictor of LBF (t = 2.1 , p < .05).
Conclusion: Findings suggest that as BCS's PAC increases, their LBF is expected to increase modestly. Additionally, findings indicate that PAC significantly predict LBF—suggesting PAC may be a determinant of patients' low body fitness. Nevertheless, other psychosocial outcomes were not significantly associated with any fitness component. It appears that psychosocial factors may not serve as ideal determinants for BCS' fitness. Future research is warranted, therefore, to investigate other factors such as physiological and rehabilitative outcomes that may influence fitness in this population.

2136 Board #149 June 1 2:00 PM - 3:30 PM

Physical Activity Levels and Cardiometabolic Risk Factors in Adults with Asthma-COPD Overlap Syndrome (ACOS).

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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 disease risk factors in adults with ACOS aged 45 years 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. Self-reported 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. Logistic regression analyses were conducted to determine the association between physical activity and ACOS, and between physical activity levels and cardiometabolic disease 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-perceived 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.

2137 Board #150 June 1 2:00 PM - 3:30 PM

Affective Response To Sprint Interval Exercise In Adults With And Without Exercise-induced Bronchoconstriction

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(No relationships reported)

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. Adults with EIBC report higher affect after performing high intensity interval exercise compared to moderate intensity continuous exercise (MICE). *Purpose:* To examine in-task perceptions of effort, dyspnea, and affective feelings during a sprint interval exercise (SIE) and MICE session in adults with and without EIBC. *Methods:* Participants with EIBC (aged 22.0±2.6) and participants without EIBC (aged (21.7±0.6) completed SIE (4 x 30 second sprints at 0.075kg/kg bodyweight, separated by 4.5 minutes 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 SIE or MICE after the second session. Sessions were completed in random order. *Results:* Among those with EIBC, 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 EIBC for either SIE or MICE. Those without EIBC reported higher RPE during SIE and had a higher enjoyment scores for SIE compared to those with EIBC. Two thirds of participants with EIBC preferred MICE and all participants without EIBC 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 EIBC.

2138 Board #151 June 1 2:00 PM - 3:30 PM

Physical Activity Interventions And Chronic Diseases: A Matched-Pair Analysis Comparing Cochrane And Non-Cochrane Systematic Reviews

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PURPOSE: Systematic reviews and meta-analyses are important tools used to support evidence-based decisions in health care. A recent study concluded that non-Cochrane reviews report larger effect sizes with less precision when compared with Cochrane reviews. The analysis mainly considered pharmacological interventions. Therefore we explored whether there were similar differences between the two types of reviews that examined the role of physical activity in chronic diseases. Such an analysis is particularly relevant to policy makers in ensuring that recommendations made to populations are based on the most accurate and precise evidence.
METHODS: This is a substudy of an overview of 56 Cochrane reviews with RCTs of physical activity interventions for chronic diseases (cancer; cardiovascular, respiratory, renal diseases; metabolic, mental, musculoskeletal disorders). A matched-pair analysis was chosen to contrast Cochrane and non-Cochrane reviews. A systematic literature search was undertaken to identify non-Cochrane reviews that matched based on intervention, condition, outcomes and publication year as in the corresponding Cochrane reviews. Methodological quality of the reviews was assessed 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.

2139 Board #152 June 1 2:00 PM - 3:30 PM

P.p1 {margin: 0.0px 0.0px 0.0px 0.0px; Font: 24.0px Helvetica} Physical Activity For The Prevention And Treatment Of Major Chronic Disease: An Overview Of Systematic Reviews

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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 screened search outputs, selected studies, extracted data and assessed quality of included reviews using AMSTAR. Certainty of effect estimates was assessed using the GRADE method. Primary RCTs within included reviews found to demonstrate confounding were excluded, and affected pooled estimates were re-calculated. **RESULTS**: 56 Cochrane systematic reviews (49[88%] deemed high quality according to AMSTAR) across 20 chronic health conditions consisting a total of 829 RCTs and 65,032 participants were included. Data were extracted on 435 outcomes of which GRADE assessments were already available for 56 (13%) and newly derived for a further 189 (43%). We re-analysed 159 pooled-estimates across 27 reviews due to exclusion of 321 confounded trials.We found high quality evidence of a clinical and statistical benefit of PA for self-reported pain and self-reported pain and physical function in patients with osteoarthritis of the knee and hip; and dyspnoea and fatigue quality of life measures in patients with COPD. Conversely, high quality evidence for no effect of PA was found for bone mineral density of the neck, hip and trochanter in postmenopausal women; and disease activity and radiological damage in patients with rheumatoid arthritis. The remaining outcomes showed moderate (42[17%]), low (112[46%]) and very low (79[32%]) quality evidence, predominantly in favour of PA.
CONCLUSIONS: A number of chronic health conditions for which clinical guidelines recommend physical activity may not be supported by high quality, clinically relevant evidence. Where there is a strong evidence-base, a formula of efficacious physical activity interventions is warranted but maybe hampered by heterogeneity within the available literature.

2140 Board #153 June 1 2:00 PM - 3:30 PM

Evidence Of Benefits Of Exercise And Its Mechanisms In Inflammatory Arthritis

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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-Pro principle (frequency, intensity, time, type and progression) is followed in exercise prescription. Evidence of benefit of aerobic and resistance 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.

2141 Board #154 June 1 2:00 PM - 3:30 PM

Improving Strength and Mobility of Adults with Multiple Sclerosis Through a 16-week Exercise Program

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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_{age}: 51.3 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 measurements 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 ($\alpha = 0.05$). Effect sizes were calculated using the partial omega-squared (ω^2_p) test.
Results: Collectively, participants showed significant ($p < 0.05$) improvements from pre- to post-program on the timed up-and-go (TUG) ($\omega^2_p = 0.21$) and wall push-up tests ($\omega^2_p = 0.45$). Strong trends ($p < 0.1$) toward improvement were shown for flexibility ($\omega^2_p = 0.19$), comfortable walking speed (CWS) ($\omega^2_p = 0.28$), gait cadence ($\omega^2_p = 0.20$), vitality ($\omega^2_p = 0.26$), fatigue ($\omega^2_p = 0.17$), and mental health ($\omega^2_p = 0.18$). 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 progressive 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.

2142 Board #155 June 1 2:00 PM - 3:30 PM

Aquatic-Dietary Intervention On Fitness & Metabolism In SCI Individuals With Glucose > 100mg/dl

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PURPOSE: Assess dosed group aquatic exercise at 70-75% of heart rate reserve (HRR) and weekly nutritional guidance upon body mass, glucose, insulin, A1C, peak VO2, and resting metabolic rate (RMR) for four individuals with CMISCI and a history of elevated fasting glucose concentrations greater 100 mg/dL.
METHODS:Four men (63 yo, AIS D, body mass index (BMI) 31.9; 34 yo non-ambulatory, AIS C, BMI of 31.6; 58 yo, AIS D, BMI 27.4; and 45 yo non-ambulatory, AIS C, BMI 28.56) enrolled in an individualized 10-week aquatic exercise (3 days per week for 40 minutes each session) and dietary guidance (by phone once per week) intervention. Nutritional guidance included reducing refined carbohydrates and processed food, limiting high glycemic fruits, and increasing vegetable, fluid and lean protein intake. Outcome measures (pre/post) included: three-day electronic food logs, weekly hard copy food logs, glucose, insulin and A1C (via standard fasting venipuncture), peak VO2 and RMR.
RESULTS: Participant one decreased glucose, 20% (132 to 106 mg/dL); A1C, 11% (6.3-5.6); weight, 10%, (11.9 kg); RMR, 13%; and peak VO_2, 12% Participant two showed no change in A1C or RMR; decreased weight, 3% (3.3kg); peak VO_2 (16.4%); and increased glucose 9%. Participant three decreased: glucose, 14%, (126 to 108 mg/dL); A1C, 5% (7.5 to 7.1); weight, 6% (88.9 to 83.8 kg); RMR, 12.5%; and increased peak VO_2, 8% (21.9 to 23.7). Participant four increased glucose, 9.3% (86 to 94 mg/dL); decreased A1C 5.5%; showed no change in weight; increased peak VO_2, 34.1%; and RMR, 24.6%.
CONCLUSIONS: Moderate exercise with weekly nutritional guidance decreased body mass, glucose, and A1C in individuals with CMISCI. Further examination of the impact of a low cost intervention of combined aquatic exercise with nutritional guidance exerts upon body mass, metabolic status, and cardiovascular fitness for individuals with CMISCI is indicated

D-66 Exercise is Medicine®/Poster - **EIM - Older Adults**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2143 Board #156 June 1 2:00 PM - 3:30 PM

Long-term Exercise Program Enrolment in Older Adults: Effects on Cardiorespiratory and Musculoskeletal Fitness

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(No relationships reported)

Substantial research supports the benefits of exercise training for older adults, but much of the existing evidence comes from highly structured, laboratory-based interventions. A longitudinal investigation of the impact of enrolment in a community exercise program on cardiorespiratory fitness (CRF) and muscular strength among a heterogeneous population of older adults is warranted. **PURPOSE:** To examine changes in CRF and muscular strength among participants of the MacSeniors Exercise and Wellness program through a retrospective chart review. **METHODS:** Included subjects ($n = 124$) completed exercise tests prior to program entry and after a minimum of one-year participation in the program. One-sample *t*-tests were used to analyze rates of change in CRF and muscular strength (separately for each muscle group) in comparison to the population sample. The rate of 1.00% per year was selected for comparison because it is the minimum expected CRF decline. Rates of strength decline were compared to those established in the Health Aging and Body Composition Study (2006) by Goodpaster et al. (3.42% and 2.65% for men and women, respectively) due to its comparable design and participant characteristics. **RESULTS:** After a mean follow-up time of 5.2 ± 2.6 years, absolute- (-0.29 ± 0.58%, $p = 0.23$) and relative- (0.06 ± 0.62%, $p = 0.13$) changes in VO_2peak were not significantly different than the

minimum expected decline of 1.00% per year, among men. However, both measures of CRF significantly improved over time in women (absolute VO_2peak [2.25 ± 0.66%, $p < 0.001$]; relative VO_2peak [2.24 ± 0.68%, $p < 0.001$]). Changes in muscular strength were significantly less than the established rates of decline across all muscle groups in both men ([1-repetition maximum (1-RM) bench press: -0.38 ± 0.96%, 1-RM row: -0.01 ± 0.82%, 1-RM knee extension: 0.25 ± 0.83%], $p < 0.05$) and women ([1-RM bench press: 3.23 ± 1.11%, 1-RM row: 1.58 ± 0.91%, 1-RM knee extension: 0.73 ± 1.21%], $p < 0.05$). **CONCLUSION:** Enrolment in the MacSeniors Exercise and Wellness program attenuated the age-related decline in VO_2peak in women, but not in men in comparison to previously published rates of decline. Decline in upper and lower body large muscle force was attenuated in both men and women across all muscle groups compared to previously published normative rates of change.

2144 Board #157 June 1 2:00 PM - 3:30 PM

Effects Of Mulan Quan On Physiological Functions In Middle-Aged And Elderly Women

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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 blood pressure index (ABI) were determined by an Omron arteriosclerosis detector, forced vital capacity (FVC) was measured by spirometer, 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 in the exercise group than in the control group (left side: 1372.00±136.57 cm/s vs. 1687.00±1167.71 cm/s, p<0.05; right side: 1371.70±123.09 cm/s vs. 1661.30±180.25 cm/s, p<0.05), and ABI value from the right side was 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 PVC was significantly higher in the exercise group than in the control group (2326.50±327.75 ml vs. 1938.00 ± 514.08 ml, p<0.05). For cardiovascular fitness, the step index was significantly higher in the exercise group than in the control group (66.50±8.57 vs. 59.20±6.27, p<0.05). **Conclusions:** Long-term Mulan Quan practice can significantly improve vascular function, pulmonary function and cardiovascular fitness in middle-aged and elderly women. Future studies are needed to elucidate the mechanisms through which Mulan Quan promotes health.

2145 Board #158 June 1 2:00 PM - 3:30 PM

Age, Physical Activity, And Body Composition Independently Influence Physical Function In Middle-aged And Older Women

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(No relationships reported)

PURPOSE: With aging, physical activity (PA) declines and adverse changes in body composition occur, including both increases in adiposity (%Fat) and reductions in lean mass (LM), negatively impacting lower-extremity physical function (LEPF) and risk for physical disability. However, the interactive effects of these factors on LEPF remains incompletely characterized in middle-aged and older women known to be at higher risk of physical disability compared to male counterparts. Thus, this study aimed to evaluate the associations of age, PA, %Fat, and leg LM relative to body weight (LEG-LM/BW) with LEPF in middle-aged and older females.
METHODS: Women (n = 274; 50-89 & 66.7+8.2 yo; 43.5 + 6.8%Fat) were assessed for PA using accelerometry (NL-1000; 4 valid, 10-h days of wear), body composition via DXA and LEPF using a composite Z-score from 6-Minute Walk Test, Timed Up and Go, and 30-second Chair Stand scores.
RESULTS: Age, PA, %Fat, and LEG-LM/BW were all associated with LEPF (r = -0.53, 0.58, -0.35, 0.27 respectively; all p < 0.01). As expected mathematically, %Fat and LEG-LM/BW were strongly related (r = -.95; p < 0.01) thereby not included in the same regression model. Linear regression analyses revealed A) Age and %Fat independently explained 28% and 13% of the variance in LEPF, respectively (both p < 0.05); B) Age and LEG-LM/BW independently explained 28% and 12% of the variance in LEPF, respectively (both p < 0.05). Within a subsample with objective PA (n=166; 50-77 & 62.8+6.7 yo; 6648 + 2880 steps/day), linear regression analyses revealed A) Age, %Fat, and PA independently explained 21%, 26%, and 5% of the variance in LEPF, respectively (all p < 0.05); B) Age, LEG-LM/BW, and PA independently explained 21%, 21%, and 7% of the variance in LEPF, respectively (all p < 0.05). However, interactions among independent variables of interest (age, %Fat, LEG-LM/BW, and/or PA) were not predictors of LEPF (all p>0.05).
CONCLUSION: Our results confirm that age, %Fat, LEG-LM/BW, and PA are individually associated with LEPF but, the interactive influence of these inter-related factors on LEPF are less clear. Further study is warranted to determine the salient factors for intervention to ameliorate the age associated decline in LEPF increasingly observed in middle-aged women.

2146 Board #159 June 1 2:00 PM - 3:30 PM

Exercise-based Cardiac Rehabilitation Improves Physical Health And Quality Of Life In Elderly Women

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(No relationships reported)

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, more than men. Similarly, women who complete CR have a 64% reduction in mortality rate, compared to those who don't complete CR. Research on the efficacy of CR in elderly women is lacking and research is needed to assess exercise-based CR's role in physical health and quality of life post cardiac event.
PURPOSE: This study sought to examine the effectiveness of an exercise-based cardiac rehabilitation program on CRF, self-reported QoL, depression and anxiety in elderly women with CVD.
METHODS: Participants (n=30) with CVD (71.2 ± 5.2 yrs) were referred to an 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% VO_2R), resistance (1-2 sets; 12-15 reps at 40-80% 1RM) and balance and flexibility exercise, totalling approximately 60 minutes/session. Significantly different (p<.05) pre- vs. post-program values were identified by dependent t-tests. Data are the mean ± SD.
RESULTS: Post-program CRF 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 component scores for physical (49.4 ± 41.5 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.

2147 Board #160 June 1 2:00 PM - 3:30 PM

Changes in Cardiometabolic Risk Factors after High-Velocity Circuit Resistance or Treadmill Training in Older Adults

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(No relationships reported)

Cardiometabolic syndrome (CMS) is an aggregation of major risk factors that increases a person's risk for developing cardiovascular disease, diabetes mellitus and the risk of mortality from cardiovascular disease. Continuous treadmill training (TM) has been shown to effectively attenuate the magnitude of CMS risk factors in a multitude of clinical populations. However, there is a paucity of research on the effects of high-velocity circuit resistance training (CRT) on CMS risk factors in older adults. **PURPOSE:** To compare the effects of CRT versus TM versus no exercise (CONT) on older adults with CMS risk factors. **METHODS:** Thirteen subjects (1M, 12F; 68.5 ± 7.3 years) with multiple risk factors for CMS participated in 12-weeks of CRT or TM. BMI, body fat % (BF), waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), fasting glucose (GLUC), glycated hemoglobin (A1C), and c-Reactive Protein

(CRP) were measured before and after the training. Nutritional intake was monitored to eliminate influence on CMS biomarkers. **RESULTS:** A within-group analysis showed that CRT exhibited significant decreases in A1C (MD= -0.367, SE= .142, p=0.03), SBP (MD= -21.67, SE= 6.35, p<.01), and DBP (MD= 9.33, SE= 2.53, p=.01), while TM had a trend toward decreased LDL-C (MD= 15.25, SE= 8.16, p=.09), and CONT showed a trend toward increases in CRP (MD= -0.16, SE= .08, p=.08). CRT also exhibited greater decreases in BMI, BF, and CRP than TM and CONT after the intervention, although statistical significance was not reached. There were no significant changes in TC, LDL-C, TG, or GLUC in any group. A between-group analysis showed CRT had significantly greater decreases in DBP compared to TM (MD= -10.58, SE= 3.34, p=.03) and CONT (MD= -12.13, SE= 3.19, p= .01) and a trend toward decreased SBP compared to CONT (MD= -19.47, SE= 8.03, p= .08). **CONCLUSION:** These preliminary results indicate that CRT results in greater improvements in CMS risk factors than TM. Although statistical significance was not reached for certain risk factors, a larger subject pool may strengthen our results.

2148 Board #161 June 1 2:00 PM - 3:30 PM

Continued Improvement and Maintenance in Older Veterans After Two Years of Gerofit Exercise Program

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(No relationships reported)

PURPOSE: Gerofit is an outpatient facility-based clinical exercise program for Veterans ≥65 years that was developed at the Durham VA 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 years 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, 69.7 ± 4.2 yr (mean ± SD), 72% African American, BMI 32.9 ± 6.5 kg/m^2) 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 ± 7.1, 16.6 ± 8.1; $p < 0.01$). Endurance increased 12% (502.8 ± 146.1, 533.5 ± 179.6, 563.9 ± 176; $p < 0.01$). TUG scores decreased 15% (7.6 ± 2.2, 6.9 ± 2.6, 6.7 ± 2.7; $p < 0.05$) and FSST decreased 8.7% (11.2 ± 3.8, 9.8 ± 3.3,10.3 ± 5.6; $p< 0.05$). SPPB and 10 meter walk did not significantly improve (p= 0.15 and p= 0.78). No test resulted in significant changes between 1 yr and 2 yr (p≥ 0.20).
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 a ceiling effect as baseline scores were 10 out of 12. These results demonstrate 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.

2149 Board #162 June 1 2:00 PM - 3:30 PM

The Challenges and Successes During a 12-week Exercise Program for Post-Menopausal Women: A Qualitative Study.

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(No relationships reported)

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 use qualitative methods to explore what the participants experienced. **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 during analysis 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 time commitment and weather challenges for the walking group and the intensity of the workouts for the HIIT group. **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 #CO-OP 2014-04 from University of Scranton and Marywood University, Scranton, PA.

2150 Board #163 June 1 2:00 PM - 3:30 PM

Perceptions of Exercise Screening Among Older Adults

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PURPOSE: The older adult population is largely inactive and barriers and enablers to the initiation of exercise participation have been identified. To explore the perceptions of exercise screening among older adults in order to inform evolving screening guidelines, which seek to safely encourage as many people as possible to engage in regular healthful physical activity. **METHODS**: A convenience sample of 86 community-dwelling participants (mean age (SD): 75.7 ± 7.7 years; 44% female] underwent a physical exam and screening (stress test and the Get Active Questionnaire) at a research laboratory routinely conducting screening for community-based referrals. One week later, participants returned to the study site and were interviewed on perceptions of the screening process by a research assistant who documented all responses. Questions focused on physician evaluation, self-screening, how screening impacted willingness to exercise, and experiences in completing the questionnaire. Thematic analysis was conducted. **RESULTS**: Themes identified were that: (1) Older adults largely think it's a good idea to be screened for exercise (for precautionary reasons and to assess physical condition) and that screening independently of consulting their physician was positive; however, some older adults felt it was unnecessary as they were in good physical condition; (2) There is a lack of self-screening among most older adults, (3) Older adults may perceive that checking in with a health care provider is 'self-screening' and that a self-screening tool may be unnecessary and non-specific; (4) Most older adults do not feel that screening impacts their willingness to exercise and indicate that it is not inconvenient. For some older adults, screening increased their confidence and found the screening process reassuring and motivating. The questionnaire, while simple in design, had confusing format and wording for some; subjects suggested tools should address the need for simplicity of design, be convenient and instill motivation and confidence prior to starting or changing exercise behaviours. **CONCLUSION**: Our findings suggest older adults may find screening supportive of adopting exercise and that such tools should be simple, convenient and support motivation and confidence to exercise.

D-67 Free Communication/Poster - **Exercise Testing**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2151 Board #164 June 1 3:30 PM - 5:00 PM

Fasting Plasma Glucose is Associated with the Heart Rate Response to Maximal Exercise

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(No relationships reported)

Introduction: Chronic hyperglycemia associated with diabetes impairs the exercise heart rate (HR) response. However, the relationship between fasting plasma glucose (FG) and chronotrophic response to exercise has not been well characterized in individuals with normal and impaired FG values. **PURPOSE:** To evaluate the relationship between FG and multiple HR response indices during and after maximal cardiopulmonary exercise testing (CPX). **METHODS:** Data were obtained from

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 FG and resting HR, HR acceleration (HRacc), HR recovery (HRrec), HR reserve (HRres), % age-predicted max HR achieved (%APMHR), and chronotrophic 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 %APMHR (r=-0.214), HRrec (r=-0.233), and HRres (r=-0.338). After adjusting for age, sex, body mass index (BMI), and cardiorespiratory 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 %APMHR were lower (P<0.05) in T2D compared to NFG. HRacc and %APMHR were lower (P<0.05) in T2D compared to IFG. Differences among groups for CI, %APMHR, 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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INTRODUCTION: Cardiorespiratory fitness is measured by peak oxygen consumption (VO_{2max}) and is one of the strongest predictors of all-cause and cardiovascular disease mortality. In a healthy adult population, VO_{2max} values obtained on a treadmill are approximately 10-15% higher than those yielded by cycle ergometry. VO_{2max} 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 VO_{2max} 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 cardiorespiratory 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 Dx, 26.9±6.5 kg·m^{-2}) completed two VO_{2max} 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 VO_{2max} values that were 11% higher and respiratory exchange ratio (RER) values that were 8% lower than those obtained via cycle ergometry. See Table 1. **DISCUSSION:** Relapsing-remitting MS patients exhibit a mode-related difference in VO_{2max} 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 HR_{peak} values are within normal limits, they're bordering chronotropic incompetence.

	Treadmill	Cycle Ergometer
VO2peak (ml·kg-1·min-1)	27.0 ± 6.7*	23.9 ± 6.0
HRpeak (beats·min-1)	159 ± 19	153 ± 16
SBPpeak (mmHg)	166.8 ± 20.5	163.4 ± 27.5
DBPpeak (mmHg)	72.7 ± 13.3	75.1 ± 11.5
RPE	17.9 ± 1.9	18.0 ± 2.0
VEpeak (L·min-1)	75.5 ± 21.2	79.1 ± 23.6
RER	1.09 ± 0.08*	1.19 ± 0.07

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

2153 Board #166 June 1 3:30 PM - 5:00 PM

The YMCA Submaximal Cycle Test and the 6-Minute Walk Test are Not Accurate Predictors of Cardiorespiratory Fitness During Mid-pregnancy

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PURPOSE: Assessing cardiorespiratory fitness is important for determining health status and prescribing exercise. Measurement of peak oxygen uptake (VO_{2max}) is the gold standard for the evaluation of cardiorespiratory fitness. However, VO_{2max} 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 VO_{2max} 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 (YMCAT) are currently validated tests to predict VO_{2max} 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 YMCAT as predictors of cardiorespiratory 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 YMCAT 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 (VO2max) 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/m^2, Age=30.1±3.2 yr, Gestation age=22.0±1.3 wk). Mean predicted VO_{2max} values were 36.3±3.9 and 41.1±19.0 ml/kg/min for the 6MWT and the YMCAT, respectively. Mean VO_{2max} obtained from the graded exercise test was 34.9±10.0 ml/kg/min. Actual and predicted VO_{2max} values were not correlated for either submaximal test (6MWT: r=0.28, p=0.31; YMCAT: r=0.08, p=0.79).
CONCLUSIONS: The 6MWT and YMCAT do not accurately predict VO_{2max} 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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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.

Baseline data								
	Age (yrs)	**Height (cm)**	**Body Weight (kg)**	**BMI**	**Waist Circum-ference (cm)**	**Resting Heart Rate (bpm)**	**Rest SBP (mmHg)**	**Rest DBP (mmHg)**
Avg	33.14	168.97	136.89	48.00	129.57	87.29	115.00	78.14
SD	6.64	4.73	27.60	10.01	24.67	19.19	5.80	8.69
Pooled testing data								
	Peak-VO2 (ml/kg/min)	**Exer-cise Time (min)**	**Peak RER**	**Peak HR (bpm)**	**Peak % Age Predicted HR Max (APHRMax)**	**Peak SBP (mmHg)**	**Peak DBP (mmHg)**	**Peak RPE**
Avg	19.52	12.00	1.00	166.00	0.89	170.00	74.00	6.36
SD	8.52	4.00	0.07	17.06	0.08	16.59	8.39	2.29

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 special 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.

2155 Board #168 June 1 3:30 PM - 5:00 PM

Assessment Of Cardiorespiratory Fitness And Recovery Capacity Among Women With Fibromyalgia

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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 in FM patients, a disease often compared with ME/CFS.
PURPOSE: To describe and compare the CRF and recovery capacity of women, who are mildly or moderately affected with FM, 24 hours after a maximal exercise test.
METHODS: Twelve FM women were submitted twice to a maximal exercise test (BSU/Bruce ramp) interspersed by 24 hours (T1 & T2), until participants achieved volitional exhaustion. Gas exchange (Ergogard, Medisoft) and ECG (Quinton) were continuously monitored throughout the test. Blood lactate, blood pressure, pain intensity and rate of perceived exertion, were also assessed at different moments. The Revised Fibromyalgia Impact Questionnaire was completed by participants to determine their FM severity level. **RESULTS**: No significant differences in VO_2peak (25,5±5,3 vs. 26,5±5,3 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$, p>0,05) and VO_2 at ventilatory threshold (VO_{2VT}: 21,2±4,8 vs. 21,7±4,8 ml O2·kg−1·min−1, p>0,05) were found between T1 & T2. When considering the severity of the disease, mildly affected FM patients had a significantly greater CRF only at T2 (VO_{2peak}: T2 = 30,4±3,3 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$) and higher VO_2 at the ventilatory threshold at T1 and T2 (VO_{2VT}: T1 = 24,0±4,0; T2 = 24,9±3,2) when compared with moderately affected FM patients (VO_{2peak}: T2 = 22,9±4,7 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ and VO_{2VT}: T1 = 18,5±4,4; T2 = 18,7±4,5 ml $O2 \cdot kg^{-1} \cdot min^{-1}$). Furthermore, CRF levels were lower than the general population. In fact, 75% of the VO_{2peak} results were below the «Fair» category, of which 25% were below the «Very Poor» category, when compared to the ACSM normative values for VO_{2peak}. **CONCLUSION:** In general, participants showed no significant difference in CRF and recovery after 24 hours. However, the severity of fibromyalgia negatively affected CRF in our study population and their CRF level was lower than the general population.

2156 Board #169 June 1 3:30 PM - 5:00 PM

Indirect Assessment Of Vo2max

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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 calculation of VO2max and VO2max/kg
METHODS: The data of 2777 spiroergometric 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 vise 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 = 0.0095 . 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 . 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 vice 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.

2157 Board #170 June 1 3:30 PM - 5:00 PM

A Pregnancy-Specific Equation for Predicting Cardiorespiratory Fitness

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(No relationships reported)

PURPOSE: The ability to measure VO_{2max} is important for determining health status and prescribing exercise. However, directly measuring VO_{2max} 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.
METHODS: Nineteen pregnant women (Age: 29.8±3.1 years, Pre-pregnancy BMI: 23.8± 3.9 kg/m^2), Gestation Age: 22.0±1.4 weeks) participated in the study. Each participant completed baseline measurements/anthropometrics and the Bruce protocol maximal treadmill test. Exercise data was obtained from the maximal test using heart rate from stages 1, 2, 3, and 4, and used to create regression equations calculated to predict measured VO_{2max} levels. In addition, other variables such as body mass index, age, gestation age, and physical activity level were included in these in regression models based on their predictive ability.
RESULTS: Stepwise multiple regression analysis (SPSS, version 24) was conducted to predict the VO_{2max} in pregnant women based upon baseline measures and exercise data. The results of this analysis indicated that VO_{2max} was significantly related to maximum heart rate (maxHR), $F(1,11) = 22.38$, $p < .001$, and demonstrated $R^2 = .670$ and adjusted $R^2 = .640$. The regression equation for this linear model is:
$VO_{2max} = -179.74 + (1.25 \times maxHR)$
The other baseline and exercise variables did not predict significantly in this sample. Based upon these results, maxHR appears to be the best predictor of VO_{2max} in pregnant women.
CONCLUSIONS: Data from the current study was used to create an equation that can be used to predict cardiorespiratory fitness in pregnant women. A logical next step is to further validate such equations in a larger cohort of pregnant women. Validated equations created will allow healthcare providers to safely and effectively predict their pregnant patients' fitness level; thus, allowing them to best tailor their patients' exercise prescriptions in order to maximize the benefits of exercise in both the mother and her offspring.

2158 Board #171 June 1 2:00 PM - 3:30 PM

The Use of Prediction Equations in Hypertrophic Cardiomyopathy

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PURPOSE: To evaluate a recent equation (FRIEND) for the estimation of peak exercise capacity (VO_2peak) in a heterogeneous clinical population of patients with cardiomyopathy against the current standard in estimation equations (Wasserman, 1986).
METHODS: 1100 consecutive ambulatory patients performed clinical cardiopulmonary exercise testing (CPX) at Stanford University. VO_2peak was measured directly during CPX (CosMed USA), and estimated VO_2peak were calculated using the FRIEND (Fitness Registry and the Importance of Exercise: National Database) registry equation and the equation from Wasserman et al. VO_2peak data were assessed for variation around the median and comparisons were made.
RESULTS: Patients were on average 48 (15) y and 62% male. VO_2peak as measured by CPX was on average 23.7 (9.8) ml/kg/min. The Wasserman equation average prediction for VO_2peak was 27.8 (9.4) which resulted in an percent predicted of 88%, whereas the FRIEND equation resulted in average predicted VO_2peak 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 VO_2peak estimation equations and further development of these equations seems warranted.

2159 Board #172 June 1 3:30 PM - 5:00 PM

Association Between Heart Rate Recovery, Cardiorespiratory Fitness, And Physical Activity In HIV+ Hispanic Adults

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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 VO_2) using the modified Bruce protocol. Measurements continued for 6 minutes post-exercise. They also wore an ActiGraph GT3X+ accelerometer attached to an elastic waist band placed in the right hip area for 7-days. T-tests were used to detect differences by group and classification of PA and CRF. Correlation and regression analyses were used to evaluate associations between variables. **RESULTS:** No differences in the proportion of HIV+ and HIV- classified as active vs. inactive (42.4 vs. 52.5% & 53.6 vs. 46.4%; P=0.328), and with good vs. low CRF (44.1 vs. 55.9% & 60.0 vs. 40.0%; P=0.155) were observed. HRR was not different by group, but %HRR was lower in HIV+ compared with HIV- (38.4±.7.4 vs. 44.0±5.6%; P<0.001). Considering PA classification, active HIV+ had lower HRR and higher %HRR than inactive HIV+ (91.0±11.8 vs. 98.4±10.6 bpm, P= 0.02; 41.6±4.3 vs. 36.0±8.4%, P=0.004; respectively); while HIV- showed no differences. Based on CRF classification, HRR was not different in both groups, but %HRR was higher in both HIV+ and HIV- with good CRF compared with those with low CRF (41.2±6.2 vs. 36.1±7.5%, P=0.007; 45.6±5.6 vs. 41.6±5.0%, P=0.05). Correlation and regression analyses confirmed associations between VO_2peak, PA, and %HRR. **CONCLUSION:** Impaired %HRR among HIV+ Hispanic adults compared with HIV- was apparent regardless of CRF and PA classification. However, both PA and CRF positively influenced %HRR in the HIV+ group, supporting our hypothesis. Supported by: NIH/CTSA KL2-RR024151, NIH/NIMHHD 8U54MD 007587-03.

2160 Board #173 June 1 2:00 PM - 3:30 PM

Posture During Exercise Effects Breathing Pattern And Reports Of Dyspnoea

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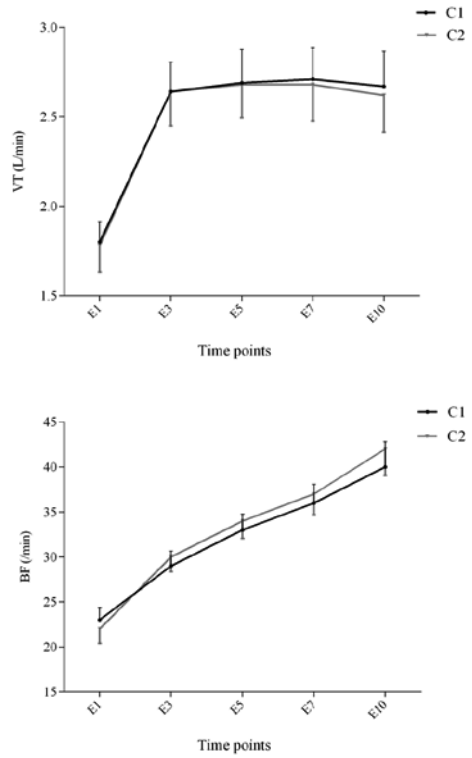
(No relationships reported)

Purpose: The posture an athlete holds during exercise may alter breathing pattern and increase reports of exercise induced respiratory symptoms. The purpose of this study was to investigate the effect of different postural positions during high-intensity cycling on breathing frequency (BF), tidal volume (VT), rating of perceived exertion (RPE) and dyspnoea.
Methods: Fifteen healthy male athletes (Mean +/- SD age: 26.1±7.0 yrs.) performed a 10-minute cycling test at 70% of their peak power in two conditions, in a randomised order: with normal shoulder position (C1) and with hunched shoulders (C2). BF and VT were continuously monitored during exercise. RPE and dyspnoea were gauged by using Borg RPE and Borg-10 scales, respectively.
Results: BF and VT showed no significant difference between conditions at any time point, however an alteration in BF was observed in C2 (Figure 1). Significant main effects of time emerged for BF, RPE and dyspnoea in both conditions (all p values <0.001).
Conclusions: Cycling with hunched shoulders at high intensities over a prolonged period leads to altered breathing mechanics and as a consequence, an increase in perceived exertion and dyspnoea. These findings suggest that posture may contribute to reports of respiratory symptoms during exercise in the absence of cardio-pulmonary disease.



C1 represents normal shoulder position and **C2** represents hunched or lifted soulder position.
E1, E3, E5, E7, E10 represent minutes 1, 3, 5, 7 & 10 of the 10-minutes cycling test.

D-68 Free Communication/Poster - **Fitness Assessment**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2161 Board #174 June 1 3:30 PM - 5:00 PM

Vertical Jump Height Measurements: Correlation Between Vertec And My Jump App.

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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 Ipad 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 measures 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.

2162 Board #175 June 1 3:30 PM - 5:00 PM

No Difference In Time To Stabilization Between Male < Female Dancers Following A Jump-landing Task

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Dance is a jump 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 exists among dancers with females having up to 55% higher relative frequency of ankle sprains compared to their male counterparts. PURPOSE: To determine the effect of gender on time to stability (TTS) after landing from a horizontal jump. METHODS: Forty-one professional ballet and modern dancers (14 men, 23.8±4.3 and 27 women, 26.1±4.7) without prior ankle injury consented to participate in this biomechanics laboratory study. Shod in personal, flat soled running shoes, subjects performed three submaximal (50% maximum) trials of the TTS test. Independent t-tests were employed with gender (male/female) as the independent variable and TTS (anterior-posterior [AP]/medial-lateral [ML]) as the dependent variables. RESULTS: No differences were found between men and women dancers for either AP or ML aspects of the horizontal TTS jump test (AP: men 2.707±0.11 seconds, women 2.709±0.11 seconds; p=0.98), (ML: men 2.718±0.294 seconds, women 2.853±0.177 seconds; p=0.121). CONCLUSION: Men and women dancers exhibited similar TTS after landing from a horizontal jump task when wearing flat soled shoes on a flat surface. The gender disparity in landing mechanics found by other researchers may not have been found here due to jump type or to extrinsic factors such as the interaction of variable floor surfaces 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.

2163 Board #176 June 1 3:30 PM - 5:00 PM

Relationship Between the Ruffier Test and Maximal Treadmill Testing in Healthy Adults

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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/m^2; 9 F) participated. During one testing session, participants performed a Ruffier fitness readiness test (30 squats in 45 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 (VO_{2peak}), 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<0.0001. The Ruffier score averaged 8.8 ± 3.4 points (from 0-20 points). The Balke VO_{2peak} measure 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 VO_{2peak} 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.

2164 Board #177 June 1 3:30 PM - 5:00 PM

Hip Adductors are Stronger in Persons with Bilateral Compared to Unilateral Knee Injury: Pilot Study

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Introduction: 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 (PFPS). This pilot investigation separated those with unilateral or bilateral knee injury to assess differences in adductor strength and abductor-to-adductor strength ratio.
Purpose: Determine if differences in hip adductor strength is present in persons with unilateral compared to bilateral knee injuries.
Methods: Males and females, ages 18-24, with a history of unilateral (n=10; 6 F, 4 M; PFPS or anterior cruciate ligament reconstruction (ACLR)) or bilateral knee injuries (n=10; 6 F, 4 M; B PFPS or B ACLR) 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>0.5). 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 abductor-to-adductor 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 abductor strength in either group (p=0.2).

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 abductor-to-adductor ratio 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.

2165 Board #178 June 1 3:30 PM - 5:00 PM

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

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(No relationships reported)

Range of motion (ROM) is vital for daily living and exercise. Flexibility is especially of interest 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 experimental design with random assignment was 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 significant 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.

2166 Board #179 June 1 3:30 PM - 5:00 PM

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

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(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 have 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 IPAQ-Short Format and the Marijuana Use Measure questionnaires. MU had used MJ 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), body mass index (BMI), body fat (skinfold, BF) resting systolic (SBP) & resting diastolic (DBP) blood pressure were assessed. Pulmonary function was evaluated (forced expired volume in 1-second percent (FEV1%) and relative forced expired volume in 1-second ($RFEV1_{max}$)) using spirometry. Cardiorespiratory fitness (VO_2max), lactate threshold (LT) and onset of blood lactate accumulation (OBLA) (treadmill test with measurement of expired gasses) were assessed. Independent t-tests were used to identify differences between groups (p<.05). Data are presented as mean ± SD. **RESULTS:** MU used MJ an average of 21 times out of the last 30-days. All MU were smoking MJ in some form. All participants (MU and NU) averaged 23 yrs. ± 5 yrs. age, 80.4 ± 14.9 kg BM, 25.0 ± 3.6 kg/m^2 BMI, 12.0 ± 5.9 % fat, 65.8 ± 13.1 bpm RHR, 123.2 ± 8.4 mmHg SBP, and 70.3 ± 10.0 mmHg DBP. $RFEV1_{max}$ (54.7 ± 10.2 ml/kg/s) and FEV1% (92.9 ± 12.8 %) were not different between groups (p<0.05). VO_2max was not different between groups (MU=51.1 ± 8.9; NU=53.5 ± 5.5 ml/kg/min; p=0.5.) Rate of perceived exertion at termination for MU and NU were (8.9 ± 0.9) and (9.5 ± 0.7), (p=0.1). LT and OBLA occurred at (69.3 ± 9.2 %) and (80.4 ± 11.1 %) of VO_2max 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 because 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: FRBP-NPP at UNC

2167 Board #180 June 1 3:30 PM - 5:00 PM

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

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(No relationships reported)

Self-paced VO_2max 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 closed-looped and consisted of five two-minute stages 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 VO_2max (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 VO_2max 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±.09) was significantly higher (p<.05) than CON (1.18±.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 VO_2 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.

2168 Board #181 June 1 3:30 PM - 5:00 PM

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

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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. **Purpose.** To determine if a modified 6-s anaerobic test could be used to measure PP as an alternative to the traditional WAnT30 in recreationally active females.
Method: Thirteen females (28.4 ± 6.3 yr., 163.2 ±5.3 cm, 66.8 ± 10.9 kg^{-1}), previously familiarised with protocols, performed a WAnT30. In a subsequent separate session participants performed a modified 6-s Wingate Test (WAnT6) and a 6-s Wattbike Pro 'all out' sprint (Watt6) in a randomised manner. A 15 min standardised recovery was completed between sprints. Agreement was measured between WAnT6, Watt6 and WAnT30 using simple linear regression models and Bland Altman plots.
Results: WAnT30 correlated with WAnT6 (R^2 = 0.74; P < .001) with a mean bias of -55W. Between Watt6 and WAnT30 the agreement was R^2 = 0.40 (P <.05), with a mean bias of 41W. The bias between a WAnT30 and a WAnT6 could be corrected using the following equation:
WAnT30= 0.691 * (WAnT6) +156.1 W (r = 0.85, R^2 = 0.72, SEE = 60.3 W; P < 0.001).
Conclusion: A WAnT6 can be used instead of WAnT30 in recreationally active females when PP is the main measure of interest. This avoids unnecessary fatigue and

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 WAnT30 from WAnT6.

2169 Board #182 June 1 3:30 PM - 5:00 PM

Evaluating Upper-body Strength And Power From A Single Test: The Ballistic Push-up

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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. **METHODS:** Sixty 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 (R^2 = 0.837, SEE = 11 kg); time-based power prediction equations: Peak Power = 11.0 × Body Mass + 2012.3 × Flight Time - 338.0 (R^2 = 0.658, SEE = 150 W), Mean Power = 6.7 × Body Mass + 1004.4 × Flight Time - 224.6 (R^2 = 0.664, SEE = 82 W); and velocity-based power prediction equation: Peak Power = 8.1 × Body Mass + 818.6 × Peak Velocity - 762.0 (R^2 = 0.797, SEE = 115 W); Mean Power = 5.2 × Body Mass + 435.9 × Peak Velocity - 467.7 (R^2 = 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.

2170 Board #183 June 1 3:30 PM - 5:00 PM

Ntprobnp, Lactate And Bp Responses To The Want In Young Male Wrestlers And Untrained

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ABSTRACT
Purpose: To investigate the influence of the WAnT on blood pressure, lactate, and NTproBNP in trained Wrestlers and untrained young males. **Methods:** 20 males (n=20), ages 18-25 underwent the WAnT. The study included 2 groups. Group 1 included 10 untrained individuals, and group 2 included 10 wrestlers. NTproBNP (ng/mL), lactate (mmol/ L), and blood pressure (mmHg) were measured at rest, immediate-post, two minutes post, and ten minutes post. The mechanical outputs (W) calculated for each subject. NTproBNP was analyzed utilizing ELIZA. **Results:** The wrestler's resting NTproBNP levels were higher (35.5±7.59 vs 35.15±4.82 accordingly), with non-significant differences between the groups. Immediate Post NTproBNP was higher for wrestlers (40.25± 14.08 vs 37.33± 9.94) with a positive and strong correlation between PP and IP NTproBNP (r = 0.85). While the untrained had a substantially higher post 10 NTproBNP (45.07± 11.75 vs 32 ± 5.57), both group's NTproBNP was elevated post 10 minutes with a significant difference from post 2 minutes values (p=0.035). PP was significantly higher for the wrestlers (1031.6±188.65 vs 960.91±189.01). No significant differences were found between groups for RPP and RMP. **Conclusions:** NTproBNP values were within the ranges reported in the literature. The WAnT did not put any of the subjects at risk due to cardiac stress. The recovery dynamics regarding NTproBNP were different between groups. Wrestlers recovered rapidly with a slight elevation 10 minutes post-test, while the untrained recovered slowly with a significant elevation of NTproBNP 10 minutes post-test.

2171 Board #184 June 1 3:30 PM - 5:00 PM

Relationship Between the Repeated-Sprint Ability Test, Maximal Exercise and Exercise Tolerance in Female Athletes

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The repeated-sprint ability (RSA) test consists of 6 maximal sprints of 40m (20m + 180° turn + 20m) with 20s of passive recovery between each sprint. It has been used in most intermittent-like sport modalities (i.e. soccer, rugby) to match-relate athletes' performances, however, the RSA relationship with maximal exercise capacity as well as exercise tolerance needs to be investigated. **PURPOSE:** To verify the relationship between the RSA test with a maximal cardiopulmonary exercise test (CPX) and a constant speed test until time to exhaustion (TTE) of intermittent-sport female athletes. **METHODS:** Twenty-two professional female soccer athletes (23 ± 4 years, 55.4 ± 6.9 kg, 162 ± 6 cm, maximal oxygen uptake ($\dot{V}O_2$) 2341.8 ± 209.4 ml.min^{-1}) performed the RSA test in a grass field. RSA mean performance time and percentage of performance decrement were calculated afterwards (RSA_{mean} and RSA_{dec}, respectively). At least 48h later, all athletes underwent the CPX on a treadmill, where cardiac and respiratory variables were measured and calculated by a metabolic cart. Additionally, arterialized blood samples from earlobe puncture were collected in order to quantify blood lactate concentration ($[lac^-]_B$) during maximal exercise. Lastly, after 48h, all athletes performed a constant speed test (at 100% speed reached in CPX) until TTE to verify their exercise tolerance. **RESULTS:** Statistically significant correlations were found between: 1) maximal heart rate of CPX and RSA_{dec} (P = .000, r = .692); 2) $[lac^-]_B$ at the peak of CPX and RSA_{dec} (P = .012, r = .539); and 3) TTE and RSA_{dec} (P = .000, r = -.632). No correlations between RSA variables and $\dot{V}O_2$ were found. **CONCLUSION:** This study showed that maximal chronotropic and blood lactate responses to maximal exercise testing are related to RSA test performance. In addition, exercise tolerance obtained during a near maximal exercise performance is also associated to RSA test performance in female intermittent-like sport modality athletes. *Supported by CNPq Grant #487385/2013-6 and FAPESP Grants #2014/10145-9 and #2015/04101-1.*

2172 Board #185 June 1 3:30 PM - 5:00 PM

Differences Between Open and Closed-Kinetic Chain Measurements for Assessing Bilateral Strength Deficits

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(No relationships reported)

Rugby is an 80-minute closed-kinetic chain field sport with maximum bouts of speed, power, strength, and physicality. Assessing a player's strength capacity is important for determining position, eligibility, and return to play after injury. Bilateral strength deficits (difference between bilateral strength and the sum of both unilateral measures) could potentially put an athlete at greater risk for injury. The isometric mid-thigh pull (IMTP) is a closed-kinetic chain test examining multiple muscle groups force output involving the whole body, more similar to rugby, whereas the isometric knee extension is an open-kinetic chain test isolating the torque output of only the quadriceps muscle group. Some disagreement exists regarding whether open or closed-kinetic chain tests are more valid to assess an athlete's bilateral strength deficit. **PURPOSE:** To determine differences between an isolated open-kinetic chain and closed-kinetic chain testsf to evaluate the bilateral deficit. **METHODS:** Seventeen club rugby athletes (men n=6, age=22.0±2.6 yrs, height= 172.66±6.12 cm, mass=80.28±11.13; women n=11, age= 24.72±3.66 yrs, height= 164.00±5.23 cm, mass =74.00±18.14 kg) completed a standardized warm-up then stood on an AMTI force plate and performed a bilateral IMTP, and two IMTP measured for each leg unilaterally in random order. They also performed a Biodex knee extension isometric test bilaterally, as well as each leg unilaterally in random order. **RESULTS:** ANOVA revealed that the Biodex bilateral deficit (20.99%±13.86%) was significantly greater than the IMTP (6.75%±9.78%). **CONCLUSIONS:** Injury rates have previously been associated with bilateral strength deficits, making strength assessments crucial for coaches. The IMTP closed-kinetic test may be more sport-specific, however, athletes may compensate for leg weaknesses with other muscle groups. The ability of the Biodex open-kinetic test to isolate specific muscle groups may be more beneficial for coaches testing bilateral strength deficits, and determining their athlete's return to play.

2173 Board #186 June 1 3:30 PM - 5:00 PM

Physiological Attributes of an NCAA Intercollegiate Triathlon Team

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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 tests and for the 1km swim.

	VARIABLE	MALE	FEMALE
RUN	VO_{2peak} (ml/kg/min)	66.2 ± 5.9	49.1 ± 4.6 *
	HRmax (bpm)	194.8 ± 8.3	201.0 ± 7.2 *
	Lactate Peak (mmol/l)	7.8 ± 2.5	11.0 ± 3.4 *
BIKE	VO_{2peak} (ml/kg/min)	60.9 ± 6.2	51.5 ± 2.1 *
	HRmax (bpm)	188.3 ± 3.6	184.7 ± 13.9
	Lactate Peak (mmol/l)	10.7 ± 2.5	8.4 ± 1.6 *
	Peak Watts	332.5 ± 14.4	283.3 ± 38.1 *
	Watts/kg	4.7 ± 0.2	4.7 ± 1.3
SWIM	HRmax (bpm)	182.2 ± 9.4	190.6 ± 9.2 *
	HRavg (bpm)	170.2 ± 8.8	180.6 ± 10.1
	Breaths per lap	8.7 ± 1.4	11.0 ± 0.8 *
	1 km time (min:sec)	12:45.6 ± 0:46	14:34.8 ± 1:03 *

* Sig. diff.; $p \leq 0.05$; mean ± SD
Participants had lower VO_{2peak} values than highly trained (male 73.8 ± 1.6, female 59.7 ± 5.0 ml/kg/min; $p \leq 0.05$) and junior elite triathletes for run (male 73.2 ± 7.4 ml/kg/min; $p \leq 0.05$) and bike (male 68.2 ± 7.4 ml/kg/min; $p \leq 0.05$) but had greater aerobic capacities than recreational triathletes for run (male 62.9 ± 7.2 ml/kg/min; $p \leq 0.05$) and bike (male 59.6 ± 5.4 ml/kg/min; $p \leq 0.05$). Mean (± SD) 1km swim times for male and female participants were significantly slower than national performance standards for 19 yr old triathletes (male 11:59.0 and female 12:48.0; $p \leq 0.05$).
CONCLUSION: Our findings are the first to present physiological attributes of NCAA varsity intercollegiate triathletes and indicate favorable VO_{2peak} values compared to recreational triathletes, but not to highly trained or junior elite triathletes.

2174 Board #187 June 1 3:30 PM - 5:00 PM

Sex Differences In Bilateral And Unilateral Asymmetries In Recreationally Trained Individuals

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(No relationships reported)

PURPOSE: Limb musculature performance asymmetry can negatively impact various exercise and sport performance outcomes, but whether the percent difference of torque asymmetry between men and women is different remains less examined. Therefore, the purpose of the investigation was to determine sex differences in bilateral and unilateral asymmetries in recreationally trained individuals.
METHODS: Forty-five males (n = 24; age, 23.54 ± 2.24 yrs; mass, 83.07 ± 10.48 kg; height, 168.65 ± 2.14cm) and females (n = 21; age, 22.47 ± 2.42yrs; mass, 63.33± 6.80kg; height, 163.94 ± 5. 71cm) participated in both a familiarization session and a testing session in one day. Participants signed an IRB approved informed consent, physical activity readiness questionnaire, and a health history questionnaire, followed by measuring age, weight, and height. Participants were instructed to perform 5 maximal repetitions of knee flexion and extensions on each leg at an angular velocity of 60°/s. Percent differences in torque were calculated for bilateral and unilateral asymmetries, bilateral quad percent difference (BQ%), bilateral hamstring percent difference (BH%), unilateral right leg percent difference (UR%) and unilateral left leg percent difference (UL%). Independent t-tests were used to analyze sex differences between all variables. Additionally, independent t-tests were used to analyze sex differences between age, height, and weight.
RESULTS: There were no significant ($p>0.05$) differences between recreationally trained males and females for BQ% (M= 9.89 ± 5.95%; F= 7.26 ± 5.69%), BH% (M= 6.97 ± 5.97%; F= 10.02 ± 10.88%), UR% (M= 50.28 ± 6.86%; F= 46.65 ± 11.28%), and UL% (M= 50.19 ± 7.71; F= 50.13 ± 10.85%). There was no significant ($p>0.05$) difference between sex for age and height, however there was a significant ($p<0.05$) difference for weight.
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.

2175 Board #188 June 1 3:30 PM - 5:00 PM

Correlation Between Bench Press and Pushup Repetitions to Failure Relative to Bodyweight

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(No relationships reported)

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±6.87, mass=83.74±9.41) performed a 1RM 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 AMTI 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, triceps were parallel to the floor, while for the up position, triceps 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 relationship (r=0.289) between bench press repetitions to failure (29.5±7.59) and push up repetitions to failure (33.0±6.53). 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 must be seen as two distinct and different exercises that use very different loads, which could result in dissimilar upper body muscular endurance adaptations.

2176 Board #189 June 1 3:30 PM - 5:00 PM

Hamstrings to Quadriceps Ratios Differ Between Legs and Isometric and Dynamic Tests in Amateur Rugby Players

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(No relationships reported)

Non-contact knee injuries have been associated with large differences in strength between the quadriceps and hamstrings muscle groups. Similarly, favoring movements on the dominant vs. non-dominant leg may lead to imbalances that could result in injury. Screening players for hamstring to quadriceps ratios (HQR) by measuring isometric and dynamic strength prior to the season may demonstrate mode specific imbalances. **PURPOSE:** To measure the dynamic and isometric strength of the quadriceps and hamstrings in the dominant and non-dominant legs of rugby players prior to a collegiate season. **METHODS:** 19 amateur rugby players (11 females, age= 24.73±3.66 yrs, height=164.00±5.23 cm, mass=74.00±18.14 kg) and (8 males, age=22.38±2.45 yrs, height=175.38±7.44 cm, mass=83.24±10.99 kg) performed dynamic maximal effort 3-repetition isokinetic concentric knee flexion/extension at 60°/s, and maximal effort isometric tests on the dominant and non-dominant legs on a Biodex dynamometer at a 60° knee angle. Peak torque (PT) was measured for all tests. **RESULTS:** Dominant leg Q isometric PT was 231.61±58.11Nm and H was 140.90±39.76Nm.Dominant leg Q dynamic PT was 222.58±59.63Nm and H

was 152.60±47.04Nm. Non-dominant Q isometric PT was 240.02±80.49Nm and H was 132.42±38.65Nm. Non-dominant Q dynamic PT was 219.50±68.14Nm and H was 164.81±59.14Nm. A 1x4 repeated measures ANOVA revealed that dominant leg isometric HQR (.61±.10) was less than dominant leg dynamic HQR (.69±.12). Non-dominant leg isometric HQR (.57±.09) was less than non-dominant leg dynamic HQR (.76±.16). Dominant leg isometric HQR was greater than non-dominant HQR while non-dominant leg dynamic HQR was greater than dominant leg dynamic HQR. **CONCLUSIONS:** These results demonstrate that rugby players have greater HQR ratios in dynamic vs. isometric strength tests in both legs. Dynamic strength is displayed during rugby specific situations such as the scrum and therefore may be a more relevant measure. However, the importance of isometric HQR should also be of concern as isometric and dynamic muscle actions are performed by the hamstrings and quadriceps throughout a game. Therefore, test specificity should be considered when assessing muscle strength and ratios.

2177 Board #190 June 1 3:30 PM - 5:00 PM

Effect Of Exercise Intervention On Health States Of Civil Servants In Chengdu City

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PURPOSE:Understand the health states of civil servants in Chengdu city by physical measurement and blood test,and design different exercise prescription to the civil servants.Observe its effect,so as to provide practical information to the exercise intervention in health states.
METHODS:Through the random number table method randomly divide 110 Chengdu civil servants,aged 20-59 into 5 groups(control group, 6000 steps, 10000 steps, 6000 + joint gymnastic, 10000 + joint gymnastic,and each group of 22 people) ,took an exercise intervention 4 times per week for 12 weeks .The physical and blood parameters were measured before and after intervention, at the same time analyzed the intervention effect.Statistical analysis, T-test, and one-way ANOVAwere conducted by SPSS19.0,P <0.05 was considered statistically significant.**RESULTS**:Compared with pre-intervention:①There were no significant difference in 6000 group.②There were significant differences in body shape, SBP and muscle strength in 10000 group (P<0.05), and TG was significantly decreased (P<0.05).③There were significant differences in waist circumference and systolic blood pressure in 6000+group (P<0.05).④The scores of physical fitness, body shape, BP, upper and lower limbs muscle strength and flexibility were significantly improved (P <0.05) in 10000+group, TC, TG and LDL were significantly decreased (P<0.05).⑤Compared between these interventions,walking+joint gymnastic is better than walking,10000+joint gymnastic is the best.
CONCLUSIONS:①The health status especially in blood indicators of Chengdu civil servant is not good compared with other people in China.We should strengthen the public health awareness.②Exercise is medicine.exercise can effectively improve the health, physical quality and the state of blood of civil servant.The 10000+joint gymnastic it is worth promoting in change the health status of civil servants.

2178 Board #191 June 1 3:30 PM - 5:00 PM

Validation Of An On-ice Continuous Multistage Test For Short Track Speed Skaters

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PURPOSE: There are still no sport-specific tests to evaluate directly on ice the aerobic capacity for short track speed skating athletes. The aim of this project was to create an on-ice test to estimate skater's VO_2max.
METHODS: Two athletes of the men's Canadian national team participated in the pilot study. Participants were 22 years old, with mean body weight of 69.8 ± 1.0 kg and height of 176.5 ± 8.9 cm. The skaters performed a continuous multistage test on Olympic-sized ice rink (Maurice Richard arena, 111.12m course perimeter). An audio track was created (beep test audio track) so that the speed of skating would accelerate by 0.20 seconds every 2 lap stages. The first stage started at 13.0 seconds/lap, representing a speed of 8.55 m/s. The skaters had to follow the rhythm of increasing speed until exhaustion or until they could no longer maintain the pace (off on two consecutive beeps). Measurements during the test for oxygen consummation (VO_2), respiratory exchange ratio (RER) and heart rate (HR) were performed with a portable metabolic analyzer and an HR monitor.
RESULTS: Skater #01 stopped at stage 15 (10.89 m/s) with an HR of 185 bpm, a VO_2max of 61 ml/min/kg and a RER of 1.27., compared to skater #02 who stopped at stage 18 (11.58 m/s) with an HR of 194 bpm, a VO_2max of 66 ml/min/kg and a RER of 1.28. These preliminary results suggest that the protocol brings athletes to their maximal capacity by reaching a plateau for the HR and VO_2, and a RER higher than 1.15.
CONCLUSIONS: A progressive speed skating test till exhaustion appears to measure maximum aerobic capacity of elite speed 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 VO_2max. estimating chart and also confirmed with a laboratory-based VO_2max. 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

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(No relationships reported)

Osteoporosis is a leading cause of fracture and morbidity in older populations (Colon-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) 1.7 +/- 0.1, body fat % 20.8 +/- 9.6) performed a relative grip strength 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 (J), cortical area (Ct.Ar), 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% tibia 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 (R^2=0.6089, p=0.008), Ct.Ar (R^2=0.6030, p=0.008), and SSI (R^2=0.5948, p=0.009). Peak power resulted in a significant, but negative relationship with cBMD (R^2=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.

2180 Board #193 June 1 3:30 PM - 5:00 PM

The Age-related Changes In Multi- And Single-joint Measures Of Power Output

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(No relationships reported)

Many previous studies have demonstrated age-related reductions in power output. However, few studies have identified if the age-related declines in power output during a functional lower body movement are similar to single-joint isokinetic testing.
PURPOSE: To compare the relationships between the age-related reduction in power output using a single-joint isokinetic muscle action versus a more functional multi-joint vertical jump (VJ) assessment.
METHODS: Forty middle- to older-aged men (mean±SD; age=59.2±7.8 years; range= 50-74 years) visited the lab on two occasions, separated by 48-72 hours. During the second visit, and following a familiarization session on visit one, participants performed 2-3 maximal countermovement VJ attempts while attached to commercially available equipment designed to examine lower body power output. The equipment was placed on the floor behind the subject to allow the cord to be extended without impeding the VJ technique. Following the VJ assessment, the participants performed three maximal concentric isokinetic muscle actions of the right leg extensors at $240°\cdot sec^{-1}$ using a calibrated isokinetic dynamometer. The torque and position signals were sampled from the dynamometer at 2 kHz and were processed offline using custom written software. Isokinetic mean power (MP) was calculated as the product of the average torque (Nm) during the load range and isokinetic velocity ($°\cdot sec^{-1}$). Pearson correlation coefficients (*r*) were used to evaluate the relationships between age and VJ, and age and isokinetic MP. The Steiger Z calculation and an effect size was used to determine the difference between the relationships. The alpha level was set at $P \leq 0.05$.

RESULTS: There were significant relationships between age and VJ power output (r=-0.633; P<0.001) and age and isokinetic MP (r=-0.410; P=0.009). The correlation coefficients were similar (P=0.112), 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.

2181 Board #194 June 1 3:30 PM - 5:00 PM

Comparison Of Mechanical Efficiencies From Self-selected And Rapid Speed Rock Climbs

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Purpose: To determine if there is a difference in mechanical efficiency between a self-preferred and a rapid-speed rock climb.
Methods: Ten experienced climbers volunteered to participate in this study (ages 18-40 years, 7 males, 3 females, at least one year of recreational climbing experience). Participants climbed up and down a vertical route (30 feet) on a rock-climbing wall at a self-selected pace for ten minutes. They then climbed the same vertical route as fast as they could to cover the same distance achieved during the 10 minutes of the self-selected climb. VO2 was measured at rest and then continuously during the climb using a portable COSMED device. Mechanical efficiency of each participant was calculated for both the self-selected pace and rapid-speed climbs, and then compared using a paired T-test on Microsoft Excel 2016 with statistical significance accepted at p<.05.
Results: There was no significant difference in mechanical efficiency between the self-preferred and rapid speed climbs (p=0.4211).
Conclusion: The rock climbers did not experience a significant change in mechanical efficiency between the self-selected and rapid-speed climbs. Familiarity with the climbing route and forearm fatigue may have contributed to this finding. Future studies should consider using a counterbalance system for assigning climbing order.

2182 Board #195 June 1 3:30 PM - 5:00 PM

The Relationship between Echo Intensity and Specific Strength as Measures of Muscle Quality

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The use of ultrasound (US) echo intensity (EI) as a measure of muscle quality has increased in popularity over recent years. However, in early studies muscle quality was quantified as a function of force per unit of muscle, or specific strength (MQ_{ST}). Limited data exist that have examined the relationship between these two measures of muscle quality. **PURPOSE**: The purpose of this study was to examine the relationship between US EI and MQ_{ST} as measures of muscle quality.
METHODS: Thirty-one healthy volunteers (mean ± SD age, 35 ± 7 yrs; Body Mass Index [BMI], 28.66 ± 5.08) participated in this study. Following a familiarization session, participants visited the laboratory on a separate occasion for isometric strength testing and skeletal muscle US imaging. Peak torque (PT) was determined from highest mean value (500 ms) that occurred during three maximal voluntary contractions. Vastus lateralis (VL) cross-sectional area (CSA) and EI were assessed with a B-mode US device. The VL images were taken perpendicular to the longitudinal axis of the muscle at half of the distance between the greater trochanter and articular cleft of the knee. All US images were analyzed in ImageJ using the polygon function to determine the VL CSA that included as much muscle as possible without the surrounding fascia. The same region of interest was used for the EI (gray-scale) analyses and subsequently corrected for subcutaneous fat thickness. MQ_{ST} was defined as PT per unit of muscle size (VL CSA). Pearson correlation coefficients were used to examine the relationship between VL EI and MQ_{ST}, while separate partial correlation coefficients were used to examine the influence of BMI and sex. An alpha level of $P \leq 0.05$ was used to determine statistical significance. **RESULTS**: There was a significant relationship between VL EI and MQ_{ST} (r = 0.409, P = 0.022). In addition, similar relationships existed when controlling for BMI (r = 0.376, P = 0.041) and sex (r = 0.411, P = 0.024). **CONCLUSIONS**: A significant relationship exists between VL EI and MQ_{ST}, however a large amount of variance is left unexplained (r^2 = 0.167). Although both are considered to reflect muscle quality, each measure may be influenced by unique physiological variables (i.e. muscle activation, hydration status). **GRANT FUNDING:** National Institute of Occupational Safety and Health (T42OH008673)

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 (N=556; 26.3±4.2 yrs; ht: 179.98±7.32 cm; wt: 87.20±15.0 kg) from the Illinois Fire Service Institute. Baseline descriptive measurements included waist (89.99±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 VO_{2max} (41.54±5.10 $ml \cdot kg^{-1} \cdot min^{-1}$), 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_s<0.001, all ES_s=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.

2184 Board #197 June 1 3:30 PM - 5:00 PM

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 weight are not reach the national standard. Approximately 70 % 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), Weight(SMD=-0.11,P=0.12) and Height (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.

2185 Board #198 June 1 3:30 PM - 5:00 PM

The Relationship between Vertical Power and Bone Mineral Content in College-Aged Women

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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 40% of the variability of BMC in 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.

2186 Board #199 June 1 3:30 PM - 5:00 PM

Sex Differences in the Physiological Responses' of Elite Collegiate Hockey Players during a Submaximal Test

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To optimize the health and sport performance in athletes, sport scientists have recently turned to monitoring physiological variables and markers of performance. Currently, preferred types of monitoring have not been identified and past research has shown that males and females might react differently to physiological stress. **Purpose:** To compare the physiological response of male and female elite collegiate hockey players after a 4-minute submaximal cycling test performed at a predicted 75% of VO_2max. **Methods:** 52 elite Canadian collegiate hockey players, 28 males (age = 22.6±1.3, height =182.59 ±6.00 cm, weight = 87.12±6.43 kg, body fat = 17.3±4.28%) and 24 females (age = 19.9±1.3, height =166.97 ±7.20 cm, weight = 67.75±8.10kg, body fat = 26.3±4.68%) participated in a 4-minute submaximal cycling test at a predicted 75% of VO_2max. Heart rate (HR) and rate of perceived exertion (RPE) were assessed during each stage and after the submaximal test, while blood lactate level was measured 2 minutes after the test. ANOVA was used to compare sex differences in HR, RPE and post exercise blood lactate. **summary of Results:** Females had higher heart rates at each stage of the exercise test: time 1 ($F(1,51) = 5.914$, $p \leq .05$), time 2 ($F(1,51) = 14.457$, $p \leq .05$), time 3 ($F(1,51) = 15.299$, $p \leq .05$) and time 4 ($F(1,51) = 14.628$, $p \leq .05$). There were no between sex differences in post exercise blood lactate and RPE at any stage of the exercise test. **Conclusion:** Under similar physiological stress, male and female athletes demonstrate similar post exercise blood lactate levels. However, submaximal heart rates at each stage of the submaximal test were higher among the female athletes. More work is needed to understand cardio-metabolic sex differences, which could help sport scientists better tailor training program for elite female athletes. This novel method of testing may be suitable for tracking physical fitness over the course of a playing season for male and female athletes.

2187 Board #200 June 1 3:30 PM - 5:00 PM

Physical Activity Level Of College Students: Do We Really Know How Much?

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Physical Activity Level of College Students: Do we really know how much?
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Background: Around the world, people in different populations are struggling with mental and physical disabilities that are caused by poor health. Poor health involves many factors including a low physical activity (PA) level. A person's PA can be measured in several ways, one that has become popular is an accelerometer. Most PA guidelines recommend that an adult must acquire 7,500-10,000 steps/day to be considered somewhat active. However, studies have found that different equipment can calculate different step counts. **Purpose**: To determine if college students are meeting recommendations for physical activity in regards to steps taken per day and if current measurement devices are accurately reporting these outcomes. **Methods**: Thirty one college students (20 y.o.; 69.93 kg) wore an Actigraph GT3X accelerometer (GT3X) around the waist during daily activities to determine steps taken in an average week. We compared our calculated outcomes versus GT3X's reported outcomes. All data used was collected via the GT3X. **Results**: The GT3X reported that the students averaged 5,746 steps/day, while we calculated an average of 4,493 steps/day, resulting in a difference of 1,253 steps/day. **Conclusion**: Our results indicated that college students either fall in a step count range of approximately less than 5,000 or a range of 5,000-7,499 steps/day. Our data suggests that college students may be categorized as low active or sedentary based on which count is accurate. The difference in steps may have resulted from how total time was calculated. Further research is warranted to gain a better understanding of how to monitor the accuracy of measurement devices when determining activity levels for a population. This gained knowledge could lead to healthier students with a lower risk of mental and physical disabilities across multiple college campuses.

2188 Board #201 June 1 3:30 PM - 5:00 PM

Agreement of Ventilatory Responses to Continuous and Interval Specific Taekwondo Cardiopulmonary Exercise Tests

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PURPOSE: To analyze the agreement of ventilatory responses of continuous and interval taekwondo cardiopulmonary exercise tests (CTKDet and iTKDet, respectively). **METHODS:** Twelve male taekwondo athletes (age: 20 ± 2 yrs; body mass: 67.5 ± 5.7 kg; height: 175 ± 8 cm) visited the laboratory three times. The University ethics committee approved this study (opinion #765.698). In the first visit, an anthropometric assessment was performed. In the next two visits, participants performed cTKDet and iTKDet, in a counterbalanced order. Taekwondo tests were constituted by progressive stages of kicking sequences, with 1 min duration, and kick intervals starting from 4,6s and reduced 0,4s every minute until fatigue. ITKDet also presented a passive recovery between every two stages. During all tests, respiratory 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 Mean, and compared using Paired T-test (effect size: Cohen's *d*). Non-parametric data were described by median (interquartile range), 95% Confidence Interval of Median, and compared using Wilcoxon test (effect size: $z/\sqrt{n}$). 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.

Table 1. Agreement of ventilatory responses to cTKDet and iTKDet.

		Mean (SD) or Median (IR)	95%CI	Comparison Test's *p* (ES)	ICC (ICC 95%CI)
$\dot{V}O_{2PEAK}$ (mL.kg^{-1}.min^{-1})	cTKDet	52.3 (5.3)	48.9 - 55.7	0.73 (0.10)	0.82* (0.34 - 0.95)
	iTKDet	52.7 (4.3)	50.0 - 55.4		
Peak Kicks Interval ^{NP} (s)	cTKDet	1.2 (0.2)	1.0 - 1.4	0.004* (-0.82)	0.19 (-0.24 - 0.63)
	iTKDet	0.9 (0.1)	0.8 - 1.0		
VT_1 VO_2 ^{NP} (mL.kg^{-1}.min^{-1})	cTKDet	38.8 (1.0)	37.8 - 39.9	0.14 (-0.43)	0.22 (-1.05 - 0.75)
	iTKDet	35.8 (3.8)	33.3 - 39.9		
VT_1 VO_2 (%)	cTKDet	73.6 (5.8)	68.0 - 79.0	0.11 (0.51)	-0.22 (-2.05 - 0.60)
	iTKDet	69.5 (4.9)	66.0 - 72.0		
VT_1 Kicks Interval ^{NP} (s)	cTKDet	4.0 (0.2)	3.8 - 4.2	0.02* (-0.74)	0.17 (-0.61 -0.69)
	iTKDet	3.8 (0.0)	3.4 - 3.8		
VT_2 VO_2 ^{NP} (mL.kg^{-1}.min^{-1})	cTKDet	46.9 (5.0)	41.6 - 50.8	0.64 (0.14)	0.74* (0.06 -0.92)
	iTKDet	47.6 (5.5)	43.6 - 51.9		
VT_2 VO_2 (%)	cTKDet	89.7 (3.4)	88.0 - 92.0	0.80 (0.07)	0.34 (-1.66 - 0.82)
	iTKDet	90.2 (6.8)	84.0 - 97.0		
VT_2 Kicks Interval ^{NP} (s)	cTKDet	1.8 (0.3)	1.4 - 2.2	0.02* (-0.68)	0.39 (-0.30 - 0.79)
	iTKDet	1.4 (0.0)	1.0 – 1.4		

cTKDet - continuous taekwondo cardiopulmonary exercise test; iTKDet - interval taekwondo cardiopulmonary exercise test. *p* – Significance level. 95% CI – 95% confidence interval. ES – Effect Size. ICC - Intraclass Correlation Coefficient. The absence of ^{NP} denotes parametric data, presented as mean (sd - standard deviation) and 95% confidence interval of mean (inferior limit – superior limit). ^{NP} Denotes non-parametric data, presented as median (IR - interquartile range) and 95% confidence interval of median (inferior limit – superior limit). Parametric data compared through Paired T-test (Cohen´s d effect size). Non-parametric data compared through Wilcoxon signed rank test (z/√n effect size). * Denotes $p < 0.05$. VO_{2PEAK} – Highest oxygen uptake value observed. VT – Ventilatory threshold. Percentage variables (%) were calculated with the peak value observed at each test.

2189 Board #202 June 1 3:30 PM - 5:00 PM

Training-Induced Change in Aerobic Fitness and Anaerobic Power among Female College Basketball Players

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(No relationships reported)

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 VO_2 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/ml/min. Relative peak power and relative mean power significantly increased after preseason training from 8.3 to 9.1 W/kg (p = .025) and from 6.7 to 7.6 W/kg (p < .001), respectively. Fatigue index did not significantly change as a result of preseason training. Despite these positive results, individual responses varied widely. Change in maximal aerobic fitness ranged from +0.2 to +6.1 ml/kg/min. Change in relative peak anaerobic power ranged from -1.0 to +3.0 W/kg, and change in relative mean anaerobic power ranged from +0.9 to +1.5 W/kg. Interestingly, change in maximal oxygen uptake and change in measures of anaerobic power were not significantly correlated with baseline levels of either of these variables. There were also no significant correlations between these changes in performance and age, year in school, or position played. There was, however, a significant, positive correlation (r = .77, p = .002) between change in relative peak anaerobic power and relative mean anaerobic power.
CONCLUSIONS: Preseason training can have a positive effect on aerobic endurance and anaerobic power. These changes varied widely between athletes. However, this variation was not related to baseline fitness levels, age, year in school, or position played. This information may be useful for strength and conditioning coaches to design individualized training programs to maximize effects.

2190 Board #203 June 1 3:30 PM - 5:00 PM

Gender Inequality and Sex Differences in 20 Meter Shuttle Run Test Performance across 45 Countries

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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 sex difference in 20mSRT performance for each country, described as Z_{diff}. 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_{diff} 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_{diff}) were calculated for 45 countries representing five continents. The mean Z_{diff} 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_{diff} 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.

2191 Board #204 June 1 3:30 PM - 5:00 PM

Physical/Physiological Comparison between Cohorts of Marine Corps Forces Special Operations Command Experienced and Entry Level Operators

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Marine Corps Forces Special Operations Command Operators (MARSOC) must possess optimal musculoskeletal and physiological performance characteristics to sustain health and fitness, and maintain physical readiness. Upholding these characteristics can be difficult due to age, deployment cycles and the related demands of training. **PURPOSE:** To examine the effects of age and service time on physical and physiological characteristics of Experienced and Entry Level MARSOC Operators. **METHODS:** A total of 37 Experienced Operators (Age: 31.8 ± 4.3 years, Height: 176.7 ± 6. cm, Mass: 84.7 ± 10.0 kg, 13.36 ± 4.12 years of service) and 98 Entry Level Operators (Age: 25.1 ± 2.2 years, Height: 178.6 ± 6.7 cm, Mass: 85.0 ± 8.4 kg, 6.52 ± 1.07 years of service) participated. Testing included fat mass (FM), fat free mass (FFM), anaerobic power (PAnP), anaerobic capacity (MAnP), aerobic capacity (VO_2max) and knee and torso isokinetic strength testing (KF, KE, TF, TE). 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 KF (144.4 ± 27.1%BW, 127.4 ± 23.6%BW; p=0.011), KE (268.6 ± 41.7 %BW, 246.5 ± 45.8%BW; p=0.003), and MAnP (9.2 ± 0.7 W/kg, 8.8 ± .9 W/kg; p=0.028). Entry Level operators demonstrated less TE (422.24 ± 77.5 %BW, 387.25 ± 77.1 %BW; p=0.021). No significant differences were found in FM (p=0.726), FFM (p=0.915), TF (p=0.529), PAnP (p=0.598), or VO_2max (p=0.145). **CONCLUSION:** Experienced Operators demonstrated less overall leg strength and anaerobic capacity than Entry Level Operators. Further consideration is necessary to determine what characteristics may be influenced by the combined effect of training demands, age, and overall service time and the impact on career longevity.
Supported by the Office of Naval Research (N00014-15-1-0069)

2192 Board #205 June 1 3:30 PM - 5:00 PM

Relationship Between Heart Rate Variability Outcomes vs Firefighter Performance, Physical Activity, and Fitness Measures

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PURPOSE: 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. FFs 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 $p < .05$. **RESULTS**: SDNN values recorded the same day as the SFGT were correlated with decreased SFGT time on 3 individual SFGT tasks (r=-.7 to -.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<.01; 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

2193 Board #206 June 1 3:30 PM - 5:00 PM

Relationship Between Anthropometric Profiles and Sports Specific Physical Performance Tests in College Football Players

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INTRODUCTION: Football specific testing is done at all levels of football to assess player's strength, speed, and agility. Differences exist in anthropometric profile 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 applied to BF% across the physical assessments. Bivariate correlation comparisons were conducted to identify significant differences in between skilled and non-skilled athletes using the Fisher's r-to-z transformation, followed by an independent sample z-tests to assess statistical differences in correlation coefficients of skilled to non-skilled athletes. Statistical significance set at $p \leq 0.05$. RESULTS: For non-skilled players, the relationship between BF% and all performance measurements showed significance except for the broad jump. In the skill positions, significance was observed in the relationship between speed, explosion and agility assessments compared to BF%. No significance was found in the strength measurements. When comparing skilled and non-skilled positions, both bench and pro agility showed significant differences. For bench press, non-skilled players had a higher correlation coefficient compared to skill players. For pro-agility, skilled players had a higher correlation coefficient then non-skill players. CONCLUSION: These findings suggest that BF% is related to measurable performance advantages across different types of tests, depending on player position and position-specific demands. Results from both of these types of testing parameters can possibly be utilized to predict future player performance and to better evaluate player development and progress.

2194 Board #207 June 1 3:30 PM - 5:00 PM

Physical Activity Classes Improve Health-Related Physical Fitness Levels

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PURPOSE: College is sometimes associated with weight gain and a decline in physical fitness levels, yet very few universities require physical activity classes even though the health and academic benefits are well known. This study investigated 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) who enrolled in a 16-week PA class at a university in the USA. The PA classes met two or three times a week for a total of 150 minutes/weekly, 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 ± 22.4), 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 vs. 17.5 ± 3, $p < 0.10$), 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.

D-69 Free Communication/Poster - **Integrative Exercise Physiology**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2195 Board #208 June 1 2:00 PM - 3:30 PM

Inonotus Obliquus Polysaccharide Extract (IOP) Does Not Enhance Exercise Duration or Alter Interstitial Oxygen Kinetics in Rat Skeletal Muscle

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(No relationships reported)

Skeletal muscle produces reactive oxygen species during contractions, that lead to fatigue by depressing force in contracting muscle. The polysaccharide extract of the mushroom *Inonotus obliquus* (IOP) has been proposed to have antioxidant properties and to delay the onset of fatigue. Contractile function in skeletal muscle is dependent on the balance between oxygen delivery (QO_2) and oxygen consumption (VO_2) as reflected by the interstitial partial pressure of oxygen (PO_2i) within the muscle. **PURPOSE:** To determine whether IOP supplementation in rats 1) reduced muscle fatigue (treadmill run time to exhaustion) and 2) altered PO_2i kinetics in the isolated soleus and extensor digitorum (EDL) muscles. **METHODS:** Rats (n=10) were acclimated to treadmill running (at 20% incline) then randomly divided into two groups; control (C, n=5) and IOP supplementation (IOP, n=5). IOP was dissolved in the drinking water at 300 mg/kg/day. On day 14 of IOP, all rats performed a time to exhaustion treadmill test (Test 1) in which speed was increased 5 ft/min each minute until the rats could no longer continue. On day 16, a second treadmill test (Test 2) was performed in which speed was held constant at 70 ft/min and the rats ran until they could no longer maintain this speed. Starting on day 18 of IOP, the rats were anesthetized with pentobarbital sodium (50 mg/kg ip) and the soleus and extensor digitorum longus (EDL) muscles of the rats were surgically isolated. The muscles were electrically stimulated to study PO_2i kinetics using phosphorescence quenching at a low intensity (1 Hz, 2 ms) and at a higher intensity (2 Hz, 20 ms). **RESULTS:** Time to exhaustion during both treadmill tests was not different between groups (Test 1: 15:28

± 1:11 vs. 15:26 ± 1:10 min; Test 2: 7:44 ± 0.06 vs. 7:45 ± 0.04 min). During isolated muscle contractions, the initial PO_2i and PO_2i kinetics at the onset of contractions were not different between C and IOP groups in either the soleus or EDL muscles, at either low or high intensity. **CONCLUSION:** These data indicate that IOP supplementation did not reduce fatigue or enhance exercise duration, and did not result in changes in QO_2 to VO_2 matching during muscle contractions. Supported by a grant from the Graduate Program, KCOM-ATSU.

2196 Board #209 June 1 2:00 PM - 3:30 PM

Upper Limits Of Exercise Tolerance

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(No relationships reported)

The power-duration relationship accurately predicts exercise tolerance for constant power exercise performed in the severe intensity domain. At intensities above critical power (CP, highest sustainable power without impending failure), the power-duration relationship establishes a hyperbolic curve. This curve can be linearized as a 1/time model. However, the prediction of exercise tolerance is currently unclear for work rates (WR) within the extreme intensity domain (durations <2 min). **PURPOSE**: To test the hypothesis that the power-duration relationship deviates from a linear 1/time relationship for WRs within the extreme intensity domain. **METHODS**: To date, two men (age 21 yrs) completed the experimental protocol. Two-legged knee extension was performed to determine peak aerobic power (Ppeak). A one-repetition maximum (1RM) was determined by progressively increasing weight until a pre-determined range of motion could not be achieved. Subjects performed exercise tests to exhaustion at 6 different %Ppeak intensities (40, 60, 90, 130, 170, and 180 %Ppeak; 20, 30, 40, 60, 75, and 85 %1RM, respectively), each on different days. Test durations between 2 - 15 min (40 - 90 %Ppeak) were used to determine CP (1/time model) with a 95% confidence interval (95% CI). WRs with durations < 2 min (130 - 180 %Ppeak, 60 - 85 %1RM) were plotted on the previously determined 1/time model. **RESULTS**: The r2 for 1/time models were 0.99 ($p < 0.05$). CP, Ppeak, and 1RM were 20, 35, and 75 kg, respectively. 1RM and CP were 200 and 57 %Ppeak, respectively. The 130 %Ppeak (60 %1RM, test duration of 114.86 s) and 170 %Ppeak (75% 1RM, test duration of 71.02 s) WRs fell within the 95% CI, however, the 180 %Ppeak (85 %1RM, test duration of 46.39 s) did not.
CONCLUSIONS: Our hypothesis was partly explained by the data. These data show that exercise bouts lasting less than 60 s deviate from the linear model of the power-duration relationship. However, time to exhaustion greater than 60 s can be predicted using the power-duration relationship. This suggests that mechanisms that may not have had a significant role at lower intensities become the limiting factor to exercise tolerance at intensities greater than ~170 %Ppeak (75 %1RM).

2197 Board #210 June 1 2:00 PM - 3:30 PM

Body Composition, Nutritional Profile And Muscular Fitness Affect Bone Health In A Sample Of Schoolchildren From Colombia: The Fuprecol Study

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(No relationships reported)

PURPOSE: The objective of the present study is to investigate the relationships between body composition, nutritional profile, muscular fitness (MF) and bone health in a sample of children and adolescents from Colombia.
METHODS: Participants included 1,118 children and adolescents (54.6% girls). Broadband ultrasound attenuation (BUA) was obtained by using quantitative ultrasound technique at the calcaneus as a marker of bone health. Body composition (fat mass and lean mass) was assessed using bioelectrical impedance analysis. Furthermore, height, weight, waist circumference and Tanner stage measured and body mass index (BMI) was measured. Standing long-jump and isometric handgrip dynamometry were used as indicators of lower and upper body muscular fitness, respectively. Also, a muscular index score was computed by summing up the standardised values of both standing long-jump and handgrip strength. Dietary intake and degree of adherence to the Mediterranean diet were assessed by a 7-day recall questionnaire for food frequency and the Kidmed questionnaire, respectively. Poor bone health was considered using a Z-score cut off of ≤−1.5.
RESULTS: Once the adjustment was performed (by age and Tanner stage), the predisposing factors of having a c-BUA z-score ≤ − 1.5 SD included: included: being underweight [OR 2.30 (95% CI 1.53 to 1.69)], or being obese [OR 0.17 (95% CI 0.04 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 2.29 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.

2198 Board #211 June 1 2:00 PM - 3:30 PM

Relation between Hand Grip Strength and Body Composition Associated with Cardiovascular Risk in University Students

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(No relationships reported)

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 in the Students of Elective Course of Physical Activity and Sports (SECPAS) 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®, it was registered two measurements of Right Hand (RH) and Left Hand (LH) in seated position, using the best result for analysis. A bioelectrical 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 kg). For 78% of students (n=71), are in an average classification of low 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 OMRON® 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 SECPAS.

2199 Board #212 June 1 2:00 PM - 3:30 PM

The Effects Of A Muscle Biopsy On Motor Unit Firing Properties

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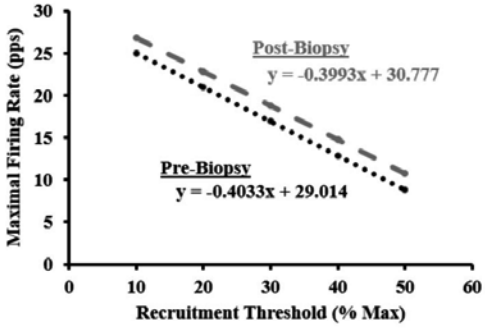
(No relationships reported)

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_{max}) and recruitment threshold (RT) were calculated for each subject pre- and post-biopsy. Separate Paired-Samples T-Tests were run to examine for 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 (Pre: 29.0 ± 7.3; Post: 30.8 ± 7.6; p =

0.26) following the biopsy process. Figure 1 below depicts the relationship between group mean FR_{max} (x-axis) and group mean RT (y-axis) both pre- and post-biopsy. **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_{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.



2200 Board #213 June 1 2:00 PM - 3:30 PM

Hormonal Responses After Eccentric Exercise In Humans

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(No relationships reported)

Following muscle damage, multiple responses associated with an inflammatory and degenerative phase are activated before the completion of muscle repair or regeneration. The final outcome of those responses is influenced by a crucial balance between anabolic and catabolic, among others, factors. Nevertheless, less is known about the responses of the competitive (anabolic vs catabolic) hormones growth hormone (GH) and cortisol (CORT) following muscle damaging exercise. **PURPOSE**: The purpose of this study was to investigate serum levels of CORT and GH during muscle degeneration/regeneration after eccentric exercise-induced muscle damage in humans. **METHODS:** Ten healthy men volunteers (age: 25±5 yrs, height: 180±5 cm, mass: 77±8 kg) performed 50 maximal eccentric muscle actions using the knee extensor muscles of both legs on an isokinetic dynamometer. Blood samples were withdrawn before and at 6, 48 and 120 hrs post-exercise, while muscle soreness was evaluated at 24, 48 and 120 hrs post-exercise. Serum levels of CORT and GH were measured by ELISA using commercially available kits. One-way ANOVA was used for statistics. **RESULTS:** The participants reported significant muscle strength decrement and muscle soreness post exercise ($p<0.01$-0.001). Serum CORT levels showed a 40% increase 6 hours post exercise and remained elevated throughout the experimental period, however without reaching significance (393.0±66.6 ng/ml, 362.8±48.5 ng/ml and 370.7±34.9 ng/ml, at 6, 48 and 120 hours after exercise, respectively, compared to 306.5±29.8 ng/ml at baseline; mean±SE, $p>0.05$). Serum GH levels exhibited a more than 2.5-fold increase 6 hours post exercise and then gradually decreased (506.7±144.5pg/ml, 701.1±161.4 pg/ml, 647.0±205.5pg/ml and 509.5±144.1pg/ml at baseline, 6, 48 and 120 hours post-exercise, respectively). However, those GH changes also failed to reach significance ($p>0.05$) due to a large variability shown between the subjects' responses. **CONCLUSION:** Our findings suggest that muscle damaging eccentric exercise triggers mild adaptive responses of CORT and GH, which may reflect a specific drive towards a balance between anabolic and catabolic processes during muscle regeneration. More studies are needed to further characterize the hormonal responses to eccentric exercise in humans.

2201 Board #214 June 1 2:00 PM - 3:30 PM

Evidence Of A "Male Athlete Triad" In Competitive Triathletes

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(No relationships reported)

PURPOSE: To look for low energy availability, hormonal dysfunction and low bone mineral density in male triathletes, a group not previously well described with this disorder.
METHODS: Blood, urine and DXA testing were assessed on a series of 4 male triathletes who presented to our Sports Medicine/Metabolic Bone Clinics at University of Colorado for repeated or poorly healing lower extremity stress fractures.
RESULTS:

Age	BMI	Stress fracture type	DXA (g/cm2) and Z-score spine	DXA (g/cm2) and Z-score hip	Total T (ng/dL)	Vitamin D (ng/mL)	Serum Ca (mg/dL)	PTH (pg/mL)	24 hour urine Ca (mg/day)
40	22.0	Femoral neck	.882 -2.2	-858 -0.9	372	59	9.8	21	259
47	27.7	Tibial metatarsal	0.982 -0.7	0.691 -1.1	216	48	9.4	33	440
44	23.5	Tibial	1.092 -1.1	1.116 0.4	230	23	9.8	32	188
22	23.1	Metatarsal	1.024 -1.1	1.002 -0.4	242	36	10.0	24	476

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.
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2202 Board #215 June 1 2:00 PM - 3:30 PM

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/β-catenin pathway thereby inhibiting bone formation. **PURPOSE:** to examine 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 (r=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.

2203 Board #216 June 1 2:00 PM - 3:30 PM

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 used to measure change in the medial longitudinal arch associated with midfoot motion (Fig 1). 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).
Results: Static loaded LAA compared to clinical LAA values were identical for pronated feet and similar for normal feet (2.5° diff). The LAA decreased throughout stance period indicating a decrease in medial arch height. The static loaded LAAs were different than the dynamic measures (p<0.05) between 42% to 80% in the normal feet, and between 57% to 79% in the pronated feet. Both groups experienced similar LAA excursion (10.7° and 10.3° for the normal and pronated feet respectively), while the normal group had a higher average LAA than pronated (136.2° and 128.0° respectively) (Fig 2).
Conclusions: The results indicate that LAA measured with stereo radiography is a responsive metric to assess midfoot posture during walking and is sensitive to foot type differences. This methodology can be effectively used to assess the effect of foot orthoses on midfoot posture when using shoes.

D-70 Free Communication/Poster - **Interval Training**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2204 Board #217 June 1 2:00 PM - 3:30 PM

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

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(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 (FPG), 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.

2205 Board #218 June 1 2:00 PM - 3:30 PM

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 heath, 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, VO_2max=41.4 + 4.1 mL/kg/min, BMI=23.1 + 2.1 kg/m^2). 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). Rating 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. **RESULTS:** Higher enjoyment (p=0.013, Cohen's d=1.54) in HIIT (103.83 ± 9.44) versus MICT (84.17 ± 19.11) was observed, with 11/12 participants (92%) preferring HIIT to MICT. Affect was lower (p<0.05, d=0.78) and HR, RPE, and BLa were higher (p<0.05) in HIIT versus MICT. **CONCLUSIONS:** Despite greater physiological strain, HIIT was cited as more enjoyable than MICT due to its ever-changing stimulus, greater sense of accomplishment, and relative time-efficiency. Future studies in various populations are merited to examine the potential for greater adherence to HIIT compared to MICT, and whether this leads to superior adaptations and concurrent health-related benefits.

2206 Board #219 June 1 2:00 PM - 3:30 PM

Aerobic and Anaerobic Effects of Manipulating Sprint Interval Training Work and Rest Period Durations

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(No relationships reported)

Performance benefits resulting from short (10-15 s) sprint interval training (SIT) bouts suggest that peak speed generation may be an important adaptive stimulus, though the optimal work and rest period duration has not been established. **PURPOSE:** To determine the effects of manipulating SIT work and rest period durations while maintaining total exercise duration on aerobic and anaerobic performance. **METHODS:** Thirty-four recreationally active males (n = 20) and females (n = 14) trained for four weeks (3 times/week) using one of the following SIT protocols: 1) 30:240 (4-6 x 30 s work, 4 min rest); 2) 15:120 (8-12 x 15 s work, 2 min rest); 3) 5:40 (24-36 x 5 s work, 40 s rest). Protocols were matched for total work (2-3 min) and recovery (16-24 min) duration, as well as the work-to-recovery ratio (1:8 s). Pre- and post-training measures included a graded VO_{2max} test, 5-km running time trial, and 30 s running sprint test. Post-training psychological measures of task self-efficacy, enjoyment, and intentions were assessed immediately following the last training session. **RESULTS:** Training improved VO_{2max} (5.5%; P<0.001), 5-km time trial performance (5.2%; P<0.001), peak speed (2.6%; P<0.05), and time to peak speed (32.4%; P<0.001) with no differences between groups. There were no anaerobic effects. There were no main effects for group on measures of perceived self-efficacy (P=0.926), enjoyment (P=0.249), or intentions to perform SIT three (P=0.533) or five (P=0.951) times/week over the coming month. **CONCLUSION:** Manipulating the SIT work and rest period duration while maintaining total exercise duration does not compromise aerobic and anaerobic benefits typically observed with traditional, longer 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.

2207 Board #220 June 1 2:00 PM - 3:30 PM

Effects Of 5 Days Of HIIT On Exertional Rhabdomyolysis In Trained And Untrained Individuals

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(No relationships reported)

Exertional Rhabdomyolysis is potentially life threatening, and has been diagnosed in individuals who overexert themselves during exercise. Individuals who participate in exercise beyond their level of physical fitness may be at higher risk for excessive muscle breakdown due to overexertion.
PURPOSE: To measure the severity of skeletal muscle breakdown via myoglobin and creatine kinase after five days of high and low intensity interval training in previously trained and untrained individuals.
METHODS: 18 males and females (9 trained (TR) and 9 untrained (UT); Age: 22 ± 1) completed five consecutive days of high intensity interval training and five consecutive days of low intensity interval training with a two week washout period 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 after 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: 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 this is greater in untrained individuals. Therefore, previously untrained individuals should take caution when beginning exercise programs that require consecutive sessions of high intensity exercise.

2208 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

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SCIENTIFIC ABSTRACT
High intensity interval training has gained popularity in military settings in recent years, but no research has investigated how varying HIIT frequency impacts performance in the cardiovascular fitness component of an official military physical fitness test.
PURPOSE: Effects of varying high intensity interval training (HIIT) frequency on 1.5 mile (2.4 km) run performance in U.S. Air Force Reserve Officer Training Corps (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 (CG) that performed moderate intensity training 3x week. HIIT protocols consisted of 4 x 3 min intervals at 90-100% of velocity at maximal oxygen consumption (vVO_2 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 retested 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.

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

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One barrier to meeting fitness recommendations may include time constraints. Finding exercises that can promote improvements in both aerobic and muscular fitness while minimizing the duration of the exercise and the required equipment are needed. One such exercise may be the side-step interval exercise. Currently, it is unknown how different tempos influence this exercise and how heart rates and muscle activation differ between tempos. **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 (VO_2max) 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 in between sets. Four sets of these exercise intervals were performed. The fast (112 bpm) or slow (84 bpm) tempo was randomly assigned during the first exercise session with the other tempo being used in the next visit. Surface electromyography (EMG) measured muscle activation of the vastus lateralis and a heart rate monitor (Polar) measured heart rate (HR). Two-way repeated measures ANOVA analyzed differences between tempos and sets. Pearson product moment correlations analyzed associations between VO_2max, HR response and muscle activation. Statistical significance was set at p<0.05. **RESULTS:** Slow tempos produced significantly lower amounts of muscle activation compared to the fast tempos [46% vs. 59% of the maximum isometric voluntary contraction muscle activation (EMG_{max}), p=0.002]. HR significantly increased at the end of sets 3 (150 ± 8 bpm, p=0.012) and set 4 (152 ± 8 bpm, p=0.001) when compared to set 2 (146 ± 8 bpm). The fast tempo produced significantly greater HR than the slow tempo (82% HRmax vs. 70% HRmax, p<0.001). A significant inverse relationship was also found between VO_2max and vastus lateralis muscle activation (r=-0.855, p=0.003), fast tempo HR (p=-0.896, p<0.001) and slow tempo HR (p=-0.924, p<0.001). **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 #223 June 1 2:00 PM - 3:30 PM

Sprint Interval Training and Power Output In College Age Females

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(No relationships reported)

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 (21.1 ± .62 years), recreationally active women. 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 active recovery between sprints for a total of 5 minutes. 3INT sprinted three 20-second all-out bouts with active recovery between sprints for a total of 10 minutes. END cycled continuously for 20 minutes at 60% of their VO_2max. Wingate testing (anaerobic power) was completed at baseline, mid-, and post-intervention. RESULTS: Average power in both 2INT (6.9 ± 0.17 v 7.1 ± 0.41 watts·kg^{-1}) and 3INT groups (7.03 ± 0.53 v 7.02 ± 0.265 watts·kg^{-1}) remained unchanged while the END group average power (6.6 ± 0.44 v 5.89 ± 0.914 watts·kg^{-1}) decreased by 10.7%. CONCLUSIONS: Although not significant, it is important to point out that 2INT and 3INT were able to maintain their average power; even though exercising for a limited duration. The findings of this study demonstrate that SIT may be utilized to maintain anaerobic fitness in women.

2211 Board #224 June 1 2:00 PM - 3:30 PM

Sprint Interval Training and Development of Peak Power in Females

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(No relationships reported)

Interest in interval training has been expanding rapidly while it has been shown to induce numerous beneficial physiological outcomes. High intensity interval training (HIIT) is comprised of submaximal high-intensity interval training lasting >30 seconds. A subset of HIIT is sprint interval training (SIT) and consists of supramaximal sprints of very short durations (10-20 seconds). This study aimed to investigate the responses of SIT on peak power output in females. Recreationally active females (n=11) (21.1 ± 0.62 years) performed a Wingate Cycle Test at baseline, mid-intervention (4 weeks), and post-intervention (8 weeks) to measure peak power. Subjects were randomized into one of three groups: two intervals (2INT), three intervals (3INT), or endurance group (END). All groups cycled three times a week for eight weeks, for a total of 24 sessions. 2INT sprinted two 20-second bouts and cycled five minutes total and 3INT sprinted three 20-second bouts and cycled ten minutes total. The END group cycled 20 minutes at 60% of their VO_2max. Upon completion of the study, subjects completing 2INT had a modest, but significant improvement of 2.3% in peak power (9.10 ± .62 v 9.22 ± 0.73 watts·kg^{-1}), compared to both the 3INT (8.45 ± .57 v 8.30 ± 0.71 watts·kg^{-1}) and the END group (8.54 ± .43 v 7.99 ± 0.93 watts·kg^{-1}). The present data demonstrate the importance of SIT on power development in females. In addition, more research is needed into SIT and its impact on performance measures specific to women.

2212 Board #225 June 1 2:00 PM - 3:30 PM

Changes in VO2max and Muscular Strength Over A 24-Week Cycle Ergometer Interval Program Among Active Middle-Age Adults

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(No relationships reported)

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 (VO_2max) 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 max sprint intervals with 20 sec active rest. Participants reported that they did not change other exercise behavior during the study. VO_2max was measured (via indirect calorimetry) pre, mid (3 month), and 6 month post intervention. Isometric leg strength, including peak torque extension (PTE) and flexion (PTF) was measured (pre and 6 month post intervention) on the right leg using the Biodex3 dynamometer. Results were assessed via repeated measures ANOVA. **RESULTS:** Average VO_2max increased from pre to mid-test (33.8±6.2 ml/kg/min vs. 38.5±6.8 ml/kg/min), and was maintained from mid to post-test (38.5±6.8 ml/kg/min vs. 38.3±7.3 ml/kg/min), $F(2,62) = 57.65$, $p<0.001$. PTE increased significantly from pre to post test (119.6±42.6ft/lbs vs. 131.7±48.8ft/lbs), $F(1,35)=8.00$, $p<0.008$. PTF did not change from pre to post-test (71.2±21.4ft/lbs vs. 70.2±21.7ft/lbs), $F(1,35)=0.13$, $p=0.73$. **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

2213 Board #226 June 1 2:00 PM - 3:30 PM

Metabolic Efficiency Between Two Types of High-Intensity Interval Training

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(No relationships reported)

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.

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

METHODS: Measurements were obtained from 22 CrossFit® male athletes (age = 34.8 ± 8.0 years, BMI = 28.3 ± 3.7 kg/m^2), 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 routines (P = 0.3). Respiratory exchange ratio was higher during the CF routine (1.0 ± 0.6 VCO_2/VO_2) compared to HIIT routine (0.9 ± 0.4 VCO_2/VO_2), 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.

2214 Board #227 June 1 2:00 PM - 3:30 PM

Cardiovascular and Workload Responses to High Intensity Interval Training in Adolescents

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(No relationships reported)

Despite the promising evidence supporting positive health benefits of high-intensity interval training (HIIT) in adults, there is limited research focusing on adolescents. **PURPOSE:** The purpose of this study was to describe the impact of HIIT training on

cardiovascular responses to exercise in male and female adolescents. **METHODS:** Ten (4 male, 6 female; Age=11.7+1.4 years; VO_2peak=27.33+ 6.89; BMI=28.6+6.6) adolescents, referred from local pediatricians, completed 16 HIIT 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 VO_2peak test, while the "off" workload was set to be equivalent to 50%. Subsequent to this initial session, workload was adjusted so that RPE during the last 5 intervals was 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+14 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

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(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

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(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 (M/W/F) and Tuesday/Thursday (T/Th). A no class period (common hour: 1:00pm-2:30pm) on M/W/F is offered as scheduled breaks in the academic course schedule for student activities at different Penn State University Commonwealth campuses. **Purpose:** To objectively determine the differences in daily step count and energy expenditure of Kinesiology students on different days of the week. **Methods:** Sixty eight (35M/33F, 21.6±2.9 years, average BMI 25.9±5.2 kg/m^2) apparently healthy juniors and seniors were recruited from the Penn State Berks. A wrist-worn activity-tracker was deployed for one week to assess students' free-living physical activity levels. **Results**: M/W/F vs. T/Th (Mean±SD) step count (10387 ± 3560 vs. 9268 ± 2899 steps/day; $p=0.015$) and activity calories (1056.4±535.2 vs. 963.5±608.3 kcal/day; $p=0.097$) were measured. Students were most active on Mondays (10691±4531 steps/day) compared to the rest of the week. **Conclusion**: 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 no 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 Courses

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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-prescribed, 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% ± 7.55; $p=0.49$); (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 ± 2.2 minutes) improving significantly more than the online group (mean improvement = 0.60 ± 0.96 minutes; $p=.003$). 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 enthusiasm 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

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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 hundred female competitors (28.72 ± 4.87 y; 63.65 ± 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 (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 Fight-gone-bad) were compared between quintiles using separate one-way analysis of variance. **RESULTS:** Q1 reported greater ($p < 0.05$) 1RM 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 not different from 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) times in Fran (159.4 ± 28.3 sec) 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 Filthy 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 on benchmark workouts that emphasized muscle strength and endurance (i.e., Fran, Grace, and Filthy-50). Though aerobic and anaerobic fitness also appeared to be greater in higher-ranking competitors, distinctions between quintiles were more broad.

2219 Board #232 June 1 2:00 PM - 3:30 PM

Analysis Of Anthropometric Profiles And Long-term Career Progression In 24 Years Of German Junior Rowing

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(No relationships reported)

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 anthropometrical 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 (OG). 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 cm, 86.5±6.7kg), 6.9% 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 ($F(3,702) = 9.30$, $p = .000$, $\eta 2 = 0.038$) and BM ($F(3,702) = 4.31$, $p = .005$, $\eta 2 = 0.018$) among progression levels were found. Rowers competing not higher than U19-WCh were smaller (-0.69 - -1.42%; $p < .005$) and exhibited less BM (-1.08 - -3.05%; $p < .007$) compared to higher progression levels. This effect increased by 0.45 % ($R^2 = .97$) for SH and 1.01% for BM ($R^2 = .99$) 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.

2220 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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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: 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, subscupula, midaxilla, chest, suprailium, 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 using 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-Wormsley 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.

2221 Board #234 June 1 2:00 PM - 3:30 PM

Influence of Lower Extremity Strength on Physical Activity in Young Adults

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Decreased physical activity has been identified as a risk factor for many health related conditions. Lower extremity muscular strength is an important aspect for the completion of physical activity. Differences have been found to exist between males and females with their lower extremity strength. However, limited evidence exists evaluating the influence of strength of the hip and knee muscles on physical activity between sexes. **PURPOSE**: To explore if a relationship between lower extremity isometric strength and physical activity exists between male and female young adults.
METHODS: Isometric strength was recorded on the dominant limb in 47 college aged participants with a handheld dynamometer (30 females and 17 males). Strength was assessed for participant's hip flexors, extensors, external rotators, internal rotators, abductors, adductors and knee flexors and extensor muscle groups. Strength was normalized as a percentage of body weight. Physical activity was recorded with a commercial activity monitor over 2-weeks, with steps per day being the main outcome. Relationships between lower extremity muscle strength and activity level were explored with pearson product moment correlations, controlling for age and body mass. A linear regression was utilized to explore if lower extremity strength could predict physical activity.
RESULTS: Significant correlations were found between activity level and strength in females for their hip flexors (r=.484, p=.007), hip abductors (r=.629, p<.001), hip external rotators (r=.453, p=.012), knee flexors (r=.393, p=.032) and knee extensors (r=.421, p=.020). Isometric hip abductor strength was found to a significant predictor of physical activity when assessed by steps per day (p<.001), accounting for 39% of the variance in the model. No significant correlations were found in males between activity level and strength.
CONCLUSIONS: Lower extremity strength appears to play a role in physical activity levels in female college aged individuals, with hip abductor strength significantly predicting activity level. Intervention programs should evaluate strength training for females as one potential approach to improve physical activity.

2222 Board #235 June 1 2:00 PM - 3:30 PM

Predicting Maximal Oxygen Uptake in Adults Using a Walk Test

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Purpose: Maximal oxygen consumption (VO_{2max}) testing is not always feasible, practical, or safe. The purpose of this study was to find a good fitting VO_{2max} prediction equation using a 9-minute walking test. **Methods:** Healthy adults aged 18-79 years participated in this study. Resting heart rate (RHR) and a VO_{2max} test to volitional fatigue were assessed. Participants were asked to complete a 9-minute, ramped-intensity, over-ground walking test, where they were instructed to walk for 3-minutes each at a self-selected slower than normal, normal, and faster than normal walking speed. VO_2 and heart rate (HR) responses were collected using a portable metabolic device and averaged the last two minutes of each stage. These represent the main predictors of interest in this study. Other covariates were age, gender, body mass (kg) and change in HR from RHR (delta HR). A stepwise selection method with a p-value criterion of .05 for inclusion and exclusion was used to determine the predictive model. **Results**: The final sample (N=123) was 57.7% female, average age 46.4±17.2 years, BMI 25.8±4.6 kg/m^2, VO_{2max} 34.7±10.5 ml/kg/min, and RHR 60.5±9.2 bpm. A null model with only age (p<0.001), gender (p<0.0001), and body mass (p<.0001)

was able to account for 73.5% of the variance in VO_{2max} (R^2=.736). The estimated prediction model using measurements from the normal walking speed stage including $V0_2$ (p<0.0001), HR (p<0.0001) and delta HR (p=0.0051) along with covariates age (p<0.0001), gender (p<0.0001) and body mass (p<0.0001) was able to achieve an R^2 of 83.3%. The addition of these variables increased the strength of the prediction model by ~10%. **Conclusion**: The results from this study indicate that a 3-minute over-ground walking test at a self-selected normal pace, where only VO_2 and HR are recorded in conjunction with demographic variables, is able to provide a good fitting model to predict VO_{2max}. Compared to other reported over-ground submaximal prediction equations, the model obtained in this study was able to achieve a similar fit in predicting VO_{2max}.

2223 Board #236 June 1 2:00 PM - 3:30 PM

Core Strength/Endurance and Inspiratory Muscle Performance - Are They Related?

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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±6.1 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:** Men 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 92.6±18.3 cm H2O and 683.9±191.0 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, respectively) when IMP was tested in the SP position. **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.

2224 Board #237 June 1 2:00 PM - 3:30 PM

Physiological Predictors of Fatigability in Healthy Adults

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(No relationships reported)

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 cardiopulmonary 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/m^2) 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/VCO_2 ratio and VE/VCO_2 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/VCO_2 ratio of 24.72 ± 2.18 and VE/VCO_2 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 (d= 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

2225 Board #238 June 1 2:00 PM - 3:30 PM

Step Test as a Predictor of Law Enforcement Pursuit Requirement

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(No relationships reported)

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 employment 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 (≈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

Descriptive Statistics
Gender

	Frequency	Percent
female	99	13.1
male	657	86.9
Total	756	100.0

	N	Minimum	Maximum	Mean	Std. Deviation
Push up Trial 1	614	0	94	37.02	16.998
Push Up Trial 2	533	0	103	39.07	18.189
average pushup (1&2)	609	.5	94.5	37.933	17.0524
Push up Post trial	529	0	104	51.89	18.456
CAT1 (sec), total	669	42	416	74.57	39.492
CAT2 (sec), total	692	38	312	69.51	32.917
run1 (sec), total	756	567	1514	868.92	163.857
run2 (sec), total	756	525	1215	764.01	121.654
% body fat	592	2.04	63.07	24.6151	7.86330
height (cm)	592	144.8	200.7	176.19	8.988
hips (cm)	83	81.2	139.7	101.36	11.657
neck (cm)	592	27.9	50.8	38.89	3.858
waist (cm)	592	60.9	149.9	94.97	14.08
weight (kg), pre	736	44.9	165.5	87.64	17.76
weight (kg), post	707	45.8	156.4	87.00	16.894
Valid N (listwise)	34				

2226 Board #239 June 1 2:00 PM - 3:30 PM

Predicting 2015 NBA Rookie Class On-Court Contribution Using Draft Combine and Performance Measurable's

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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

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 contribution 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 recorded 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) ($F(3,21) = 6.080$, $p = 0.005$; $R^2 = 0.503$). The three predictor model was able to account for 50.3% of the variance in PIE. PIE = -37.208 + 9.245(three quarter court sprint) + 9.245(2014 assist:turnover ratio) + 0.254(2014 field goal percentage), 95% CIs [-68.196, -6.220], [-0.455, 18.944], [0.593, 3.143] and [0.210, 22.843], respectively. **CONCLUSIONS:** The findings of this study suggest that the performance testing conducted at the 2015 NBA Combine and in-game performance variables could partially predict on-court contribution during the 2015 NBA regular season, though R^2 prediction was varied. However, of the 19 variables assessed, only three provided significant predictive value. These findings may help teams and scouts to assess performance and determine potential on-court contribution of draftees and undrafted free agents.

2227 Board #240 June 1 2:00 PM - 3:30 PM

Comparison Of Physiological Demands Of Basketball Practice Sessions To A Pre-season Game

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(No relationships reported)

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., 2013). 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, Montreal, CAN) which measure heart rate (HR) via ECG, g-force (above that of the earth's gravity) via triaxial accelerometry, 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 ($P = 144 \pm 2$; $G = 126 \pm 2$ min; $p \leq 0.05$). While average HR did not differ ($P = 121 \pm 5$; $G = 121 \pm 17$ bpm), maximal HR was higher in the game ($P = 180 \pm 6$; $G = 189 \pm 7$ bpm; $p \leq 0.05$). Average g-force was higher in practice ($P = 0.38 \pm 0.05$; $G = 0.30 \pm 0.11$ m/s^2; $p \leq 0.05$), however maximal g-force did not differ between the two ($P = 3.64 \pm 0.42$; $G = 3.97 \pm 0.71$ m/s^2, $p = 0.10$). Total g-force (average g-force of the session multiplied by the minutes of the session) differed between the two conditions ($P = 55.2 \pm 7.7$; $G = 37.4 \pm 13.6$ min·m/s^2; $p \leq 0.05$). A coefficient of determination elucidated an $r^2 = 0.175$, indicating that only 17.5% of the change in total g-force was explained by the difference in time between P and G. **CONCLUSION:** Practices were longer, less intense based on maximal HR and a trending maximal g-force, with a higher average g-force and total g-force compared to the pre-season game. Volume of training for practices could be better tailored to more closely mimic game-type conditions, although the goals of practice should be considered.

2228 Board #241 June 1 2:00 PM - 3:30 PM

Comparisons Between Jump Power, Swing Velocity, and Hitting Measures in Collegiate Baseball and Softball Athletes

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(No relationships reported)

Successful performance in baseball and softball requires the ability to perform multiple skills efficiently. The skills most critical to the game include fielding, throwing, and hitting and each have components of strength, agility, and muscular power. **PURPOSE:** To evaluate the relationships and differences between maximal leg power and swing velocity in collegiate baseball and softball players. **METHODS:** Thirty-four subjects (20.4±1.3yrs, 176.8±9.8cm, and 77.7±13.9kg) were assessed for vertical jump power and swing velocity using a force plate and visual 3D technology, respectively. Mean differences were calculated by independent t-tests and relationships between parameters of interest were calculated using Pearson Correlation coefficients. Statistical significance was set at 0.05 **RESULTS:** Baseball (n=17) and softball (n=17) player mean age, height (cm), and weight (kg) were 20.7±1.2yrs, 184.8±4.1cm, 88.3±9.8kg and 20.1±1.4yrs, 168.9±6.7cm, 67.0±8.0kg, respectively. Vertical jump power and swing velocity means were 1528.3±169.7W, 38.6±1.4m/s and 1045.4±121W, 29.8±1.8m/s, respectively. Baseball players were significantly taller ($p \leq 0.01$) and heavier ($p \leq 0.01$) than softball players. They also generated significantly more jump power ($p \leq 0.01$) and achieved higher swing velocities ($p \leq 0.01$) but no differences were revealed for hitting measures. Vertical jump power tests revealed moderate to strong relationships for baseball players (r=.58-.96, $p<0.05$) between height, weight, swing velocity, batting average, and slugging percentage for baseball but only height and weight for softball players. Swing velocity revealed poor to moderate relationships for both groups (r=-.28-.51) for batting average, slugging percentage, and home runs. **CONCLUSION:** Statistical evaluation revealed moderate to strong relationships between vertical jump power and anthropometric measures for both groups. Furthermore, baseball players display moderate to strong relationships between vertical jump power, swing velocity, batting average, and slugging percentage. In conclusion, evaluating and predicting performance from physiological variables remains a challenge, however, maximal leg power could serve as a moderate indicator of performance in baseball athletes.

2229 Board #242 June 1 2:00 PM - 3:30 PM

Limb Mass And Passive Muscle Tension Contributions To Knee Flexion Torque At Long Muscle Lengths

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Purpose: During isokinetic and isometric strength testing it is important to correct torque for the contribution of limb mass and passive muscle tension. This is particularly important in testing hamstring strength since weakness at long muscle lengths is a factor in recurrent hamstring strains. The purpose of this study was to quantify the relative contributions of passive muscle tension and limb mass during strength testing with the hamstrings in a stretched position.
Methods: Isometric strength tests were performed on 50 athletes (30 men, 20 women) prior to return to sport after a hamstring strain. Strength was assessed at 80°, 60°, 40°, and 20° knee flexion in sitting with the test thigh flexed 40° above horizontal and the seat back at 90° to the horizontal. In this set up the leg was horizontal at 50° knee flexion. Passive torque (limb mass + passive hamstring tension) was recorded at each angle. Passive torque at 80° was defined as limb mass with no muscle tension; limb mass at 80° and 20° were equal (30° below/above horizontal); limb mass at 60° and 40° were calculated [(passive torque at 80°/cos 30°) *cos 10°]. Torque due to passive muscle tension = measured passive torque - limb mass.
Results: Passive muscle tension contributed 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	Total Torque (Nm)		Contractile Torque (Nm) (% of Total Torque)		Passive Muscle Tension (Nm) (% of Total Torque)		Limb Mass Torque (Nm) (% of Total Torque)	
Knee Flexion	INV	NON	INV	NON	INV	NON	INV	NON
20°	73±32	74±27	48±27	48±22	15±6	14±7	11±3	11±4
	100%	100%	63%	63%	21%	21%	16%	16%
40°	79±31	81±28	60±28	62±25	6±4	6±5	12±4	12±4
	100%	100%	74%	76%	8%	8%	17%	16%
60°	78±31	82±28	64±28	67±25	2±2	2±3	12±4	12±4
	100%	100%	80%	81%	3%	3%	17%	16%
80°	72±31	73±25	61±28	62±23	0±0	0±0	11±3	11±4
	100%	100%	84%	85%	0%	0%	16%	15%

INV=involved, NON=noninvolved
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.

2230 Board #243 June 1 2:00 PM - 3:30 PM

Predicting Success in Division I College Football Players Based on Initial Physical Performance Tests

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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 linebackers (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 (HT), body mass (BM), 1 repetition maximum (1RM) in the squat (SQ), bench press (BP), power clean (PC), push jerk (PJ), vertical jump (VJ), sit and reach test (SR), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same strength coach over the ten-year period. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player 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 BP1RM (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.

2231 Board #244 June 1 2:00 PM - 3:30 PM

Relationship Between Dynamic Postural Control And Core Strength In Collegiate Women's Basketball Players

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(No relationships reported)

RELATIONSHIP BETWEEN DYNAMIC POSUTRAL CONTROL AND CORE STRENGTH IN COLLEGIATE WOMEN'S BASKETBALL PLAYERS
Hardman, Brenda, Burns, Karlee, Vargas, Tiffanye, Wu, Wilbur, Nakajima, Mimi. Center for Sport Training and Research, California State University, Long Beach. **Context:** Core strength and balance have been emphasized as important pieces to injury prevention, however, there is limited research regarding the relationship between the two. The Star Excursion Balance Test (SEBT) has been used to predict injury rate in athletic populations. **Purpose:** The purpose of this study was to evaluate the relationship between dynamic postural control using the modified SEBT and core strength in NCAA Division I women's basketball players. **Methods:** Fourteen Division I collegiate women's basketball players (age 19.71 ± 1.20 years; height 175.26 ± 7.32 cm; mass 71.36 ± 12.76 kg) completed a modified SEBT and core strength tests in a single testing session. Reach distance during the modified SEBT was collected in the anterior, posteromedial, and posterolateral directions and normalized by leg length. Composite score was calculated by adding individual directions. Core strength was measured using endurance tests for back extension, trunk flexion, and single leg wall sits, all for time. **Results:** There was a significantly moderate correlation $r(12) = 0.599$, p = 0.024 between combined composite SEBT score and trunk flexion holds. There was a significantly moderate correlation $r(12) = 0.568$ p = 0.04 between right leg anterior reach and back extension holds. A regression analysis was performed and determined that back extension holds was a good predictor of right anterior reach $R^2 = 0.460$ p = 0.009. **Conclusion:** This study corresponds with previous studies that shows the positive relationship between core strength and dynamic balance. Despite sample-size limitations, this study showed that increase in some core strength parameters may influence dynamic postural control.

2232 Board #245 June 1 2:00 PM - 3:30 PM

Comparison of Lung Volumes and Estimated VO2MAX in College-aged Wind Musicians Versus Aerobic Athletes

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(No relationships reported)

It is well known that aerobic athletes and musicians have higher dynamic lung functions than the general population. There is a gap in the current literature comparing the lung volumes of college-aged aerobic athletes to the lung volumes of college-aged wind musicians. **PURPOSE:** To compare the lung volumes (SVC, FVC, FEV_1, MVV) and VO_{2MAX} between college-aged Division II athletes and physically inactive wind musicians. **METHODS:** Subjects (n=21) were recruited based upon age and medical criteria. Athletes (n=11) were defined as individuals who accumulated at least or more than 150 minutes of moderate intensity aerobic activity per week and participated on an aerobic based athletic team. Wind musicians (n=10) were defined as individuals who played a wind instrument at the collegiate level who did not meet aerobic exercise guidelines. Three respiratory tests (SVC, FEV_1, MVV) were performed to assess lung volume using a spirometer. VO_{2MAX} was also estimated using an 8-minute treadmill walk test that elicited a heart rate between 50% and 85% of their maximal heart rate. Collected results were analyzed using a two-tailed independent t-test and Pearson correlations. **RESULTS:** There was a significant difference in VO_{2MAX} (p=0.013) between groups with the athletes (42.1 ± 7.2) having higher values than musicians (30.44 ± 11.9). There were no significant differences in the other lung volumes between groups. However, there were strong positive correlations between FVC and SVC (r=0.927), as well as, MVV and SVC (r=0.911) with musicians. There were also strong correlations between FEV_1 and FVC (r=0.980), FEV_1 and SVC (r=0.946), and FVC and SVC (r=0.937). **CONCLUSION:** The VO_{2MAX} results were greater in athletes when compared to wind instrument musicians. Interestingly, physically inactive musicians had similar lung functions as athletes. This difference could be attributed to athletes training their cardiorespiratory system and not solely their respiratory system.

2233 Board #246 June 1 2:00 PM - 3:30 PM

Predictability Of Vo2max Using A Gps Watch

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Using accurate submaximal methodologies to estimate VO_{2max} is a convenient alternative to maximal exercise testing. Submaximal testing is practical because it provides a cheaper, more time-efficient alternative to maximal testing and allows a wider range of individuals to be tested. **PURPOSE:** To examine the predictability of VO_{2max} based on a submaximal 15-minute outdoor run using a GPS sports watch compared to measured VO_{2max}. **METHODS:** Twenty-three participants (16 M, 7 F; 20-55 years old) volunteered for this study. Participants came to the laboratory on two separate occasions. On day 1, participants arrived in a fasted state (no intake in the past 3 hours) and completed a treadmill graded exercise test (GXT) to determine VO_{2max}. Participants completed the test using a self-selected pace (mph). The self-selected pace remained constant throughout the test while the grade increased 2% every 2 minutes until volitional exhaustion. During the test, heart rate (HR) and VO_2 (ml/kg/min) were recorded every minute. On day 2, participants completed a 15-minute submaximal outdoor run. Participants were fitted with a GPS sports watch, which was used to estimate VO_{2max} based on subject characteristics (gender, age, height (in), weight (lbs.), maximal HR (recorded on day 1 of testing)) as well as total distance of the run, pace, time (15 minutes), and HR. A paired samples t-test was used to determine if there was a significant difference between directly measured VO_{2max} and estimated VO_{2max} using the GPS watch. Statistical significance was determined by $p<0.05$. **RESULTS:** Five participants (3 males, 2 females) were excluded from the analysis due to the GPS watch malfunctioning, not reaching a true max, or dropping out of the study. The remaining 18 participants were 27.61 ± 7.94 years old, had a height of 172.28 ± 5.23 cm, and weighed 75.44 ± 12.67 kg. A significant difference was found between measured VO_{2max} (52.41 ± 8.61 ml/kg/min) and estimated VO_{2max} (49.33 ± 4.88 ml/kg/min) from the GPS sports watch. **CONCLUSIONS:** The GPS sports watch was not a valid estimate of VO_{2max}. Variability of HR could have potentially influenced the results from the GPS watch.

2234 Board #247 June 1 2:00 PM - 3:30 PM

Effect of Plyometrics and Whole Body Vibration on Vertical Jump Height: A Meta-analysis

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(No relationships reported)

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 ($CI_{95\%}$) were considered statistically significant. Heterogeneity was assessed using Q and I^2, 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 ($CI_{95\%}$ = 0.82 to 1.27, p <0.001) and the control group an ES = 0.032 ($CI_{95\%}$ =-0.12 to 0.18, p= 0.73). The ES for the experimental group in the whole body vibration training method was 0.652 ($CI_{95\%}$ =0.3 to 1.0, p= 0.001) and the control group an ES= 0.038 ($CI_{95\%}$ =0.3 to 1.0, p=0.75. 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= <0.00), final series of exercises (r= 0.601, p= <0.00) 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.

2235 Board #248 June 1 2:00 PM - 3:30 PM

Relationships Between Assessments Of Athletic Ability In NAIA Athletes

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PURPOSE: To examine the relationships between flexibility, body composition, and several field methods indicative of athletic ability in a population of National Association of Intercollegiate Athletics (NAIA) athletes. **METHODS:** Shoulder flexion (SF), hip flexion (HF), and ankle plantar flexion (APF) were assessed by goniometry. %BF and FFM were assessed using BodPod. Athletic ability was assessed by the Illinois Agility Test (IAT), Queens College Step Test (QCST), vertical jump (VJ), isometric handgrip (IH), and a push-up muscular endurance test (PU). Subjects (n = 18) included both sexes across a variety of sports. Relationships between range of motion at each site, %BF, FFM, and all indicators of athletic ability were examined using Spearman's correlation coefficients. For relationships involving IAT and QCST, only 10 subjects are reported as the others did not complete this assessment. **RESULTS:** Relationships between variables are presented in Table 1. Means and standard deviations for each variable were as follows: SF (191 + 22°), HF (77 ± 11°), APF (37 ± 13°), FFM (73 + 8 kg), %BF (16.8 ± 6.6 %), VJ (66 ± 10 cm), IH (45 + 6 kg), PU (41 ± 19 PU/min), QCST (55 + 14 steps), IAT (17.4 ± 1.2 s).

	SF	HF	APF	FFM	%BF	VJ	IH	PU	QCST	IAT
SF	1	.34	.15	**.65 p=.003**	.41	-.06	-.23	.05	.20	.41
HF	-	1	-.21	.45	-.03	-.09	-.05	.14	.35	-.19
APF	-	-	1	.06	.08	.33	-.15	-.03	-.37	-.16
FFM	-	-	-	1	**.55 p=.017**	-.14	.01	.25	-.02	-.25
%BF	-	-	-	-	1	.05	-.13	-.17	-.27	-.24
VJ	-	-	-	-	-	1	.32	.04	-.12	.23
IH	-	-	-	-	-	-	1	.24	**-.85 p=.002**	.19
PU	-	-	-	-	-	-	-	1	.23	.45
QCST	-	-	-	-	-	-	-	-	1	.20
IAT	-	-	-	-	-	-	-	-	-	1

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.

2236 Board #249 June 1 2:00 PM - 3:30 PM

Low Correlation Between Bench Press One-Repetition Maximum and Angle Specific Isometric Bench Press

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(No relationships reported)

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 1RM and angle specific isometric bench press. **METHODS:** Twelve recreationally trained males (age=24.83±2.89yrs, height=172.33±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 1RM 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 1RM (115.43±12.68kg) and isometric bench press at all angles (60°=56.60±9.72kg, r= -.04; 90°=65.25±9.77kg, r= -.26; 120°=110.39±20.79kg, r= -.11; 150°=121.46±29.83kg, r= -.24; 50% arm length=57.72±8.09kg, r= -.25). **CONCLUSIONS:** Traditionally, dynamic movements are the focus of strength testing. The 1RM 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.

2237 Board #250 June 1 2:00 PM - 3:30 PM

Prediction Of Lactate Threshold By Physiological Variables Utilizing Human Motion During Exercise

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Running at Lactate threshold (LT) for training is a frequent training method used by healthy and elite 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±1.8years, Percentage (%) body fat: 12.4±3.3%, height: 173.4±4.7cm, weight: 68.2±5.8kg, bone mineral content: 2738.6±252g and lean mass: 56233.7±4751.4g) completed an incremental discontinuous submaximal to exhaustion protocol on the treadmill. VO_2 $ml*kg^{-1}*min^{-1}$ was determined at every stage and VO_2max $ml*kg^{-1}*min^{-1}$ was determined at volitional exhaustion. Human motion, blood lactate, heart rate (HR), VO_2 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) (r = 0.908) and angle between right (thigh & leg) phase 3 (r = 0.858). The equations derived with human motions (A) VO_2 = (VO_2 - 7.56)±10.83$ml*kg^{-1}*min^{-1}$ and (B) VO_2 = (VO_2-15.81)±15.76$ml*kg^{-1}*min^{-1}$ can be used to predict the VO_2 at LT if VO_2max is known. **CONCLUSIONS**: Results indicated that human motions have significant relationship with HR, VO_2, and blood lactate during running at submaximal intensities. The human motion derived equation can predict VO_2 at LT if VO_2 at exhaustion is known without using a invasive method.

2238 Board #251 June 1 2:00 PM - 3:30 PM

Comparison of Prediction Models for Cardiorespiratory Fitness from Maximal Anaerobic Capacity in Young Adults

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(No relationships reported)

The superior method of cardiorespiratory fitness assessment is often considered an incremental treadmill VO_2max protocol. During these protocols energy production pathways switch from primarily aerobic to anaerobic by the point of VO_2max

attainment. Similarly, the Wingate cycle test is a commonly accepted method of anaerobic capacity assessment which stresses anaerobic energy pathways. Based on the energy systems utilized at the point of VO_2max attainment and during a Wingate protocol it has been shown that peak power obtained from a Wingate cycle test is a good predictor of VO_2max. 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 model for a non-consecutive day testing protocol and a same day testing protocol. **METHODS:** Participants (N=23) completed an incremental treadmill VO_2max 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). VO_2max (L/min) and peak power (PP) were collected. All data were analyzed using simple linear regression. **RESULTS:** Linear regression analysis of NON revealed R^2=0.808 and prediction equation $\hat{Y}$=1.499+0.004X and SAME showed R^2=0.861 and prediction equation $\hat{Y}$=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 VO_2max testing is a better predictor of cardiorespiratory fitness. 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.

2239 Board #252 June 1 2:00 PM - 3:30 PM

The Development Of A Metabolic Equation To Estimate Caloric Consumption On A Non-motorized Sport-performance Treadmill

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Reported Relationships: S. Zanuso: *Honoraria; Receive honoraria from Technogym.*

PURPOSE: To create a Metabolic Equation (ME) predicting caloric consumption in walking and running speeds on a new non-motorized treadmill, named as the 'Skillmill' (SK). On the SK the running surface is moved mechanically by the user, specifically designed to develop sports performance qualities.
METHODS. A group of 27 healthy individuals (18 male and 9 female; age 35.8 + 9.3; BW 76.2 + 19.1) were enrolled in the study. All subjects executed two familiarization sessions with the SK, one dedicated to walking and another to running. Each subject performed two trials, trial one required the subjects to walk at 4 and 6 km/h and trial two required the subjects to run at 8, 10 and 12 km/h. Each speed consisted of an 8 minute duration in order to obtain a steady state condition. The rest between speeds and trials consisted of 5 minutes.Oxygen consumption was continuously monitored with a metabolic cart (Cosmed Quark b^2, Rome, Italy). VO_2 consumption was then measured when the subject achieved a stead state of metabolic intensity. Overall, 135 steady state points were collected.
RESULTS.The steady state VO_2 ranged from 13.32 to 31.09 $ml.kg^{-1}.min^{-1}$ when walking and from 31.27 to 47.67 $ml.kg^{-1}.min^{-1}$ when running. To estimate the VO_2 consumption expressed in $ml.kg^{-1}.min^{-1}$ related to a given speed, both Speed (S) in km/h and Body Weight (BW) in kg were considered. The equation that better predicts actual VO_2 consumption is $p_{00}+p_{10}*BW+p_{01}*S+p_{20}*(BW^2)+p_{11}*BW*S$.
The different coefficients of this polynomial equation of the 2nd degree relative to BW are: p_{00}= 16.42; p_{10}= -0.3036; p_{01}= 4.547; p_{20}= 0.001826; p_{11}= -0.01816 with a Root Mean Squared Error of 1.751 when (S) is lower than 8 km/h.
p_{00}= 0.808; p_{10}= 0.248; p_{01}= 4.21; p_{20}= -0.002509; p_{11}= -0.004976 with a Root Mean Squared Error of 2.081 when (S) is equal to or higher than 8 km/h.The correlations between the values predicted by this equation and the VO_2 measured with the metabolic cart are r^2=0.83 when (S) is lower than 8 km/h and r^2=0.84 when (S) is equal to or higher than 8 km/h.
CONCLUSIONS. The present Metabolic Equation that predicts oxygen consumption and caloric expenditure from the subject's speed and body weight, provides a good estimate of the actual values.

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. Also, incremental VO_2max treadmill test is used as a measure of aerobic capacity. If expressed as a relative value (ratio of VO_2max and body mass) or RVO_2max it is a good predictor of endurance or long distance running time. Considering that longer distances running time and RVO_2max 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 (tAE) 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 (300YR) and incremental VO_2max treadmill test. Their body mass (BM) was also measured. Relative maximal oxygen uptake (RVO_2max) 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 tAE. **RESULTS:** Regression analysis yielded BM allometric exponents for 2MR, eAE=0.33 (95%CI=0.23 - 0.43); RVO_2max, eAE=-0.47 (95%CI= -0.55 - (-0.38)); 300YR, eAE=0.22 (95%CI=0.15 - 0.28). Mean eAE =0.34 and compared with tAE=0.33 was not significantly different (p>0.05) when tested by one sample t-test. **CONCLUSION:** The results indicate that experimentally derived mean AE 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 times.
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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

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(Sponsor: Yuri Feito, FACSM)

(No relationships reported)

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 ± 8.4 y; 85.2 ± 7.88 kg; 177.01 ± 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 separate one-way analysis of variance. **RESULTS:** Greater ($p < 0.011$) performance scores were reported by Q1 for DL (232.4 ± 20.5 kg), SQ (201.6 ± 19.1 kg), CJ (148.9 ± 12.1 kg), SN (119.4 ± 10.9 kg) and Fran (2.3 ± 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 only better than Q3 (62.6 ± 7.3 sec, p = 0.022), Q4 (7.9 ± 0.7 min, p = 0.007) and Q5 (398 ± 73 repetitions, p = 0.010) respectively. No specific quintile differences were observed in 5,000-m or Filthy-50 performance. **CONCLUSION:** The 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.

2242 Board #255 June 1 2:00 PM - 3:30 PM

Increases in Maximum Oxygen Consumption and Lactate Threshold Predict Improvements in Race Performance during a Cross Country Season

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(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 (1.8+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 TruOne 2400 Metabolic cart. Near-infrared spectroscopy (Portamon, Artinis Inc.) of the vastus lateralis was used to measure tissue saturation index (TSI) for each stage of the graded exercise

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 analyzer (Nova Biomedical) to determine the inflection point 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:** VO_2max significantly increased ($p<0.05$) from T1 to T2 (51.6 + 3.2 ml/kg/min to 56.6 + 4.3 ml/kg/min) indicating an average gain of 4.9 + 3.9 ml/kg/min or 9.7%. The slope of the TSI became more positive from T1 ($-14.8 \times 10^{-3} + 6 \times 10^{-3}$) to T2 ($-7.9 \times 10^{-3} + 7 \times 10^{-3}$), indicating less of a decline in muscle deoxygenation. The LT increased by one workload in four of the nine subjects. The subjects who experienced an increase in LT also experienced an increase in racing performance. Lastly, running efficiency did not significantly change between T1 and T2. **CONCLUSIONS:** On average, VO_2max, LT, and muscle oxygenation improved from pre- to mid-season. The greatest gains in VO_2max and in LT from pre-season to mid-season correlated to the greatest improvements in racing performance. About 40% of the variance in race performance can be explained by the changes in VO_2max whereas improvements in LT explained 32% of the variance in racing performance. These data suggest that improvements in VO_2max are most important in predicting race performance in collegiate cross country runners.

2243 Board #256 June 1 2:00 PM - 3:30 PM

Comparison of Training Impulse and Training Load Estimation Among Soccer Players Using the Edwards Equation and Polar Team2 System

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(No relationships reported)

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% HR_{max}, whereas Polar's TL is measured via their Team2 system using a proprietary equation that incorporates anthropometrics and maximal oxygen consumption (VO_{2max}) 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 yrs) 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 VO_{2max}. In instances where TL was >300 per match, athletes had reduced intensity during practice sessions to aid in improved recovery. Data recorded included time spent in each of five heart rate zones, ranging from 50% to 100% HR_{max}, in 10% increments. **RESULTS:** When comparing Edwards TRIMP and TL, significant correlation coefficients were found for the first half, second half, and both halves combined (r=0.992, r=0.972, and r=0.936, p<0.01). Although TRIMP and TL had high variability due to individual players playing for different time periods, mean TRIMP (190.9 ± 102.1) and TL (219.5 ± 92.4) for the season were similar. Estimated VO_{2max} scores were not significantly different pre to post-season (52.0 ±4.84 vs. 53.7 ±3.14 $ml \cdot kg^{-1} \cdot min^{-1}$, t=-1.794, p>0.05). **CONCLUSIONS:** Estimating TRIMP using the Edwards equation is a valid option for coaches to gauge training readiness. TRIMP may be used if TL is unavailable to determine athlete readiness. Subsequent training sessions may be modified based on the amount of TL/TRIMP undergone in order to maintain fitness levels of athletes throughout the season.

2244 Board #257 June 1 2:00 PM - 3:30 PM

Predictor Variables for Success in Collegiate Wrestling

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(No relationships reported)

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 determine if there are certain additional attributes that can predict success in wrestling. **Methods:** The study consisted of 6 NCAA division II collegiate level male wrestlers. Their ages ranged from 18-25 years. The following served as independent variables: Wingate arm cranking test, wrestling shot velocity, percent change in body weight, vertical jump height, and grip strength of the non-dominate hand. The dependent variable was percent wins during the wrestling season. A multiple regression with a stepwise progression was the statistical technique used to analyze the date. Significance was set at p=0.05. **Results:** The model summary only included one independent variable, percent change in body weight. Thus the model summary was: r=0.838, r^2=0.702, adjusted r^2=0.627, Beta=1.507, with F=9.402, and p=0.037. Therefore, based on this study, 70.2% of the percent wins in wrestling was accounted for by increases in body weight throughout the season. The regression equation for predictive success is: $\hat{y}$=62.148 + 1.507 x kg. Although not significant, the next most influential independent variable was shot velocity with r=0.649 and p=0.148. **Conclusion:** The results of our study indicate that for every 1 kg increase in body weight, there is an accompanied 1.507 increase in percent wins. The authors assume this profitable increase in body weight would be in the form of lean muscle mass, hydration levels, and possibly glycogen stores. Perhaps there would have been more significant predictors had there been more than 6 participants. Furthermore, only two of the wrestlers qualified for the NCAA national championships. Additionally, none of the wrestlers placed at the NCAA national championships. Therefore, the lack of success in our sample of wrestlers could have influenced the outcome.

2245 Board #258 June 1 2:00 PM - 3:30 PM

Validity of Commercial Electrical Impedance Myography as a Predictor of Grip Strength

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(No relationships reported)

PURPOSE: Electrical impedance myography has gained recognition throughout the literature as an effective assessment of neuromuscular disorders. However, evidence regarding the efficacy of commercial electrical impedance myography (cEIM) devices is limited. Therefore, there were two aims of this independent research. First, the author aimed to assess the validity of a cEIM device as a predictor of grip strength. The second aim was to determine whether the number presented by the cEIM device was a direct representation of grip strength force produced.
METHODS: Muscle quality and grip strength were measured in 17 female subjects (M_{age} = 20 years, SD = 1.5) via cEIM and a Jamar hand dynamometer, respectively. The cEIM device was placed on the volar surface of the dominant forearm midway between the medial epicondyle of the humerus and ulnar styloid on each participant. Grip strength measurements were then taken in accordance with recommendations from the American Society of Hand Therapists. True scores were documented as the results for each assessment before grouped into normative categories. The true scores for each assessment were compared using the Wilcoxon signed ranks test. The results were then categorized into either *normal* or *abnormal* according to their respective normative data. Spearman's ranked correlation (r_s) was utilized to assess the relationship between the true scores and the two categorical groupings of normal and abnormal. Statistical significance was accepted at $p < 0.05$.
RESULTS: The average grip strength score of all participants was 30.82 kilograms (SEM = 1.20, 95% CI [28, 33]). Muscle quality scores averaged 41.29 (SEM = 3.70, 95% CI [33, 49]). A strong correlation was observed between the categorical groupings of each assessment (r_s = 0.618, p = 0.008). No significant relationship was observed between the true scores of the cEIM device and grip strength (r_s = 0.23, p = 0.38). The true scores were observed as significantly different from each other (Wilcoxon test, p = 0.015).
CONCLUSIONS: Although the commercial electrical impedance myography device did not provide a direct representation of grip strength force produced, the device was effective at predicting normal versus abnormal grip strength.

2246 Board #259 June 1 2:00 PM - 3:30 PM

Relationship Between Physiological/Anthropometric Profiles and Future NHL Status Among Division I Collegiate Ice Hockey Players

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(No relationships reported)

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 purpose of this study was to determine if the results of a discontinuous graded exercise test and selected anthropometric measures could predict a collegiate ice hockey player's likelihood of playing professionally in the NHL.
METHODS: Physiologic and anthropometric player profiles were obtained through yearly preseason fitness testing of a NCAA Division I men's ice hockey team from 1980 through 2015. Players participated in a discontinuous treadmill graded exercise test to volitional exhaustion, consisting of 3 min run stages and 90 sec rest stages. Aerobic capacity was measured (indirect calorimetry) and total test time (including treadmill stage completed) was recorded. Height, weight, and %fat were also measured for each athlete. Athletes who later played at least one game in the NHL (n=55) were compared to non-NHL athletes (n=190) to determine if any outcome variables of interest predicted their NHL status. Binary logistic regression was performed, and Odds Ratios (OR) and 95% Confidence Intervals (CI) were calculated for each variable. **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

(83.8±5.3 vs 83.6±7.2 kg), body fat (11.2±2.9 vs 12.5±3.1 %), BMI (25.3±1.5 vs 25.3±1.6 kg/m^2), VO_2max (59.0±4.1 vs 58.0±4.0 ml/kg/min), completing treadmill stage 5 (45% vs 40%), and year of last college season (1994 vs 1998). Entering all variables into the logistic model showed that the only significant predictors of achieving NHL status were %fat and playing year (OR=1.19; CI=1.06, 1.33). **CONCLUSIONS**: According to our findings, players with the lowest %fat values and earlier careers were 19% more likely to play in the NHL. These NCAA Division I players' physiologic profiles and overall size are very similar; therefore, NHL success may be more influenced by other factors such as player skill, other fitness variables, and mental focus.

2247 Board #260 June 1 2:00 PM - 3:30 PM

The Relationship between Hamstring/Quadriceps Strength and Field Test Measures in Collegiate Track Athletes

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(No relationships reported)

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 10 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.

D-72 Free Communication/Poster - **Neuromuscular-Musculoskeletal**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2248 Board #261 June 1 3:30 PM - 5:00 PM

VO2 Off-Kinetics Following Exhaustive Upper Body Exercise Test in Spinal Cord Injury

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(No relationships reported)

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 VO_2 off-kinetics 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 voluntarily lift legs against gravity (age: 39.1 ± 10.9 years, paraplegic: 11, tetraplegia: 2, incomplete injury: 4) and 10 healthy controls (CON group; age: 30.5 ± 5.3 years). All subjects performed an arm ergometer cardiopulmonary exercise test (CPET) to volitional exhaustion followed by a 10-minute passive recovery. VO_2 off-kinetics was determined using a mono-exponential model in which a time constant (τ_{off}) was calculated and amplitude of change in VO_2 (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 VO_{2peak} and the VO_2 off-kinetic variables. **Results:** CON had a significantly higher VO_{2peak} compared to SCI (22.41 ± 5 vs.14.64 ± 6.36 ml/kg/min, p=0.005). Compared to CON, SCI had significantly longer τ_{off} (83.4 ± 34.7 vs.54.7 ± 10.2seconds, p=0.021). A significant difference in AMP was not seen between the subjects with SCI and CON (0.85 ± 0.57 vs.1.31 ± 0.48L/min, p=0.054) however the ratio of AMP/τ_{off} was significantly smaller in the group with SCI than in CON (0.0126 ± 0.0108 vs. 0.0243 ± 0.008L/min/sec, p=0.011). VO_{2peak} and τ_{off} were inversely related (r=-0.524, p=0.01). **Conclusions:** Potentially explained by the time taken to replenish muscle ATP stores and lactate clearance, VO_2 off-kinetics is one measure of cardiorespiratory fitness. Despite an observable decline in AMP, the prolonged VO_2 off-kinetics suggested that cardiorespiratory fitness was impaired in these subjects with SCI. Funding: DoD Award #W81XWH-14-1-0613

2249 Board #262 June 1 3:30 PM - 5:00 PM

The Effect Of Low Intensity Eccentric Exercise On Torque angle Relationship, Muscle Strength And Flexibility

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PURPOSE: The angle of peak torque (APT) with shorter muscle length tends to have high probability of muscle strain injury. It is conceivable that APT with longer muscle length might be desirable condition of injury prevention. Although high intensity eccentric exercise (Ecc-Ex) which transiently shift the APT to longer muscle length associated with weaken muscle strength and decrease flexibility is well known, the acute effect of low intensity Ecc-Ex is unclear. 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 (60deg/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. 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 increased 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.

2250 Board #263 June 1 3:30 PM - 5:00 PM

The Effect of Rehabilitation with Blood Flow Restriction on Muscle Function Following Total Knee Replacement

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Low-load resistance exercise rehabilitation combined with blood flow restriction (BFR) has been suggested as an effective and safe alternative way to improve muscle strength and size compared to traditional high-load resistance exercise in clinical populations. However, there are few studies conducted to investigate the effect of low-load resistance exercise rehabilitation with BFR following total knee replacement. **PURPOSE**: To compare the result of rehabilitation with or without BFR on muscle function in the patients who were treated with total knee replacement surgery. **METHODS**: Twenty-one participants were randomized into two different interventions: low-load resistance exercise rehabilitation with BFR (BFR group, n=11) and without BFR (control group, n=10). Exercise sessions were performed 6 times per week, 30 minutes per session, for 2 weeks in all participants. Over the twelve exercise sessions in BFR group, an elastic cuff was worn on the subject's proximal thigh in its intensity being progressively increased from 160 mmHg at the first session

up to 240 mmHg at the end by adjusting the external compression. For the analysis, muscle strength, rate of torque development (RTD), range of motion (ROM), muscle mass, thigh circumference, the Timed Up and Go test, 10-m walking test and single-limb stance were measured. All outcome measures were assessed before and after the intervention.
RESULTS: In knee extensor strength, the degree of change in the BFR group was significantly larger than that in the control group (0.33±0.21 vs. 0.11±0.11 Nm/kg, p<0.05). In knee extensor RTD, although there was no statistical difference between the two groups, it was nearly significant (p=.051). 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 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.

2251 Board #264 June 1 3:30 PM - 5:00 PM

Energetic and Hemodynamic Response to Electrical Stimulation Cycling in Persons with Paralysis

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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, Restorative Therapies, MD) and two on a device that is in pre-production testing (MyoCycle, 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, CA), and central hemodynamics (for the MyoCycle device only) via impedance cardiography (PhysioFlow, Manatec Biomedical, FR). **Results**: Rate of oxygen consumption (VO_2) and cardiac output (CO) during FES were 34±20% and 49±23% of their respective VO_{2peak} and CO_{peak} achieved during maximal effort arm cycling. Both FES devices elicited similar rates of exercise energy expenditure (1.06±0.20 kcal/min) and fuel homeostasis (74:26 %CHO:%FAT). However, only the MyoCycle showed a statistically significant increase in energy expenditure at 20-30 min post-exercise time point (11.2% increase vs pre-exercise, p=.02), with this increase in energy expenditure accompanied by a 54% increase in CHO oxidation during the first 30 min of exercise recovery. **Conclusion**: Moderate intensity FES cycling qualifies as "low intensity" aerobic exercise according to authoritative guidelines, although increases in carbohydrate oxidation during and after cycling might have a meaningful impact on daily glucose regulation. Furthermore, the energetics of the recovery period seem to be influenced by the electrical control system.

2252 Board #265 June 1 3:30 PM - 5:00 PM

Insulin Resistance Adversely Affects Cutaneous Microvascular Perfusion Responses to Insulin Iontophoresis in Spinal Cord Injury

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Insulin is a vasoactive hormone and second messenger of nitric oxide that facilitates endothelial-mediated dilatation of the microvasculature with assistance by the sympathetic nervous system (SNS). The sensitivity or resistance of endothelial-mediated mechanisms that regulate skin blood flow may play an integral role in optimizing skin perfusion in vascular beds where SNS vasomotor impairment is present. Spinal cord injury (SCI) is characterized by interruption of supraspinal SNS control of sublesional vasomotor tone.
Purpose: To determine the effects of insulin resistance (IR) on sublesional cutaneous perfusion responses to insulin provocation in persons with SCI.
Methods: A prospective, open-label, non-randomized, placebo-controlled investigation was performed in persons with SCI and an able-bodied (AB) cohort. These groups were subdivided based on fasting plasma insulin (FPI) concentration cut-offs for IR (≥13.13 mIU/ml) or insulin sensitive (IS: <13.13 mIU/ml) designations into four subgroups: ABIS (n=21); SCIS (n=21); ABIR (n=9); SCIR (n=11). Laser Doppler flowmetry characterized the peak blood perfusion unit (BPU) responses (percent change from baseline) to insulin or placebo iontophoresis in the lower extremities, and the corresponding BPU responses were log_{10} transformed to facilitate comparisons. The NetIns BPU response was calculated (Insulin-Placebo BPU responses) to provide the effect of insulin to that of the acetylcholine-mediated BPU response.
Results: The groups were matched for demographics. By study design, FPI was different between the IS and IR subgroups. In ABIS, the BPU responses to insulin were significantly greater than placebo (p<0.05 and p<0.0001, respectively). In ABIR and SCIR, insulin did not produce a BPU response that differed from placebo. In SCIS, the insulin BPU response was greater than placebo (p<0.0001). The NetIns response was significantly greater in both IS groups compared to their corresponding IR group.
Conclusions: 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.

2253 Board #266 June 1 3:30 PM - 5:00 PM

Within-Session Responses to High Intensity Interval Training in Spinal Cord Injury

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(No relationships reported)

High intensity interval training (HIIT) has shown to be a robust alternative to traditional aerobic training (Gillen et al. 2014, 2016; Astorino et al. 2011). In most individuals, incorporation of HIIT elicits increases in maximum oxygen uptake and overall health status, yet its feasibility in persons with spinal cord injury (SCI) is unknown. **PURPOSE:** The aim of this study was to compare acute changes in cardiorespiratory and metabolic variables during different HIIT regimens versus moderate intensity continuous exercise training (MICT). **METHODS:** Nine habitually active men and women (injury duration = 6.8 ± 6.2 yr) with SCI initially underwent determination of peak oxygen uptake (VO_2peak) on an arm ergometer. During subsequent sessions, they completed MICT, HIIT, or sprint interval training (SIT). MICT consisted of 25 min of arm cycling at 45 %Wpeak. HIIT consisted of eight 60 s bouts at 70 %Wpeak separated by 90 s of active recovery at 10 %Wpeak, while SIT required eight 30 s bouts at 105 %Wpeak separated by 120 s of active recovery at 10 %Wpeak. Gas exchange data, heart rate (HR), and blood lactate concentration were measured. Each session was broken up into 16 phases (eight exercise and eight recovery data points for HIIT/SIT) for which mean oxygen uptake and HR were determined. **RESULTS**: Peak VO_2 was higher (p = 0.03) in response to HIIT (1.13 ± 0.44 L/min at bout 8) and SIT (1.02 ± 0.37 L/min at bout 8) compared to MICT (0.90 ± 0.29 L/min), but mean VO_2 was similar (p > 0.05) between MICT (0.86 ± 0.17 L/min), HIIT (0.89 ± 0.20 L/min), and SIT (0.82 ± 0.19 L/min). Peak HR was higher (p < 0.05) with HIIT (90 %VO_2peak and 99 % HRpeak) and SIT (80 %VO_2peak and 96 %HRpeak) versus MICT. There was no difference in mean HR across bouts (p = 0.16) which was equal to 130.7 ± 19.3, 129.3 ± 18.6, and 126.9 ± 14.9 b/min for HIIT, SIT, and MICT, equivalent to 79 - 82 %HRpeak. **CONCLUSION:** Despite a higher intensity, all participants preferred HIIT
or SIT versus MICT. Compared to MICT, submaximal or supramaximal interval training elicits higher peak oxygen uptake and heart rate. The long-term efficacy and feasibility of HIIT in this population should be explored, considering that exercise intensity seems to be the most important variable manipulated in exercise programming to optimize maximal oxygen uptake.
This study was partially funded by a University GPSM grant.

2254 Board #267 June 1 3:30 PM - 5:00 PM

Knee Extensor Asymmetry in Multiple Sclerosis Patients Before and After Single-Leg Cycling

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Multiple Sclerosis (MS) is an immune-mediated disorder of the central nervous system that is both chronic and progressive. MS is one of the most common neurological diseases that affect young adults; causing fatigue, debilitating ambulatory effects, as well as impacting quality of life. There have been clinical observations of bilateral differences (asymmetry) in lower extremity strength and function in people with MS.
Purpose: Therefore the purpose of this study was to quantify lower extremity strength asymmetry before and after a bout of single-leg cycling exercise to failure. **Methods:** Eight individuals (6 women and 2 men) with mild MS (Age 51.6 ± 9.2 yrs, BMI 25.0 + 3.9 kg/m^2, Extended Disability Status Scale 2.6+1.6) and seven (5 women and 2

men) non-MS controls (CON) (Age 49.4 ± 14.3 yrs, BMI 26.0 + 8.3 kg/m²) completed bilateral assessments of muscle knee extensor strength (KES) before and immediately after a single leg incremental cycling (SLC) test to induce localized musculature fatigue. KES asymmetry scores (weak/strong) were calculated for both groups (scores equal to 1.0 indicates symmetry between limbs). Body composition (lean and fat mass) was assessed using Dual X-Ray absorptiometry (DXA). Independent and dependent t-tests were used to detect between and within group differences respectively. Cohens d effect size (ES) was calculated, and level of significance was set to p<0.05. **Results:** No significant differences in baseline demographic measures were observed. No significant differences were observed in lower limb lean mass and fat mass within or between groups. There was a significant between group difference for leg asymmetry before the SLC test (CON: 0.933+0.131, MS: 0.818+0.0942, p<0.034, ES: 1.0); however, following the SLC test no between group differences were observed (p>0.05). **Conclusion:** The group of individuals with MS exhibited asymmetry in KES that was significantly different than CON group. The SLC test did not appear to cause fatigue of the knee extensors in either group, and appeared to improve strength in the MS group. The increase in strength could possibly be related to potentiation from the SLC test. However, further studies should utilize different fatigue protocols to determine the effects of exercise on asymmetries in people with MS.

2255 Board #268 June 1 3:30 PM - 5:00 PM

Neuromuscular Electrical Stimulation Improves Walking Performance In People With Multiple Sclerosis: Double-blind, Randomized Trial

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Multiple sclerosis (MS) is a neurological disorder that afflicts ~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 (52.6 ± 7.4 yrs) participated in the study. Participants were randomly assigned to two groups: NP group (0.26 ms; 50 Hz; n=13; 54 ± 6.3 yrs), and WP group (1 ms; 100 Hz; n=14; 51.2 ± 8.3). 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 s on and 12 s 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 retention period (10 wks). **RESULTS:** Both groups (NP & WP) improved walking endurance and walking speed after the intervention (*P* values < 0.05). The 6MWT (m) results: NP - before (mean ± SD) = 345 ± 138, after = 387 ± 154, retention = 396 ± 178; WP - before = 409 ± 131, after = 442 ± 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 for 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.

2256 Board #269 June 1 3:30 PM - 5:00 PM

Within- And Across-Day Reliability Of Mobility Measures In People With Multiple Sclerosis

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PURPOSE: Individuals with Multiple Sclerosis (MS) often exhibit slowed walking speed, foot tap speed, and longer Timed-Up-and-Go (TUG), and Six Spot Step Test (SSST) times. The goal of this study was to evaluate within- and across-day reliability of these measures in individuals with MS. **METHODS:** On 3 visits, each separated by 7 days, women with MS (n=11; mean±SE, age: 53±3 yrs; self-reported EDSS: median=4.5, range=0-6.5) completed two 25-foot walk and 2 TUG trials, and the fastest trial for each visit was used for analysis. Next, participants completed the SSST and the average time for 4 trials was recorded for each visit. Participants were instructed to complete all measures of mobility "as fast and safely as possible." They then performed 10 trials of the foot tap test (FTT, 10s rapid tapping) on each foot, with the distal half of their foot positioned on a force plate and the number of taps in each trial determined from the force data. Foot tap count from all 10 trials was used to assess within-day reliability of each foot using the coefficient of variation (CoV) and rmANOVA, with Bonferroni post-hoc analyses. The fastest trial for each mobility test was used to assess across-day reliability with intraclass correlations (ICC), CoV, and rmANOVA. **RESULTS:** Within-day CoV for the FTT showed good reliability for both feet (right: 7.4±1.1%, left: 6.5±1.0%). There was a significant within-day effect of trial number for the FTT (p=0.02) and post-hoc analyses revealed differences at visit 3 such that the right foot was faster in trial 1 than trial 8 (37.5±2.4 vs. 33.8±2.4, p=0.02), and the left foot was faster in trial 1 than trial 10 (36.5±3.0 vs. 33.6±3.2, p=0.03). No other within-day differences were observed. The ICC's for the 4 mobility tests varied across visits (25-foot walk: ≥0.95; TUG: ≥0.92; SSST: ≥0.94; FTT: ≥0.75). The CoV for the 25-foot walk (4.7%), TUG (6.7%), SSST (7.3%), and FTT (right: 6.5%, left: 7.3%) demonstrated good reliability. There were no differences across visits for the 25-foot walk, TUG, and FTT (p>0.05). However, there was a difference across visits for the SSST (p=0.02), such that participants were quicker at visit 3 compared with visit 1 (8.0±1.0 vs. 8.7±1.0 s, p<0.05). **CONCLUSIONS:** The 25-foot walk, TUG, and FTT appear more reliable than the SSST for quantifying mobility in the MS population.

2257 Board #270 June 1 3:30 PM - 5:00 PM

Effect of Exercise Training on Cellular Inflammation and Fitness in Individuals with Multiple Sclerosis

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Multiple Sclerosis (MS), an immune-mediated disease of the central nervous system (CNS), is characterized by chronic neuroinflammation and demyelination. Interleukin-6 (IL-6), a major cytokine released by monocytes and macrophages, promotes a robust downstream inflammatory cascade, including the release of C-Reactive Protein (CRP), a common clinical marker of inflammation. Physical activity is known to be protective against inflammation and recent evidence suggests that increasing soluble form of the receptor for advanced glycation endproducts (sRAGE) may be an additional mechanism by which this occurs. **PURPOSE:** To characterize the relationship between fitness and inflammatory markers (CRP, IL-6) in persons with MS, and to elucidate the effects of a 12-week home-based exercise program on inflammation, estimates of insulin resistance (HOMA-IR), circulating sRAGE, and fitness in persons with MS. **METHODS:** Forty-eight participants with MS (45±2 yrs, 28.8±0.9 kg/m², 35 females) were randomly assigned to either a home-based aerobic exercise program or an attention-control stretching group. The exercise intervention consisted of cycling 3-4 d/wk at 40-60% $VO_{2\ peak}$ 30 min/d. $VO_{2\ peak}$ was assessed using open-circuit spirometry on a cycle ergometer. Blood was drawn at baseline and following the 12-week intervention and plasma metabolites were assessed using commercially available ELISA kits. **RESULTS:** Baseline $VO_{2\ peak}$ was negatively correlated with baseline plasma levels of CRP (r=-0.43, p=<0.01) and IL-6 (r=-0.51 p<0.01). $VO_{2\ peak}$ increased 8% in individuals with MS (p<.001), with no change in the attention-control group. No between or within group differences were observed for sRAGE, IL-6, CRP or HOMA-IR. **CONCLUSION:** Despite no effect of the exercise intervention, the relationship between $VO_{2\ peak}$ and CRP, IL-6 at baseline suggest that higher fitness levels are advantageous to individuals with MS and may be related to the well-known anti-inflammatory effects of exercise. This relationship is promising for the use of exercise on modulating cellular inflammation in individuals with MS, however longer duration, higher intensity or supervised exercise may be necessary in order to elicit changes in circulating IL-6, CRP, sRAGE and HOMA-IR. Supported by the National Multiple Sclerosis Society RG 4702A1/2.

2258 Board #271 June 1 3:30 PM - 5:00 PM

Relationship Between Peak Power Asymmetry and Self-Reported Measures of Fatigue in People with Multiple Sclerosis

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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; $r = 0.606$; $p = 0.02$). **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.

2259 Board #272 June 1 3:30 PM - 5:00 PM

Acute Effects of High-Intensity Interval Exercise on Physiological and Functional Outcomes in Multiple Sclerosis

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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 90% VO_{2peak} 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% VO_{2peak}. 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 VO_2 (t=-4.36, P=0.01), power output (t=-4.20, P=0.01), and RER (t=-7.24, P<0.01), with the HIIE condition inducing higher values than the CON condition. Heart rate approached a statistically significant difference between conditions (t=-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.

2260 Board #273 June 1 3:30 PM - 5:00 PM

Acute Physiologic Responses During Alternative Modes of Treadmill Exercise in Adults with Parkinson's Disease

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Parkinson's disease (PD) is a neurodegenerative condition characterized by muscle tremors, rigidity and dyskinesis leading to balance and gait abnormalities that could alter physiologic responses during exercise. Locomotion on an aquatic treadmill (ATM) or anti-gravity treadmill (AGTM) may be a safe alternative to exercise on a traditional land treadmill (LTM) in those with PD. **Purpose**: To determine the acute cardiovascular and metabolic responses to three different modes of treadmill exercise in older adults diagnosed with Parkinson's disease. **Methods**: Eight adults diagnosed with PD (68 ± 3 years of age) completed one exercise session on an LTM, one session on an ATM, and one session on an AGTM at 50% body weight. Participants walked from 1 to 3 mph in 0.5 mph increments at 0% grade during each exercise session. Heart rate (HR), energy expenditure (EE), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured at rest and during steady-state exercise at each speed on each treadmill. Rate of perceived exertion was also measured during steady-state exercise. Rate pressure product (RPP) was calculated. **Results**: All variables, with the exception of DBP, increased as speed increased across all treadmill modes ($p < 0.001$). Between treadmill modes across all speeds, EE was statistically different ($p = 0.025$). There was a significant interaction effect for mode and speed for HR ($p < 0.001$) and RPP ($p = 0.003$). At all speeds except 1.5 mph, HR was higher on the LTM versus the AGTM ($p < 0.05$). **Conclusion:** Exercising on an ATM or an AGTM elicits similar physiologic responses to exercise on an LTM in adults with PD.
Table 1: Heart rate response and rate pressure product at rest and at all speeds on each treadmill

			Treadmill Speed (mph)				
Variable	Treadmill Mode	Rest	1.0	1.5	2.0	2.5	3.0
HR (bpm)	LTM	73 ± 11^{a}	84 ± 17^{ab}	86 ± 18^{bc}	92 ± 16^{d}	99 ± 16^{e}	107 ± 18^{f}
	ATM	72 ± 11^{a}	77 ± 14^{a}	80 ± 17^{ab}	83 ± 17^{ab}	90 ± 13^{b}	97 ± 10^{b}
	AGTM	73 ± 11^{a}	80 ± 15^{ab}	83 ± 16^{ac}	85 ± 14^{cd}	88 ± 13^{bcde}	93 ± 15^{cde}
RPP	LTM	91 ± 26^{ab}	106 ± 32^{a}	112 ± 38^{ab}	123 ± 37^{b}	135 ± 36^{c}	149 ± 42^{d}
	ATM	89 ± 14^{ab}	97 ± 21^{a}	107 ± 36^{ac}	106 ± 27^{a}	118 ± 28^{bc}	130 ± 29^{c}
	AGTM	91 ± 19^{a}	102 ± 22^{ab}	108 ± 25^{ac}	111 ± 24^{c}	116 ± 25^{bc}	126 ± 28^{d}

Values are mean ± s.d. Means with the same superscript are statistically similar ($p > 0.05$). ATM = aquatic treadmill; AGTM = anti-gravity treadmill; LTM = land treadmill; HR = heart rate; RPP = rate pressure product.

2261 Board #274 June 1 3:30 PM - 5:00 PM

Changes in Balance, Gait and Motor Control Following Treadmill Exercise in Adults with Parkinson's Disease

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Locomotion on an aquatic treadmill or anti-gravity treadmill may be a safe and effective alternative to exercise on a traditional land treadmill in those with Parkinson's disease as the removal of body weight in these environments may allow the participant to exercise with less concern of falling at higher speeds before reaching volitional fatigue. **Purpose**: To determine the training effects of three different treadmill modalities on dynamic balance, gait, and fine motor control in older adults diagnosed with Parkinson's disease. **Methods**: Ten adults diagnosed with Parkinson's disease (70 ± 5 years of age) completed 8 exercise sessions (4 weeks, 2x/week) each separately on a land treadmill, aquatic treadmill, and anti-gravity treadmill at 50% body weight. Two weeks separated each intervention and the order was randomized. A 4-week control period occurred at the start of the study in which no treadmill exercise was performed. Each exercise session included a 2-minute warm-up and 30 minutes at a moderate intensity. Before and after each intervention, balance, gait and fine motor control were measured. Dynamic balance and gait were assessed using a Timed-Up-and-Go test

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.

Variable	Pre-Control	Post-Control	Post-LTM	Post-ATM	Post-AGTM
TUG (s)	8.4±1.4	9.3±3.3	8.5±2.6	7.9±2.1	8.8±3.6
POMA Balance	13.5±3.0	14.3±1.2	13.5±2.3	14.3±2.0	14.0±1.6
POMA Gait*	10.3±1.6	9.2±3.1	11.7±1.5	10.8±2.3	10.8±0.9
FMC (left hand)	8.7±3.2	9.1±2.8	9.0±3.4	8.8±2.8	9.0±3.2
FMC (right hand)	8.4±3.3	8.6±3.0	9.2±2.7	10.1±2.8	9.8±2.6
FMC (both hands)	6.1±2.4	6.6±2.7	7.3±2.9	6.8±2.2	6.2±1.9

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

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(No relationships reported)

PURPOSE: 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 yrs). Participants completed an incremental exercise test on a treadmill to determine maximal oxygen consumption (VO_{2max}), 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 encourage to complete S1 and S2 as fast as possible, while performing as many repetitions as possible in S3. Pulmonary gas exchange (VO2, VCO2, VE) were measured during each session. **RESULTS**: The mean VO_{2max} was 55.9±5.6 mL/kg/min with GET and RCP representing 61% and 79% of VO_{2max}, respectively. The average time to complete S1 was 513±59s and elicited a mean $\%\dot{V}O_{2max}$ of 70±7% that was not different from GET or RCP (p>0.05). S2 required on average 783±79s to complete, with a mean $\%\dot{V}O_{2max}$ of 82±7% of $\dot{V}O_{2max}$ that was significantly higher than GET (p<0.05), but not different compared to RCP (p>0.05). Mean $\%\dot{V}O_{2max}$ across S3 was 66±6%, however the average $\%\dot{V}O_{2max}$ was significantly higher than GET (p<0.05) at minutes 2-8, but not different at any other interval and was not different compared to RCP (p>0.05). Furthermore, $\dot{V}O_2$ demonstrated significant oscillations during all sessions (p<0.05). **CONCLUSIONS**: Participants with HIFT experience who completed sessions as quickly as possible or performed as many rounds as possible elicited an oxygen consumption from 66-82% of $\dot{V}O_{2max}$. Moreover, the oscillating $\dot{V}O_2$ during HIFT suggests that metabolic demands, which ranged from 46-92% of $\dot{V}O_{2max}$ within-subjects, do not achieve a steady-state. Previous work suggests that the oscillating $\dot{V}O_2$ response could be a potent stimulus for improving health and fitness characteristics.

2263 Board #276 June 1 3:30 PM - 5:00 PM

Characterization of Ventilatory Off-Kinetics Following Arm and Leg Cycling in Incomplete Spinal Cored Injured Men

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(No relationships reported)

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 (6.0) cm, Weight 75.9 (14.4) kg. CON: Age: 32 (4.6) years, Height: 178(3.6)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% $L \cdot min^{-1}$). V_E off-kinetics was analyzed over the 5 minutes following the 30% MVV bout using a mono-exponential model. Amplitude (Amp), in liters (L), was defined as the change from exercise to steady state of asymptote approaching baseline and tau(τ)(seconds) as the time taken to reach 63% of the of the end-recovery amplitude. **Results:** miSCI group: τ(s) and Amp(L) for arm and leg cycling were as follows: 67.9(9.8) and -20.5 (11.53), and 101.6 (19.5) and -23.4(14.5). The average arm τ was 33.7(29.27) faster than leg cycling with a 2.8(9.41) liter decrease in amplitude. CON group: τ(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), respectively. On average, arm τ was 33.39(16.5) seconds faster than leg cycling while the Amp was 5.8(3.29) liters lower. On average, τ was 11.19 and 11.50 s slower for arm and leg cycling, respectively when compared to CON. Amplitude was also lower with 22.8 and 25.8 liter difference in arm and leg cycling, respectively. **Conclusion:** The miSCI group reported a longer τ 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

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(No relationships reported)

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 $\dot{V}O_{2peak}$ (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. $\dot{V}O_2$-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**: $\dot{V}O_{2peak}$ 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. $\dot{V}O_2$ 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 $L \cdot min^{-1}$, p<0.05). $\dot{V}O_2$-power slopes were different between conditions (p<0.05), but not when EE-power slopes were analyzed. The $\dot{V}O_2$-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 $L \cdot min^{-1}$, p<0.05). The same results were found for EE-power intercepts. V_E, 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 recreationally active non-cyclists. For both groups, energy cost returns to baseline values within 20 minutes. No change in the EE-power slope and a greater 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.

2265 Board #278 June 1 3:30 PM - 5:00 PM

Do Training Masks Enhance Oxygen Utilization Capacity?

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(No relationships reported)

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 levels 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 +8.974% change in hematocrit while the masked group had a decrease in hematocrit of 1.194% 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.

2266 Board #279 June 1 3:30 PM - 5:00 PM

High Intensity Interval Training (HIT) Increases Muscle Deoxygenation During Ramp Incremental Exercise.

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(No relationships reported)

Endurance exercise training increases whole-body maximum O_2 uptake (Vo_{2peak}) by increasing both convective and diffusive O_2 conductances within the active muscles. High intensity interval training (HIT) very effectively increases Vo_{2peak} but it is unknown whether HIT enhances muscle O_2 diffusive properties.
PURPOSE: We investigated the effect of HIT on deoxygenated hemoglobin and myoglobin (Hb+Mb) concentration (HHb, reflecting fractional O_2 extraction) and total Hb+Mb concentration (tHb, reflecting diffusive O_2 potential) in quadriceps during ramp-incremental cycling (RI) 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 RI to exhaustion pre- and post-intervention. Vo_2 was measured breath-by-breath. Absolute HHb and tHb were measured in the *vastus lateralis* (VL) and *rectus femoris* (RF) by TRS-NIRS. HHb and tHb profiles were modeled by a double linear response ($y_1 = m_1 * x + b_1$, $y_2 = m_2 * x + b_2$, $y = if\ [x < IP, y_1, y_2]$, where m_x is the slope of heme chromophore accumulation above and below an inflection point, *IP*).
RESULTS: Vo_{2peak} increased in TR (48.9±4.6 vs. 52.7±5.3 $ml \cdot kg^{-1} \cdot min^{-1}$, $p < 0.05$) but not in CN (46.1±8.9 vs. 45.2±10.1 $ml \cdot kg^{-1} \cdot min^{-1}$). The amplitude of HHb from rest to intolerance increased only in TR, in both the VL and RF muscles (29.5±13.5 vs. 34.8±13.7 µM, mean of both sites, $p < 0.05$). In contrast, post-training tHb amplitude was unchanged in both groups and both muscles. Moreover the slopes (m_1, m_2) of HHb and tHb were unchanged between pre- and post-intervention in either group or muscle.
CONCLUSIONS: Five weeks of HIT increased Vo_{2peak} and regional (VL and RF) muscle deoxygenation without altering HHb slope or peak tHb - reflecting a gain of O_2 flux to active muscle with an unchanged O_2 delivery to utilization matching during submaximal exercise and an unchanged diffusive O_2 potential. This supports the notion that greater muscle O_2 consumption following HIT in young adults occurs by the improvement of O_2 extraction capacity without an obligatory [Hb]-induced enhancement of diffusive O_2 conductance. Supported by JSPS-15K16476, 24247046, 26560362.

2267 Board #280 June 1 3:30 PM - 5:00 PM

Relationship Between SMO2 Measured By NIRS And VO2 During Severe Intensity Intervals Of Running

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(No relationships reported)

Near infrared spectroscopy (NIRS) has been shown to be a non-invasive wearable alternative to measured blood oxygenation levels. PURPOSE: The purpose was to determine whether a significant relationship exists between SMO2% and VO2 during the last two stages of treadmill interval testing past LT1. METHODS: Five volunteer members of a collegiate cross country team, (2 male, 3 female, 18.6+1.5 years, 169.4+10.9 cm, 61.3+7.8 kg) completed a maximal effort stepwise test to volitional exhaustion. Each subject was fitted with a calf sleeve containing the BSX NIRS Insight device, a ventilatory mask connected to the COSMED system, and a heart rate monitor. After a 5 minute recovery pace warm up, the subject ran four minute intervals, each increasing 0.4 mph in pace, with a one minute standing recovery period between each four minute stage. After blood lactate levels increased 1.5 millimoles from baseline levels, the final stage consisted of one-minute periods with the incline increased by 1 percent each minute, until volitional exhaustion ending the test. RESULTS: A Pearson correlation coefficient was calculated for the relationship between each participant's SMO2% and VO2 during the final ramp stage, the 4 minute stage preceding the ramp stage, and for those two stages combined. A strong negative correlation was found for each participant's total rest data, ranging from r = -0.660 to -0.925, and an average +/- standard deviation of -0.852+0.110. All correlations were significant at p<.01, indicating a significant linear relationship between the two variables. CONCLUSIONS: The study suggests that the BSX Insight device is a valid option for non-invasively measuring SMO2% during ventilatory maximal interval training. Given that the study concentrated on elite runners, further testing would need to be done to generalize the results to a larger population.

Pearson Correlation SMO2 vs. VO2		
Subject	Pearson Correlation	P value
1	-0.890	p<.01
2	-0.867	p<.01
3	-0.919	p<.01
4	-0.925	p<.01
5	-0.660	p<.01
Mean	-0.852 ± 0.110	* all values significant

2268 Board #281 June 1 3:30 PM - 5:00 PM

Relationship Between SMO2 Measured By NIRS And VO2 During Recovery Periods Of Running

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Near infrared spectroscopy (NIRS) has been shown to be a non-invasive wearable alternative to measure blood oxygenation levels. PURPOSE: The purpose was to determine whether a significant relationship exists between SMO2% and VO2 during recovery periods of treadmill interval testing. METHODS: Six volunteer members of a collegiate cross country team, (3 male, 3 female, 18.8+1.5 years, 171.6+11.1 cm, 63.0+8.1 kg) completed a maximal effort stepwise test to volitional exhaustion. Each subject was fitted with a calf sleeve containing the BSX NIRS Insight device, a ventilatory mask connected to the COSMED system, and a heart rate monitor. After a 5 minute recovery pace warm up, the subject ran four minute intervals, each increasing 0.4 mph in pace, with a one minute standing recovery period between each four minute stage. After blood lactate levels increased 1.5 millimoles from baseline levels, the final stage consisted of one minute periods with the incline increased by 1 percent each minute, until volitional exhaustion ending the test. RESULTS: A Pearson correlation coefficient was calculated for the relationship between each participant's SMO2% and VO2 during each one minute recovery period and for all the rest periods combined. A strong negative correlation was found for each participant's total rest data, ranging from r = -0.518 to -0.949, and an average +/- standard deviation of -0.772 +/- 0.158. All correlations were significant at p<.01, indicating a significant linear relationship between the two variables. CONCLUSIONS: The study suggests that the BSX Insight device is a valid option for non-invasively measuring SMO2% during ventilatory recovery. Given that the study concentrated on elite runners, further testing would need to be done to generalize the results to a larger population.

Pearson Correlation SMO2 vs. VO2		
Subject	**Pearson Correlation**	**P value**
1	-0.763	P<0.01
2	-0.711	P<0.01
3	-0.928	P<0.01
4	-0.949	P<0.01
5	-0.518	P<0.01
6	-0.764	P<0.01
Mean(SD)	-0.772 ± 0.158	* all results significant

2269 Board #282 June 1 3:30 PM - 5:00 PM

The Effect Of Stride Frequency On Running Economy In Collegiate And Recreational Runners

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Running economy (RE) is often a good predictor of running performance among athletes with a similar VO_2 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 VO_2 max. Subjects completed 5 bouts of running for 5 minutes at their preferred stride frequency (PSF), ±5%, and ±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 VO_2 differences in collegiately trained runners were significant ($p < 0.05$) in all but one of the trials (-5% of SF) where $p = 0.07$. There was a U-shaped relationship that was observed between SF and running economy in collegiate runners, where any variation above or below PSF resulted in a decrease in RE. In all cases, however, the collegiately trained runners' PSF corresponded to what was most economical. Recreational runners saw mean VO_2 differences that were only 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 from an increase in SF.

2270 Board #283 June 1 3:30 PM - 5:00 PM

Comparison Of Energy Expenditure Between Continuous Walking And Very Short-Bouts Of Intermittent Walking

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Since the 1995 physical activity guidelines, a number of studies investigated as to whether a single bout of continuous exercise and several intermittent (i.e. accumulated) bouts of exercise produced the same physiological responses and health benefits. Various studies focused on walking and compared the physiological responses between a single bout of continuous walking and during multiple 10-min bouts of intermittent walking. However, no study investigated the energy expenditure (EE) accumulated during very short bouts of intermittent walking (e.g., 30 s), which would better match with the daily life walking pattern. **PURPOSE:** to compare EE accumulated during a continuous walking exercise (CW) and during an intermittent walking exercise (IW) including very short bouts of walking. **METHODS:** Ten healthy young adults (F/M: 5/5; 22±1 years; 67.9±8.2 kg; 176±8 cm) performed, in a counter-balanced randomized order, two treadmill walking trials of 20 min each: i) Trial A: one 10-min bout of CW followed by a 10-min recovery bout in standing position; ii) Trial B: twenty 30-s walking bouts (20 x 30 s = 10 min) interspersed with twenty 30-s recovery bouts in standing position. For both walking trials, subjects walked at the same absolute intensity on a motorized treadmill: speed of 5.5 km/h and 0% grade. EE (kcal) was calculated from gas exchange measured using a portable metabolic system ($K4b^2$). **RESULTS:** the EE accumulated during the 10-min single bout of CW (54.72±8.87 kcal) was significantly higher than the EE accumulated during the twenty 30-s recovery bouts of the IW (43.37±10 kcal; P<0.05). The EE accumulated during the 10-min recovery bout following CW (21.13±6.58 kcal) was significantly lower than the EE accumulated during the 20 recovery bouts of IW (38.50±9.42 kcal; P<0.05). No difference was found between the whole continuous and intermittent walking trials regarding total EE (78.97±14.58 kcal *vs.* 82.15±19.08 kcal respectively, P=0.185). **CONCLUSION**: A low absolute intensity intermittent exercise of walking, including bouts of very short-duration, enables young adults to reach a similar total EE as during a continuous walking exercise. While additional studies are needed, this study opens interesting applications not only in healthy subjects but also in very deconditioned or functionally-impaired subjects.

2271 Board #284 June 1 3:30 PM - 5:00 PM

Submaximal Predictions for Maximum Heart Rate and Maximal Oxygen Uptake from a Dynamical System Model

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Cardiopulmonary exercise testing (CPET) is the gold standard method for assessing maximum heart rate (HR_{max}) and maximal oxygen uptake (VO_{2max}). However, performing a CPET is not always practical or feasible. Alternative methods that utilize submaximal protocols and non-exercise regression models have been developed to estimate HR_{max} and VO_{2max}. However, these methods fail to account for inter-individual variability and are associated with a large degree of uncertainty and error. **PURPOSE**: The aim of this study was to develop a novel method for estimating HR_{max} and VO_{2max} that applies a dynamical system model to data collected from a submaximal exercise protocol. The dynamical system model accounts for the nonlinear dynamics and inter-individual aspects of the heart rate and oxygen uptake responses. **METHODS**: Twelve regularly exercising healthy adult males performed a CPET on a cycle ergometer to determine their true HR_{max} and VO_{2max}. Participants then performed a submaximal bout of exercise, and the dynamical system model was applied to the time series data in conjunction with a heuristic parameter estimation algorithm to estimate the participants' HR_{max} and VO_{2max}. **RESULTS**: The submaximal dynamical system model predictions were compared to the true maximal values for HR_{max} ($R^2 = 0.96$, SEE = 2.4 bpm) and VO_{2max} ($R^2 = 0.93$, SEE = 2.1 mL/kg/min). **CONCLUSIONS**: A dynamical system model that accounts for nonlinear dynamics and inter-individual physiological aspects can provide accurate submaximal predictions for HR_{max} and VO_{2max}. Supported by the ARO through an NDSEG Fellowship.

2272 Board #285 June 1 3:30 PM - 5:00 PM

Single Sprint Interval Training Session Induces Faster VO2 Kinetics that is Sustained for 72 Hours

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The VO_2 kinetics response describes the rate of adjustment of the oxidative phosphorylation, providing an overall estimate of the efficiency of the cardiovascular system. Recent lines of evidence have demonstrated that, at least in young individuals, VO_2 kinetics can become faster even after only a single session of endurance training, likely due to improvement in the provision of oxygen (O_2) to the active tissues. Additionally, sprint interval training (SIT) has been shown to induce positive adaptations in oxidative metabolism. However, the effects of an acute bout of exercise, and more specifically SIT, in the VO_2 kinetics response of older individuals are unknown. **PURPOSE:** to investigate whether a very short session (3 bouts) of Sprint Interval Training (SIT) induces speeding of the VO_2 kinetics in older participants. **METHODS:** Before, as well as 24, 48, and 72 hours post SIT exercise intervention, the time-constant of the VO_2 kinetics response (τVO_2) was measured in eight older adults (67.3 ± 3.7 years; 21.5 ± 2.4 BMI) through three step transitions in work rate (WR) from 20 W to a moderate-intensity WR that elicited a VO_2 corresponding to 90% of the gas exchange threshold. The SIT session consisted of 3 consecutive "all-out" sprints (Wingate protocol) against a resistance corresponding to 5% of the body weight, interspersed by 4.5 min recovery. **RESULTS:** The average mean power throughout the three Wingate sprints was 366 ± 74 W, while the average peak power was 602 ± 106 W, and the average total work was 22.0 ± 4.4 $kJ \cdot min^{-1}$. τVO_2 at the baseline was 41.8 ± 5.9 s. Significantly ($p < 0.05$) smaller values in τVO_2 kinetics were found 24 h (35.0±4.9 s; -16.2%), 48 h (35.5±3.4 s; -15.1%), and 72 h (37.2±7.2

s; -10.9%) post SIT intervention. **CONCLUSIONS:** This study demonstrated that a "low-volume" SIT session has the potency to speed the rate of adjustment of the oxidative phosphorylation in older adults. Despite the low dose of exercise, the speeding of the VO_2 kinetics occurred within 24 h and was sustained for 72 h, reinforcing the idea that SIT offers beneficial effects to the oxidative system, and that older individuals are capable of favorably adapting to this type of interventions.

2273 Board #286 June 1 3:30 PM - 5:00 PM

VO2, RER, And Heart Rate During Recovery Following A Whole-body High-Intensity And Moderate-Intensity Workout

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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 VO_2 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 a 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 thrusters (men 75lbs/women 55 lbs) and 10 burpees over the barbell, on separate days. VO_2 and RER were measured using indirect calorimetry immediately following each exercise and throughout recovery until VO_2 and RER returned to pre-workout levels. Heart rate was continuously monitored. Differences in time to return to baseline for VO_2 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 VO_2 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 VO_2 recovery (8.2+1.6 min after rowing vs. 22.3+7.7 min after WB HIIT, $p<0.001$). **CONCLUSION**: RER and VO_2 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 VO_2 during the workout, so future research should use equipment that would allow for testing VO_2 during WB HIIT exercise so that EPOC can be accurately calculated.

2274 Board #287 June 1 3:30 PM - 5:00 PM

Excess Post-Exercise Oxygen Consumption Following Bouts of Moderate and Vigorous Climbing

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PURPOSE: It has been observed that sustained, steady-state, rock climbing elicits a mean oxygen consumption (VO2) of 20-25ml•kg^{-1}•min^{-1} and VO2 remains elevated into the post-climb recovery period for as much as 10-min (1). To our knowledge, the extent of metabolic recovery time has not been examined following vigorous climbing activity. The purpose of this investigation was to compare excess post-exercise oxygen consumption (EPOC) following bouts of rock climbing at moderate intensity and vigorous intensity.
METHODS: Ten experienced climbers (male=7, female=3, age: 24.5±5, height: 177.4±8.4cm, mass: 70±11.25kg) performed 15min of seated rest to obtain baseline VO2 measures, followed by an indoor rock-wall climb at a self-regulated moderate pace for 10min while connected to the Cosmed k4b2 portable metabolic analyzer. Recovery VO2 was recorded for 15min immediately following the climb. A climb of maximal effort was then conducted across the same distance covered in the steady-state climb and VO2 was recorded for 15min immediately following the maximal climb. All testing was performed in the morning between 0600-1000h. EPOC duration and the magnitude were calculated for both climbs. A within-subjects dependent paired-samples t-test was used for data analysis ($p\leq0.05$).
RESULTS: Significance was observed for EPOC magnitude (steady-state = 65.93±25.32 mL O2, maximal effort = 85.88±23.24 mL O2, p=0.23). No significance was observed among duration of EPOC (steady-state = 11±2.75 min, maximal effort = 12.6±2.76 min, p=0.129). The time of completion for the maximal climb was 22% faster than the steady-state climb (7:47.3min±0.002).
CONCLUSIONS: A 23% increase in oxygen post-exercise was observed in the rapid trial despite being completed 22% faster (7:47min±0.002). Our results extend the noted increase in EPOC with rising intensity to climbing activities.

2275 Board #288 June 1 3:30 PM - 5:00 PM

Transitioning To Minimalist Footwear To Improve Running Economy: A Randomized Controlled Trial.

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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 24.34 ± 2.9 kg/m^2 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 increase of the new footwear (CF *or* MF) by 5% of weekly mileage per week. Before and after the intervention a VO_2max test and seven days apart a submaximal RE test at 70%, 80% and 90% of vVO_2max 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 222.4 to 217.5 mL·kg^{-1}·km$^{-1,}$ (p=0.0479) for running in MF at 90% of vVO_2max. 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}·km^{-1}, p=0.0186) and 90% (from 222.9 to 217.9 mL·kg^{-1}·km^{-1}, p=0.02) of vVO_2max. 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: I**n 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.

2276 Board #289 June 1 3:30 PM - 5:00 PM

Strong Association Between Cardiorespiratory Fitness and Lipoprotein Subclass Pattern in Prepubertal Healthy Children

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Both serum lipoprotein subclass pattern and cardiorespiratory fitness (CRF) are strong predictors of cardiovascular (CV) health in adults. By means of chemical measurements techniques and multicomponent data analysis more detailed descriptions of lipoprotein distributions can now be acquired. These sophisticated methods allow for a better understanding of how CRF impacts CV health through its association to lipoprotein pattern. **Purpose:** Determine the association between lipoprotein subclass pattern and CRF in prepubertal children by using a combination of sophisticated chemical measurements techniques and multicomponent data analysis. **Methods:** Serum concentrations of lipoprotein subclasses were quantified in 94 (64% boys) ethnic rural Norwegian 10-year-old children. Twenty-four lipoprotein features were used as input to multivariate regression analysis to investigate the underlying pattern describing CRF. CRF was measured in two ways: 1) directly by a peak oxygen consumption (VO_{2peak}) test using a continuous running to exhaustion treadmill protocol, 2) indirectly by the 10-minute Andersen intermittent field test. Predictive cross-validated multivariate regression models, including BMI and sex, were obtained for both CRF measures. **Results:** CRF correlated positively to average particle size for high-density lipoprotein (HDL) and its subclasses of large HDL particles and

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 both measures of CRF, but exhibited a stronger association with VO_{2peak} than to the Andersen test. **Conclusions:** Our data showed a strong association between CRF (both the VO_{2peak}-test and the Andersen-test) and lipoprotein pattern in prepubertal healthy children, and this adds to the understanding of CRFs as a good measure of children's CV health. Furthermore, the Andersen test showed even stronger association to children's lipoprotein pattern compared to the VO_{2peak}-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

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During heavy exercise intensity exercise (above lactate threshold (LT)), a higher O_2 cost than predicted by VO_2-work rate relationship for exercise below LT occurs which has been termed, the oxygen uptake (VO_2) slow component (VO_2SC). Interestingly, a decrease in the overall VO_2 response during heavy intensity intermittent versus continuous heavy intensity exercise has been previously reported. However, intermittent exercise results in less total work being performed and perhaps muscle activation, which may affect the amplitude of the VO_2SC. **Purpose:** To examine the magnitude of the VO_2SC 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 VO_2 and LT (Δ50%). In the INT condition, 3 s 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 Δ50%) which resulted in the same total work (i.e. area under the work curve) performed in CON. Pulmonary VO_2 was recorded breath-by-breath, while muscle activation (vastus medialis (VM), vastus lateralis (VL)) was assessed by surface electromyography (EMG). **Results:** The phase II τVO_2 (CON: 24.6 ±10.8 s; INT: 25.0 ± 4.5 s) and VO_2SC, as measured by $\Delta VO_{2(6-3)}$ (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 $\Delta EMG_{(6-3)}$ 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 VO_2 was similar (CON: 3258 ± 648 mL/min; INT: 3239 ± 682 mL/min, p>0.05) and absolute exercise WR was lower (p<0.05) for CON (203 ±56 W) than INT (262 ± 80 W), the VO_2/WR relationship was higher (p<0.05) for CON (16.0 ± 2.0 mL/min/W) compared to INT (12.8 ± 1.3 mL/min/W). **Conclusion:** While considerably different absolute WRs were necessary to achieve the same total work performed, the similar VO_2SC and muscle activation, but lower VO_2/WR relationship for INT versus CON suggests that brief periods of recovery significantly alter the O_2 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

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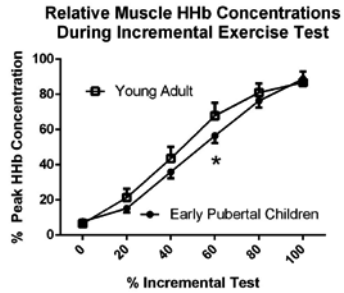
The mechanisms regulating O_2 delivery and utilization during endurance exercise differ with maturation and are incompletely understood. This is important to understand the development of cardiovascular and neuromuscular diseases that originate early in life. Time-resolved near-infrared spectroscopy (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 F; 7-11 years) and 15 young adults (7 F; 21-35 years) underwent an incremental ramp exercise test on a cycle ergometer. Pulmonary gas exchange was measured breath-by-breath (Vmax, Carefusion). *Vastus lateralis* [HHb] was quantified by TRS-NIRS (TRS-21, Hamamatsu Photonics).
RESULTS: Peak VO_2 was not different between children and adults normalized to body mass (46.7±8.1 vs. 48.9±7.7 mL/min/kg). Absolute [HHb] was not different between children and adults during unloaded pedaling (23.5±5.5 vs 26.8±10.0 uM, p=0.20) but adults had a higher peak exercise [HHb] (32.0±8.2 vs 44.4±22.6 uM, 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±10% vs 68±13%, p=0.0006), while VO_2 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 VO_2. This is consistent with a closer matching of muscle microvascular O_2 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.



2279 Board #292 June 1 3:30 PM - 5:00 PM

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±2y, height:168±11cm, mass:74.7±18.6kg, 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 VO_2 (rVO_2; ml/kg/min) and energy expenditure post-exercise. When comparing pre-RMR to EPOC there was a significant difference at minute 15 in both rVO_2 (p<0.02) and caloric expenditure (p<0.05). Yet, there was no significant difference in both rVO_2 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.

2280 Board #293 June 1 3:30 PM - 5:00 PM

Effects Of Prolonged, Fatiguing Exercise On Critical Power: Reliability And Physiological Characterisation

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The critical power (CP) is an important parameter of aerobic fitness and a strong predictor of endurance performance. Establishing how prolonged, fatiguing exercise may influence the CP is important for accurate performance prediction. **PURPOSE:** To assess the reliability of the CP in a fatigued state established using a 3-min all-out

cycling test (3MT), and to assess the effects of fatigue on CP. **METHODS:** Subjects in Study 1 (n=6, 31 ± 6 yr, 76.8 ± 6.7 kg) and Study 2 (n=9, 29 ± 11 yr, 75.9 ± 7.1 kg) completed a ramp incremental test, a control 3MT test (C-3MT) and a 3MT immediately following 2 h of heavy-intensity constant work-rate (CWR) cycling (F-3MT). In Study 1 subjects performed the F-3MT condition twice. In Study 2 subjects completed 2 h of heavy exercise immediately followed by CWR exercise to exhaustion at 15 W above and below CP measured in F-3MT. Oxygen uptake (VO2) and blood [lactate] were measured during all tests. **RESULTS:** In Study 1, CP estimates from repeated F-3MTs were not different (test 1: 273 ± 52 W vs test 2: 276 ± 58 W; P >0.05), with an intraclass correlation coefficient of r=0.99 (P<0.05) and typical error of 5 W (2%). In Study 2, CP was lower in the F-3MT (282 ± 52 W) compared to C-3MT (306 ± 56 W; P<0.05). Four of nine subjects completed 30 min of exercise below F-3MT CP with sub-maximal steady state VO2 and blood [lactate] profiles, whereas five subjects exhibited steady state VO2 but non-steady state blood [lactate] and reached exhaustion in ~9-18 min. Subjects reached exhaustion in ~4-22 min when exercising above F-3MT CP. The VO2peak and end-exercise blood [lactate] were not different between exercise bouts performed above (4.05 ± 0.41 $L \cdot min^{-1}$) and below F-3MT CP (3.93 ± 0.50 $L \cdot min^{-1}$) but the VO2peak values were lower than the VO2max in the ramp incremental test (4.33 ± 0.52 $L \cdot min^{-1}$) (both P<0.05). **CONCLUSION:** The CP estimated in a 3-min all-out test evidenced high reliability in a fatigued state. We found that exercise in close proximity below the CP in the fatigued state was not sustainable beyond ~18 min and did not exhibit steady state blood [lactate] profiles. The VO2 responses during exercise above and below CP were characterised by inability to attain the same VO2max as in the rested state. These findings suggest that the well-characterised physiological definition of the CP is altered under conditions of extreme fatigue.

2281 Board #294 June 1 3:30 PM - 5:00 PM

Priming Exercise Speeds VO2 Kinetics and Increases Critical Power During Supine but not Upright Cycling

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(No relationships reported)

Critical power (CP) is a fundamental parameter in defining high-intensity exercise tolerance, however its physiological determinants are unclear. CP has been shown to correlate with the phase II time constant (τ) of oxygen uptake (VO_2) kinetics, however causative evidence confirming this effect is lacking. A prior bout of high-intensity "priming" exercise speeds τ in the supine, but not upright, position; therefore, if τ is causally related to CP priming exercise would be expected to increase CP in the supine but not upright position. **PURPOSE**: To determine the impact of priming exercise on τ 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 VO_2 max and the gas exchange threshold. This was followed by 8 visits whereby CP, pulmonary VO_2 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 s; P < 0.001) and increased CP (CON: 177 ± 31 vs. PRI: 185 ± 30 W; P = 0.006) compared to control. However, priming exercise had no effect on τ (CON 35 ± 8 vs. PRI 37 ± 11 s; 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 s; P = 0.003) but not upright (CON: 10 ± 5 s vs. PRI: 14 ± 10; P = 0.10) position. **CONCLUSIONS**: The present study provides the first experimental evidence that VO_2 kinetics are an important determinant of CP. Specifically, priming exercise resulted in a concomitant speeding of VO_2 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 O_2 availability.

2282 Board #295 June 1 3:30 PM - 5:00 PM

Fatigability And Vo2 On-kinetics In Adults With Incomplete Spinal Cord Injury

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(No relationships reported)

It has been reported that, in people with spinal cord injury (SCI), prolonged VO_2 on-kinetics may contribute to fatigability and exercise intolerance. **Purpose:** Examine the relationship between fatigability and VO_2 on-kinetics in incomplete SCI (iSCI) during self-selected treadmill walking. **Methods:** Eight participants (age: 38.4 ± 17.8 years; gender: 7 male, 1 female; BMI: 25 ± 4.5 kg/m^2) classified with iSCI C & D according to the American Spinal Injury Association Impairment Scale (AIS) and eight able-bodied participants (age: 34.6 ± 11.3 years; sex: 7 male, 1 female; BMI: 26 ± 4.2 kg/m^2) were enrolled in the study. Fatigability was calculated as the ratio of perceived fatigability and performance fatigability. Perceived fatigability was measured using a perceived fatigability scale while performance fatigability was determined during constant work-rate treadmill test to exhaustion or 30-minutes, whichever came first, at preferred walking speed. VO_2 on-kinetics was determined using a mono-exponential model in which a time constant (τ) and amplitude (AMP) was calculated during phase 2 of the biphasic kinetic response. Differences in fatigability and VO_2 on-kinetics between the groups were analyzed using Student's t-test. Pearson product correlation was used to determine the relationship between fatigability and VO_2 on-kinetics. Statistical significance was set at p<0.05 for two-tailed hypotheses. Values are expressed as means ± SD. **Results:** The iSCI group demonstrated greater fatigability compared to the able-bodied group (6.62 ± 4.86 vs 1.87 ± 0.98; p=0.017). Performance fatigability was also higher in the iSCI group compared to the able-bodied group (1153 ± 529 vs 1800 seconds; p=0.011). iSCI group had a significantly greater τ (41.2 ± 7.7 vs 23.3 ± 6.5; p<0.0001) with no difference in AMP between groups (613 ± 128 vs 745 ± 174 ml/min; p=0.106). Fatigability was significantly correlated with τ (r=0.56; p=.024). **Conclusion:** Individuals with iSCI in this study demonstrated higher levels of fatigability as determined by both perceived and performance fatigability, and prolonged VO_2 on-kinetics compared to able-bodied individuals. Furthermore, the observed relationship between fatigability and VO_2 on-kinetics suggest τ may be a biomarker of fatigability during treadmill walking in adults with iSCI.

2283 Board #296 June 1 3:30 PM - 5:00 PM

Attenuation of the Oxygen Uptake Slow Component During Intermittent Compared to Continuous Heavy Intensity Exercise

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(No relationships reported)

During constant load exercise at intensities above the lactate threshold, an additional increase in oxygen uptake (VO_2) of delayed onset, termed the VO_2 slow component (VO_2SC), becomes readily apparent. Results of a previous study have shown a considerable decrease in the overall VO_2 response to high intensity exercise when the exercise bout is interrupted by intermittent periods of recovery. However, the extent that the addition of the brief recovery periods, which began at the onset of exercise, affected the magnitude of the VO_2SC remains unclear. **Purpose:** The purpose of this study was to examine the magnitude of the VO_2SC in response to heavy intensity continuous (CON) and intermittent (10 s work: 3 s recovery (INT)) exercise when the on-transition (i.e. phase II response) was unaltered by intermittent recovery periods. **Methods:** Five healthy males (27.0 ± 2.8 yrs, (±SD)) performed heavy intensity exercise, each bout lasting 6 minutes with 6 minutes of recovery, at an intensity of 50% of the difference between peak VO_2 and lactate threshold (Δ50%). To control for phase II kinetics, exercise was performed for 6 min for CON and the first 3 minutes for INT. In the INT condition, 3 s recovery intervals (20 W) were inserted every 10 s for the last 3 min of exercise. Pulmonary VO_2 and minute ventilation (V_E) were recorded breath-by-breath using a metabolic measurement system, while heart rate (HR) was recorded using a 3 lead electrocardiogram (ECG). Phase II VO_2 responses (time constant, τVO_2) were analyzed using either a 2 or 3 component exponential model after interpolating to 1 s and ensemble averaging each trial. **Results:** The τVO_2 was similar (CON: 30.3 ± 11.1 s; INT: 37.4 ± 14.9 s, p>0.05) as expected. The amplitude of VO_2SC, as measured by $\Delta VO_{2(6-3)}$, was decreased in the INT compared to the CON condition (-153 ± 216 mL/min vs. 522 ± 140 mL/min, p<0.05). $\Delta V_{E(6-3)}$ and $\Delta HR_{(6-3)}$ were decreased in INT (-4.8 ±11.8 L/min; -3 ± 7 bpm) compared to CON (18.4 ± 8.3 L/min; 15 ± 6 bpm), respectively (p<0.05). **Conclusion:** While phase II kinetics were similar between protocols, INT heavy intensity exercise led to a significant attenuation of the VO_2SC compared to CON exercise performed at the same WR. This may be due, at least in part, to a reduction in myocardial and respiratory work, as evidenced by the reduction in end exercise HR and V_E in the INT condition.

D-74 Free Communication/Poster - **Physical Activity Assessment in Adults**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2284 Board #297 June 1 2:00 PM - 3:30 PM

Prediction of Oxygen Uptake from Pedometer Output across Different Activities

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Pedometers may be used to estimate participation in physical activity (PA) of moderate-to-vigorous intensity. Step rate thresholds for moderate-to-vigorous PA varying by height 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 (VO_2) 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 women). They completed 8 activities each lasting 6 min: (a) sitting; (b) level walk at 2.5 mph; (c) walk at 3.5 mph and 5% grade; (d) jog at 5 mph; (e) moving a box between 2 carts 7m apart; (f) washing dishes; (g) ascending and descending a 20-step staircase; and (h) vacuuming. We measured VO_2 with a portable open-circuit spirometer and step rate with a pedometer (NL-1000, New Lifestyles) worn on the non-dominant hip. We used multi-level regression to predict VO_2, accounting for nesting of observations within participants. Possible predictors included step rate, step rate square, and height. Using VO_2 predicted from the model, we determined the absolute percent error across all activities combined and at each activity separately. Within-subject ANOVA was used to test differences in percent error across activities. **RESULTS:** Significant predictors of VO_2 were step rate and its square ($p \leq 0.001$; $R^2 = 0.72$), but not height. The prediction equation was $VO_2 = 7.6300 + 0.0872\times\text{step rate} + 0.0004\times\text{step rate}^2$. Absolute error across all activities combined was 29.4 ± 27.3%. Absolute error differed between activities ($p < 0.001$): (a) sitting, 66 ± 30%; (b) walk at 2.5 mph, 62 ± 25%; (c) walk at 3.5 mph, 11 ± 13%; (d) jog, 16 ± 17%; (e) moving box, 15 ± 14%; (f) washing dishes, 15 ± 15%; (g) stairs, 22 ± 8%; and (h) vacuuming, 29 ± 13%. **CONCLUSION:** Pedometer-determined step rate and its square are significant predictors of VO_2 across different activities and sedentary behaviors in healthy young adults. Height does not contribute to VO_2 prediction. Accuracy of prediction across activities is low to moderate.

2285 Board #298 June 1 2:00 PM - 3:30 PM

Zero Cadence as a Proxy Indicator of Sitting Behaviors in Objective Monitoring

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Consistent evidence has been presented regarding the potentially deleterious health consequences of prolonged sitting time independent of physical activity level. Zero cadence (0 steps/min) determined using accelerometers may be a suitable proxy measure of sitting behaviors since theoretically no steps should be registered in this position. **PURPOSE:** The purpose of the current study was to determine the capability of accelerometer-determined zero cadence to predict seated activities of daily living. **METHODS:** A total of 80 young adults (mean age 29.8±6.7 years), 10 men and 10 women representing each 5-year age-group category between 21-40 years (21-25, 26-30, 31-35, 36-40) performed lab-based simulated daily living activities (i.e., seated rest, watching a movie, computer work, folding laundry while standing, vacuuming, stair stepping and a self-paced over-ground walk) while concurrently wearing multiple (n=7) research-grade (e.g., ActiGraph, ActivPAL, ActiCal and StepWatch) and consumer-grade (e.g., Fitbit One and Vivofit2) accelerometers on manufacturer-indicated locations (i.e., hip, wrist, thigh or ankle). Receiver Operating Characteristic (ROC) analyses were conducted to examine the accuracy of zero cadence for classifying sitting behaviors (e.g., seated rest, watching a movie and computer work) among the performed activities. Sensitivity, specificity, accuracy and area under the ROC curve (AUC) values were compared for each device. **RESULTS:** All devices demonstrated the capability of using zero cadence to determine sitting activities with high combined sensitivity and specificity (e.g., ranges between 75-98%). AUC values of all devices were above 0.8 ($p<.001$) indicating good or excellent discrimination ability of zero cadence. Vivofit2 and wrist-worn ActiGraph provided the highest (93%) and lowest (75%) accuracy, respectively. **CONCLUSION:** In 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

2286 Board #299 June 1 2:00 PM - 3:30 PM

Effect of Wear Location on ActiGraph Activity Counts

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PURPOSE: Y-axis and vector magnitude (VM) counts of the ActiGraph accelerometer plateau at running speeds >10 km/hr, when worn on the hip. However, it is not known if counts plateau at other wear locations. This study examined if activity counts plateau with increasing running speed at alternative wear locations (wrist and ankle). **METHODS**: Participants (N=20) completed ten treadmill walking and running speeds (3-20 km/hr) for 30-s each with 30-s rest between speeds. Speeds 3-7 km/hr were walking and speeds 8-20 km/hr were running. An ActiGraph GT3X+ was 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 were 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. Asterisks indicate no significant increase in counts from the previous speed ($P>0.05$).

	Speed (km/hr)										
	3	5	7	8	10	12	14	16	18	20	R^2
Hip											
Y-axis	94	268	417	662	728	735*	707*	664*	604*	544*	0.43
VM	185	328	484	698	769	783*	761*	731*	690*	658*	0.53
Wrist											
Left y-axis	196	315	414*	1166	1388	1631	1888	2110	2439	2740	0.97
Right y-axis	199	293	395*	1253	1535	1791	2045	2260	2618	2906	0.96
Left VM	279	445	692	1604	1813	2068	2317	2524	2867	3197	0.95
Right VM	288	433	720	1702	1982	2262	2505	2711	3087	3383	0.95
Ankle											
Left y-axis	393	559	603	392*	618	861	1062	1259	1432	1673	0.92
Right y-axis	469	637	699	472*	687	943	1162	1132	1411	1640	0.92
Left VM	550	1037	1627	1959	2444	2911	3308	3673	4007	4242	0.98
Right VM	672	1143	1714	2050	2555	3069	3510	3906	4071	4419	0.98

CONCLUSION: When the ActiGraph is worn on the wrist or ankle the y-axis and VM counts 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.

2287 Board #300 June 1 2:00 PM - 3:30 PM

Device Settings Impact on StepWatch Accuracy during Running

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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. **PURPOSE**: To examine the step count accuracy of the StepWatch 3 at various running speeds by altering device settings. **METHODS**: Thirty participants aged 21.32±3.72 participated in the study. Participants completed

4-minute trials of treadmill ambulation at 6 different speeds ranging from 2.24 to 3.35 $m \cdot s^{-1}$ 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 $m \cdot s^{-1}$ ($p = .18$) and MAPE was < 3% (1.9). 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 $m \cdot s^{-1}$. 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 $m \cdot s^{-1}$, with the exception of device "Quick Step" setting at 2.24 $m \cdot s^{-1}$. 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.

2288 Board #301 June 1 2:00 PM - 3:30 PM

The Relationship Between Steps/min And Intensity On A Treadmill In 21-40 Year Old Adults

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The time-stamped sampling nature of accelerometry-based wearable technologies allows minute-by-minute study of step accumulation, and specifically cadence (steps/min). **PURPOSE**: Considering cadence has been strongly correlated with absolute 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/m^2) participated in a lab-based study of videotaped cadence and oxygen consumption (indirect calorimetry). 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 VO_2 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 for 6 METs was 131.4 (120.5-140.9) 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. NIH/NIA Grant 5R01AG049024-03 - CADENCE-Adults study.

2289 Board #302 June 1 2:00 PM - 3:30 PM

Validation Of Accelerometer-based Energy Expenditure Prediction Models In Structured And Semi-structured Settings

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Accelerometer-based physical activity monitors (AMs) and their associated prediction models are often validated in structured settings, but it is unclear if including AM data from less structured settings improves AM accuracy for free-living energy expenditure (EE) prediction.
PURPOSE: This study compared the accuracy of machine learning models developed to predict EE from AM data collected in structured and semi-structured settings.
METHODS: Twenty-four adults (age 45.8±19.4 y, 50% female) completed two sessions, performing 11-21 activities over 80-90 min protocols while wearing four AMs (right hip, ankle, and both wrists) and a portable metabolic system (EE criterion). Session 1 (V1, structured setting) involved performing 3 sedentary, 4 household, and 4 ambulatory activities for 5 min each, with activities selected by the research staff. Session 2 (V2, semi-structured setting) involved performing ≥4 sedentary, ≥4 household, and ≥4 ambulatory activities, with activity type, order, and duration chosen by participants. Artificial neural network EE prediction models were developed for each AM via a leave-one-out approach using three training methods, incorporating data from either one training setting (V1 or V2) or both settings (V1/V2). Model accuracy (r^2 and root mean square error [RMSE]) for EE prediction was evaluated in the semi-structured setting. Repeated measures ANOVA was used to assess differences in prediction accuracy among training methods.
RESULTS: The V1, V2, and V1/V2 training methods had r^2 ranging from 0.58-0.68, 0.55-0.70, and 0.60-0.72, respectively. The r^2 value for the V1 training method was significantly higher than the V2 method for the left wrist AM, and the r^2 values for the V1/V2 method were significantly higher than the other training methods for the hip and left wrist AMs ($p<0.05$). No differences were found among training methods for RMSE (1.17-1.28, 1.10-1.34, and 1.04-1.23 METs for V1, V2, and V1/V2 methods, respectively).
CONCLUSIONS: Developing prediction models using data from both structured and semi-structured data settings in a small improvement in EE prediction accuracy for particular monitor placements compared to using data from a single setting and should be considered when developing EE prediction models for AMs.
Supported by Ball State University ASPiRE grant.

2290 Board #303 June 1 2:00 PM - 3:30 PM

Physical Activity Assessment in African Americans: Modified International Physical Activity Questionnaire vs. Objective Measurement

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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 wore 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 alphas. 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 .88-.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.
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2291 Board #304 June 1 2:00 PM - 3:30 PM

Comparison of Objective and Subjective Sedentary Behavior

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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 objective and subjective 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 = .100; p = .518) and PPAQ (r = .317; p = .036), 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 PPAQ and OSPAQ 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.

2292 Board #305 June 1 2:00 PM - 3:30 PM

Indoor and Outdoor Distance Estimation for Accelerometer-Derived Proximity Data: A Simulation and Machine Learning Study

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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 RSSI. Three competing 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.

2293 Board #306 June 1 2:00 PM - 3:30 PM

Within-person Reliability Of Step-rate Cut-offs For Physical Activity Intensity

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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 (VO_2) and step-rate. This is based on the assumption that the relationship between VO_2 and step-rate across different activities is stable within people, but this has not been evaluated. **PURPOSE:** To examine if the relationship between VO_2 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. VO_2 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 VO_2 against step rate for each participant, we determined 5 variables: the slope, intercept, and R^2 of the relationship between VO_2 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 ($p > 0.05$). All ICCs were significant ($p \leq 0.023$). ICC was strong for the slope (0.80), but moderate-to-low for the intercept, R^2, and 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 49 steps·min^{-1}). **CONCLUSION:** The relationship between VO_2 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.

2294 Board #307 June 1 2:00 PM - 3:30 PM

Correlations between Objective and Subjective Instruments on the Measurement of Energy Expenditure in Older Adults

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PURPOSE: Many objective and subjective instruments have been developed to estimate energy expenditure (EE). However, the validity and correlations on these measurements are lacking especially in the older adult population. American Association of Retired Persons (AARP) questionnaire and Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire are common self-reported questionnaires. The purpose of the study was to examine which self-reported physical activity instruments correlated with objective data from ActiGraph accelerometers and fitness tests. We also compared outcomes from the above instruments with total EE (TEE) measured by the gold standard of doubly labeled water (DLW).
METHODS: Data sets were obtained from the Interactive Diet and Activity Tracking in AARP (IDATA) study through the National Cancer Institute. A total of 681 participants aged between 50-74 years were included in the analysis. The outcomes of our interest from each instrument were as follows: total number of steps and EE from ActiGraph, VO2 max from fitness test, activity EE (AEE) from CHAMPS and AARP, and TEE from DLW. Pearson's correlations were conducted to examine the relationships between objective and subjective measures.
RESULTS: The results showed that AEE from AARP was moderately significantly associated with VO2 max (r = .348) and EE from ActiGraph (r = .365). A weak but significantly positive relationship was also observed between AEE from AARP and steps from ActiGraph (r = .136). However, AEE from CHAMPS was only related to steps from ActiGraph (r = .172). No significant correlations were found between AEE from CHAMPS and the other objective measures. Each instrument was also compared to DLW. The strongest positive relationships with TEE from DLW were seen in EE from ActiGraph (r = .484) and VO2 max (r = .474). However, there was no significant association between AEE from CHAMPS and TEE from DLW, $p > .05$.
CONCLUSIONS: AEE from AARP appears to be the subjective instrument most positively associated with the objective instruments in older adults. Of all subjective

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 2:00 PM - 3:30 PM

Improved Count Based Metrics For Estimation Of Energy Expenditure With Waist Worn Actigraph

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Traditional methods for analyzing accelerometer activity counts rely on the assumption that there is a linear relationship between counts and increasing energy expenditure. However, this relationship varies depending on the type of activity being performed and intermittent activities can have a 2-3 fold higher energy cost then walking and running at the same count level. **PURPOSE**: This study explored the effects of using the 75th percentile of counts to characterize the relationship between counts and energy expenditure (EE) in an effort to make walking/running counts more comparable to counts from intermittent activities. **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 K4b^2 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 R^2 values. **RESULTS**: Across all activities, the y-axis mean counts and METs had a R^2 of 0.789, which was improved to a R^2 = 0.835 when using the 75th percentile of the y-axis counts. For the VM mean and 75th percentile count metrics, the R^2 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 2:00 PM - 3:30 PM

The Relationship Between Walking Cadence and Percentage of Maximum Heart Rate

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Previous studies report that walking cadence (steps/min) is strongly correlated with intensity measured using indirect calorimetry. **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/m^2) 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 with random effects to account for repeated measures was applied. Cadence cut points associated with moderate (64% of estimated HRmax) and vigorous (77% of estimated HRmax) intensity were calculated using the regression model. **RESULTS:** Over half of the variance in %HRmax was explained by cadence (i.e., R^2=0.54, least-squares bilinear 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 (106.9-149.04) and 146.3 (124.6-164) steps/min, respectively. **CONCLUSION:** Cadence explained over half of the variance in %HRmax, with ~130 steps/min and ~145 steps/min representing 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 2:00 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 kg/m^2) 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 calorimetry system. Constructed features included time and frequency domain variables, such as vector magnitude (VM) and its angle with the vertical axis, dominant frequency (DF), fractions of power by DF and human movement frequencies (i.e., 0.6 - 2.5Hz). Regression and classification methods were used to estimate metabolic equivalent score (METs) and detect sedentary behaviors, locomotion tasks, and intensities of activity.
RESULTS: The time and frequency features were capable of estimating METs (rMSE = 1.2 METs), activity intensity (accuracy > 80%), sedentary behavior (accuracy > 94%), 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/s^2) 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 detected (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.
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2298 Board #311 June 1 2:00 PM - 3:30 PM

Development and Validation of Universal Step Detection Threshold for Raw Accelerometer Data

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(No relationships reported)

PURPOSE: To develop a universal and computationally inexpensive algorithm for accurately detecting steps from GENEActiv 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 = 24.76±3.4 kg/m^2) 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). GENEActiv and ActiGraph GT9X accelerometers were worn concurrently on the right anterior-axillary line. For ActiGraph, 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 GENEActiv's Y-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 detected for each activity in a subsample (n=40, gender and age balanced) and used to 'train' the threshold. The threshold was developed by identifying the median of the peaks detected in the training dataset; which was then tested on the remaining sample (n=40). Mann-Whitney U nonparametric tests were used to compare mean step counts obtained from the ActiGraph, GENEActiv, and observed criterion in each activity. **RESULTS**: The threshold obtained from the training dataset (i.e., 0.0318 g) corresponded with 0.5 mph treadmill walking in 80% of the testing dataset. ActiGraph and GENEActiv step counts at treadmill speeds ≥ 2.5 mph did not differ, nor were they different than the criterion measure. The application of the thresholding technique to GENEActiv testing dataset resulted in significant improvements in step detection in both simulated activities of daily living and walking at slow speeds (0.5 ~ 2 mph)

(all p < .05) compared to the ActiGraph's proprietary algorithm. **CONCLUSIONS**: An approximate threshold based on the median amplitude of the acceleration peaks detected across a range of activities could serve as a universal data treatment technique to detect steps from raw accelerometer data with improved accuracy relative to the ActiGraph's proprietary algorithm.

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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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: "Is 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 analyses 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 an average each day (8 545 steps (most fit) vs. 3 168 steps (poor fitness), p<0.05), more light (1.5-3 MET: 3.3 h/day vs. 2.1 hours/day, p<0.05).), moderate (3-6 MET, 0.93 h/day vs 0.28 h/day, p<0.05) and vigorous (>6 MET, 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 h/day (most fit) vs. 8.1 h/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, but also 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

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(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 (2.0, 3.0, 3.5-4.0 miles*hr^{-1}) 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% [0.3]). 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 (16.7-36.1%, 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. Future 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

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(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 (accelerometery) 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 pilot work was conducted 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 wore 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 +0.58y. height = 149.5 +8.14 cm, weight = 45.3 + 13.44 kg). Intention was significantly correlated to both SR (r=0.679; p < 0.01) and AC (r=0.268; 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

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(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 GT9X 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/m^2) wore and removed an Actigraph GT9X 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 laboratory protocol was 93% and 49%, respectively. In the free-living protocol, the sensitivity and specificity of the wGT3X+BT and GT9X was 82% and 95%, and 72 and 90%, 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 inaccurately yield a higher rate of non-wear.

2303 Board #316 June 1 2:00 PM - 3:30 PM

A Decision-tree Model For Classifying Physical Activity Types Using A Three-axis Accelerometer In Japanese Adults

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(No relationships reported)

Accelerometry is a valid method for assessing physical activity in free-living conditions. Although there are numerous studies on estimating physical activity-induced energy expenditure (PAEE), classification of physical activity types using an accelerometer is not well established.
PURPOSE: To develop a physical activity classification model using a three-axis accelerometer in Japanese subjects
METHODS: Eleven healthy adults (age, 33.3±10.4 years) stayed in a human calorimeter for 23 hours and performed activities (sitting, standing, walking, lying down) while wearing a three-axis accelerometer (Actigraph-wGT3X-BT). Raw three-axis acceleration values were obtained at 30 Hz. Raw acceleration values were processed into five feature quantities: filtered acceleration values (FAC), raw acceleration values (RAC), absolute value of filtered accelerations (ABS), standard deviation of FAC (SD), and peak-to-peak of FAC (PP). A classification model was proposed using a decision tree and an 11-fold cross-validation method with time resolutions of 1, 5, or 10 seconds.
RESULTS: The classification model achieved the following accuracy levels for each time segment for all activities: 75.1% with 1-second segments, 76.1% with 5-second segments, and 77.7% with 10-second segments. Selected feature quantities in these models were RAC, ABS, and PP in 1-second segments; FAC, RAC, ABS, SD, and PP in 5-second segments, and FAC, RAC, and PP in 10-second segments. The classification model with a 10-second time resolution had better accuracy than with 5- or 1-second time resolution. The model's accuracy for each type of physical activity with 10-second segments was 80.6% for sitting, 59.6% for standing, 99.7% for walking, and 84.1% for lying down.
CONCLUSIONS: These results suggest that the decision tree is a valid method for physical activity classification in Japanese subjects. The addition of other features and classification methods, e.g., random forest, needs to be discussed in future studies.

2304 Board #317 June 1 2:00 PM - 3:30 PM

Moving Toward 24-hour Assessment: Validation Of PA Accelerometers For The Assessment Of Activity And Sleep

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Twenty-four hour accelerometer assessments create the opportunity for concurrent measurement of daily behaviors previously examined in isolation, including physical activity (PA), sleep, and sedentary behavior (SB), as well increasing device wear compliance and simplifying data capture. Evidence demonstrates that understanding how these behaviors make up the 24 hour day will help understand their compositional impact and interrelationships on health. This shift in research focus calls for the integration of methods to assess PA, SB and sleep to allow for the evaluation of overall 24-hour daily activity using a single device. Devices currently being used to assess daytime PA have not been substantially validated to evaluate sleep. **Purpose:** The objective of this study was to: 1) validate commonly used PA accelerometers using a gold standard polysomnography (PSG) test in a sample of older adults and; 2) to examine common sleep actigraphy data processing methods. **Methods:** Twenty-two subjects (50 to 75 years) were recruited for participation. Of them, 17 participants completed an in-home overnight PSG while concurrently wearing three PA accelerometers. Total Sleep Time (TST) and Sleep Efficiency (SE) were compared for each device against PSG. **Results:** Across devices mean TST ranged from 361.6 - 403.2 minutes. Mean SE estimates ranged from 86.9% (PSG) to 96.9% (hip-worn accelerometer). We found significant differences between TST measured with hip-worn accelerometers compared to PSG (p=0.03, paired t test). We did not find significant differences between TST estimated by PSG and wrist-worn accelerometers (ranged from 0.49- 0.94). For SE, we did not find significant differences between PSG and wrist-worn accelerometers, but found a significant difference between PSG and hip-worn sleep estimated SE (p< 0.001). **Conclusions:** When compared to gold standard PSG, PA wrist-worn devices worn on either wrist may be used to evaluate TST and SE. Further studies to investigate new algorithms to predict in bed and out of bed time and improve the assessment of sleep by PA devices seem warranted to advance the evaluation of sleep in addition to other 24-hour daily activity behaviors in both the clinical and population settings.

2305 Board #318 June 1 2:00 PM - 3:30 PM

Recognising Bone Loading Exercises In Older Adults Using Machine Learning

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(No relationships reported)

Machine learning has been used to accurately recognise physical activity patterns; however, classifiers for recognising targeted 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.

2306 Board #319 June 1 2:00 PM - 3:30 PM

Validation Of A Physical Activity Monitor As A Measure Of Energy Expenditure During A Circuit-style Workout With Females Who Are Overweight Or Obese

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While the SenseWear Armband has been validated for a variety of physical activities, it has not been validated with circuit-style exercise for individuals who overweight or obese. **PURPOSE:** The purpose of this study was to validate the SenseWear Armband for measuring energy expenditure in overweight or obese females during circuit-style training. **METHODS:** Overweight and obese females, $N = 40$, 20-59 years of age, completed a pre-recorded circuit-style exercise session consisting of eight exercises. An SenseWear Armband and portable metabolic analyzer were worn by each participant throughout the exercise session to measure energy expenditure. **RESULTS:** While the total overall energy expenditure between devices was not significantly different ($p = .882$), both energy expenditure excluding rest periods ($p < .001$) and rest periods between exercises ($p = .007$) were significantly different when the SenseWear Armband was compared to the portable metabolic analyzer. The SenseWear Armband overestimated exercise energy expenditure, but underestimated rest period energy expenditure compared to the portable metabolic analyzer. **CONCLUSION:** The results suggest females who are overweight or obese could use a SenseWear Armband to aid in tracking caloric expenditure with circuit-style training. However, care must be used if looking at individual exercise components.

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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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: 824 observations were analyzed (n=8; 5 female; 69±5.1 y; 169.1±5.2 cm; 69.5±12.5 kg) over a 20-minute Semi bout of activity (sit, stand, walk) while video recorded. Videos were analyzed by DO. An independent sample of 1499 observations were analyzed (n=5; 3 female, 71±5.1 y; 162.1±5.1 cm; 64.5±10.6 kg) during a three-hour bout of community-dwelling Free activity while a researcher performed DO. Both groups wore a WC placed at the sternum. WC images and DO were annotated independently for posture (sedentary, standing, movement), activity category (sedentary, walking, household, exercise/sport), and type (laundry, dishes, cooking, general cleaning). Cross tabs and Kappa statistics were run to assess accuracy between the WC images and the DO results 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 during the Semi and Free conditions, respectively. For activity category, there was 76.7% (Kappa=0.45; SE=0.10; p<0.0001) 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±47 vs. 199±50, z=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 827±333 for WC and 145±70 for DO, z=0.7459.
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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PURPOSE: Determine if the Total O_2 cost (TO_2) 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: 8 Ss, 6 female, volunteered. Ss underwent testing for VO_2Max, body composition, & 1-RM for Chest Press (CP) & Leg Press (LP). RI were 33, 50, & 75% 1-RM, with 22, 15, & 10 reps performed, respectively to control for volume of work during RE. RE consisted of: 5min Rest, followed by RE, & 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 K4b^2. 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±7.5, FatMass=13.8±7.5, LeanMass=51.5±7.7, VO_2max=46.4±8.4, RERmax=1.13±0.03, & HRmax=200±6.2. TO_2 cost was measured as the O_2 used during exercise & through 10min Post RERest using Integral estimation of breath-by-breath intervals. TO_2 cost during RE & 10 min Post RE Rest was significantly greater for LP when compared to CP at each corresponding RI: LP75-CP75 p=0.005, CI95%(6.72,13.58); LP50-CP50 p=0.003, CI95%(4.12,13.98); LP33-CP33 p=0.005, CI95%(1.81,7.33). TO_2 cost was significantly (p<0.02) greater for LP75 & LP50 when compared to LP33. TO_2 cost for CP was not significantly different at any RI. LP & CP RE times differed significantly for RI: LP75-50 p=0.000, LP75-33 p=0.001, LP50-33 p=0.016, CP75-50 p=0.007, CP75-33 p=0.000, CP50-33 p=0.002. TO_2 cost for LP75 & CP75 returned to Pre RE Rest at min 3.
CONCLUSIONS: Results suggest TO_2 cost is related to RE type, muscle mass activated, O_2 deficit incurred during RE, & O_2 debt repaid during recovery. Further, the O_2 cost during recovery from LP75 & LP50 is greater when compared to LP33 even though Work was held constant. This suggests factors other than the O_2 deficit contribute to the O_2 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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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 paucity of literature that report SD to predict EE in real time.
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 varied terrain paced by a metronome at 2.7 mph. EE was measured using a Cosmed K4b2 portable metabolic unit with each subject completing four trials per route. An integrated GPS receiver recorded latitude and longitude coordinates of each route. The modeling software STELLA was used to design the SD model which incorporates subjects' weight, walking pace, route elevation profile and distance. Pandolf'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 total EE as measured by the Cosmed K4b2 unit. A paired t-test comparing the actual versus the SD model predictions of total EE were not significantly different (p =.034).
CONCLUSION: It appears that SD modeling can be an effective tool to predict EE of individuals walking on varied 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 motivation 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

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Wrist-worn activity monitor market 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=48.4±12.5 yrs, ht=171.1±9.0 cm, wt=71.6±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 the counts. Pedometer 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±40.5, 29.1±47.8, 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±12.6, 8.9±12.8, 9.0±12.1, 9.7±15.5, 11.9±20.8 percent, respectively). LT and PL counts were significantly higher (p<.05) than AC during the swim (378±93.4 and 198.2±143.5 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), p>.05. During the swim, VS exhibited the lowest percent error, followed by XT, MF, PL, and LT (10.4±108.0, 24.6±130.4, 45.4±111.2, 177.9±119.7, 365.8±86.2 percent, 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.

D-75 Free Communication/Poster - **Posture and Balance**

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2311 Board #324 June 1 3:30 PM - 5:00 PM

Effect Of Pace On Stabilization After Rising From A Chair In Young And Older Adults

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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±4.2 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 single 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 medial-lateral (M-L) directions 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, 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 STS, 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 STS task.

2312 Board #325 June 1 3:30 PM - 5:00 PM

The Effect of Prolonged Standing on Ground Reaction Force Control

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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/m^2 [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 (%height). Weight-bearing (WBAs) and CoP asymmetries (CoPAs) were calculated by subtracting the ND limb from their D limb. **RESULTS:** There were no differences in WBA or CoPA 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 four of 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 (p≤0.018, r≤-0.660) and the level of these significant correlations changed during the post-PS trial (p≤0.024, r≤-0.628). Men and women exhibited different significant correlations for both trials. **CONCLUSION:** While these results suggest that 30 min of PS does not have an effect on WBA or CoPA 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.

2313 Board #326 June 1 3:30 PM - 5:00 PM

Optoelectronic Plethysmography Characterises Thoracic Excursion In The Evaluation Of Dysfunctional Breathing (DB)

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PURPOSE: Ventilatory pattern and thoracic excursion, can vary during exercise and impact on ventilatory performance. A deviation away from an optimal trunk lumbo-pelvic recruitment pattern may affect lung volumes, work of breathing and may be relevant in the development of exertional dyspnoea. The aim of the study was to investigate the effect of different postural positions on the ventilatory excursion using optoelectronic plethysmography (OEP) and a spirometer.
METHODS: Fifteen healthy male athletes (Mean ± SD age: 30.3±6.5 yrs.) completed the study. Ninety reflective markers were placed on the chest, abdomen and back (Figure 1). Participants underwent simultaneous OEP and spirometry data collection in two conditions, in a randomised order: (C1) with normal shoulder position or (C2) with hunched shoulders. Forced vital capacity (FVC) was assessed by the spirometer and data was gathered on the chest wall volume (CW) and the compartmental volumes of the rib cage (RC) and the abdomen (AB) by OEP.
RESULTS: The correlation between the two instruments in measuring FVC was good in both normal (R^2=0.89) and hunched (R^2=0.84) positions. FVC was significantly lower in hunched position during both spirometry (5.22±0.69 L vs. 5.35±0.69 L; p=0.03) and OEP measurements (5.22±0.62 L vs. 5.42±0.69 L; p=0.01). When volume contributions in the two conditions were compared the RC/AB ratio was significantly lower in hunched position (1.84±0.74 vs. 2.12±0.79; p=0.01).
CONCLUSIONS: These findings suggest that respiratory excursion and lung volume compartmentalisation are affected by the position of the shoulders. Specifically, a hunched should position leads to increased abdominal motion to vital capacity and decreased lung volumes. OEP may be a useful tool to detect altered parameters associated with developement of exertional dyspnoea.

2314 Board #327 June 1 3:30 PM - 5:00 PM

Effect of Respiratory Activity on Traditional Center of Pressure Related Measures during Standing in Parkinson's Patients

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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 ($A_{95\%}$ in cm^2), average velocity ($V_{Average}$ in cm/s) and standard deviation at ML (SD_{ML}) and AP (SD_{AP}) 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 Tuekey'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 $A_{95\%}$ (PG:10.36 ± 9.89 cm^2, CG: 7.52 ± 7.07 cm^2), higher $V_{Average}$ (PG: 3.18 ± 1.24 cm/s, CG: 2.56 ± .92 cm/s), more SD_{ML} (PG: .58 ± .30, CG: .54 ± .28) and SD_{AP} (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.

2315 Board #328 June 1 3:30 PM - 5:00 PM

Wii-Based and Supervised Exercise Training Decrease Falls Risk in Older Adults with Type 2 Diabetes

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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 67.7 + 5 yr) completed supervised training (ST) while 15 (mean age 66.3 + 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.

2316 Board #329 June 1 3:30 PM - 5:00 PM

Effects of Backpack Load and Load Height on Lower and Upper Body Reaching Ability

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PURPOSE: Reaching performance with lower and upper body has not been examined during load carriage with a backpack, particularly with the load in the backpack distributed high or low in the backpack.
METHODS: Lower extremity reaching during backpack carriage was tested using the Y-Balance Test (measuring leg reach in posterolateral, posteromedial and anterior directions), and upper extremity reaching was tested using the Functional Reach Test (FRT). Subjects were healthy males (n=4) and females (n=3), ages 18-49, who wore a backpack (REI) and performed in bare feet using the dominant leg and arm. Subjects were tested with no backpack, and then (in random order on different days) with the backpack empty (0), or load (weight) equivalent to 10, 30, and 50% of bodyweight in the bottom of the backpack. Trials were repeated with the load high in the backpack using a specially designed box. Three trials were completed for each reach. Results were analyzed with paired t-tests and Bonferroni corrections.
RESULTS: In Table 1, data presented as normalized for limb length reach, mean ± SD; BW = bodyweight; ld high = load (weight) in backpack at ~ level C5 vertebrae instead of bottom; * = sig diff from ld high via t-test with Bonferroni; † = sig diff from No backpack via t-test with Bonferroni. Backpack load at 30% and 50% bodyweight resulted in reductions in lower body reach in all three directions for both load high or low in the backpack compared to no backpack. When compared to no backpack, load high in the backpack resulted in significant reductions in upper body reach (FRT) at 10, 30, 50% bodyweight and load low in the backpack resulted in no significant reductions in upper body reach.
CONCLUSIONS: Backpack load height effects upper body, but not lower body, reach.

Table 1

	Anterior	Anterior (ld high)	Postero-Medial	Postero-Medial (ld high)	Postero-Lateral	Postero-Lateral (ld high)	FRT	FRT (ld high)
No backpack	67.5± 6.5	NA	108.0± 7.8	NA	104.2± 7.9	NA	155.6± 6.0	NA
Backpack 0% BW	65.6± 5.1	NA	105.8± 7.1	NA	102.3± 8.6	NA	149.5± 6.8	NA
Backpack 10% BW	64.1± 4.8	64.0± 6.7	100.9± 7.4	101.5± 9.7	97.8± 8.7	99.3± 10.5	151.9± 8.8*	144.4± 9.6†
Backpack 30% BW	62.6± 5.0†	60.5± 5.7†	93.1± 7.5†	94.4± 10.2†	88.1± 9.2†	90.7± 13.6†	154.0± 7.6*	141.7± 11.6†
Backpack 50% BW	60.3± 5.9†	58.1± 5.8†	85.3± 8.0†	89.7± 13.1†	80.8± 8.9†	83.5± 14.0†	150.6± 6.5*	130.1± 7.7†

2317 Board #330 June 1 3:30 PM - 5:00 PM

Sprint Interval Training: Dissociating Stamina and Stability in Older Adults

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The risks and consequences of falling are appreciable in sedentary older adults. Regular exercise has been proposed as an intervention, however the perceived time commitment may prove problematic for exercise initiation and/or compliance. Sprint interval training (SIT) evokes rapid and appreciable physiological adaptation in a time efficient manner, but the utility of SIT for improving stability in older adults is unknown. PURPOSE. To determine the effect of SIT on fatigue resistance and stability in young and older adults. METHODS. Sedentary young (Y: n=7, age: 21±1 years (mean±SE)) and older (O: n=6, age: 69±2 years) men and women completed three weeks of SIT (9 sessions of 4-8 30s maximal efforts on a cycle ergometer). Maximal oxygen uptake (VO_{2max}) and time to exhaustion while cycling at 75% VO_{2max} were determined prior to and following SIT. Stability (amount of sway of center of pressure with eyes closed) was determined prior to and following a single bout of sprinting, prior to and following SIT. RESULTS. VO_{2max} (Y: 39.5±2.7 *vs*. 41.3±3.1; O: 22.8±1.5 *vs*. 24.6±0.8 ml/kg/min), and time to exhaustion (Y: 25.8±4.0 *vs*. 37.0±3.1; O: 31.5±3.9 *vs*. 54.0±8.8 min) were increased (all *P*<0.05) in young and older adults. Stability (normalized to height) prior to a single bout of sprinting was unaffected by short term SIT in either young (214±13 *vs*. 268±38 mm/m) or older (230±10 *vs*. 186±10) adults; similarly, SIT did not attenuate the decline in stability following a single bout of

sprinting (Y: 302±21 vs. 334±72; O: 235±14 vs. 246±22). CONCLUSION. Short term SIT dissociated stamina (VO_{2max} and fatigue resistance) from stability in young and older adults.

2318 Board #331 June 1 3:30 PM - 5:00 PM

The Relationship Between Hip Musculature Range of Motion and BESTest Scores

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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 and compared to scores from the BESTest (Balance Evaluation Systems) to determine a correlation. Overall BESTest scores were compared to each aspect of hip musculature ROM. **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=0.52 (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.

2319 Board #332 June 1 3:30 PM - 5:00 PM

Examining Postural Control Without Feedback in Individuals with history of Ankle Sprain

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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 external visual 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 Athlete 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 (8.61±2.33cm^2) was similar to without feedback (10.94±2.43 cm^2). 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.

2320 Board #333 June 1 3:30 PM - 5:00 PM

Evaluating Perturbations To Human Balance Following An Exercise Intervention In Previously Sedentary, Overweight Adults

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PURPOSE: Previous research suggests that an improvement in body composition could potentially lead to a substantial improvement in balance performance in previously obese and overweight individuals (Handrigan et al., 2010; Maffiuletti et al., 2005). However, few studies have evaluated the balance of a person before and after weight loss following an exercise intervention that did not include any directed balance exercises. The purpose of this study was to evaluate if an exercise intervention alone can lead to a substantial decrease in body weight and therefore 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) and motor control test (MCT) prior to and after a 10-week exercise intervention. SOT equilibrium scores were analyzed using a repeated-measures ANOVA.
RESULTS: Results from the SOT equilibrium (EQ) scores revealed significant differences in the eyes open, sway referenced visual surrounding and platform (EOSRVP) condition ($p = 0.033$). Post hoc pairwise comparisons for this variable revealed significantly higher SOT equilibrium scores in post-intervention evaluation versus pre-intervention. No other SOT EQ scores were found to be significant ($p > 0.05$). Also, no significant differences were seen in MCT postural latency scores ($p > 0.05$).
CONCLUSIONS: The results of the current study suggest that an exercise intervention alone without a significant loss in weight and also without any form of specific balance training can lead to an improved balance performance, but that it may be limited to the conditions where the somatosensory system plays a larger role in balance maintenance.

2321 Board #334 June 1 3:30 PM - 5:00 PM

Effects of Long Term Marijuana Use On Postural Steadiness During Quiet Standing

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(No relationships reported)

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 yrs ± 6 yrs) or non-marijuana users (NU, n =15, mass = 73.5 ± 13.5 kg; ht = 1.80 ± 0.08 m; age = 25 yrs ± 6 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 open, 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, a group effect was observed, (left leg: $\Lambda^* = .843$, F=2.706, DF=6,87, p=.019; right leg: $\Lambda^* = .822$, F=3.129, DF=6,87, p=.008). Mean velocity in the AP direction for the right leg was greater among NU (p= .044, 19% difference), respectively) and approached significance for the left leg (p= .054, 18% difference). Mean frequency in the AP (p= .006, 24% difference) and ML direction (p< .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.

2322 Board #335 June 1 3:30 PM - 5:00 PM

Effect of Abdominal Wall Muscle Fatiguing Exercise on Balance in Healthy College-Age Individuals

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(No relationships reported)

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 fatiguing stimulus to the abdominal muscle groups affects balance in healthy college-age individuals. **METHODS:** A randomized pre-test 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 3.21±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.

2323 Board #336 June 1 3:30 PM - 5:00 PM

The Correlation of Forward Head Posture Measured via The Craniovetebral Angle to Neck and Low Back Pain

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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 via the craniovetebral angle (CVA) utilizing the Head Posture Spinal Curvature Instrument (HPSCI). 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 (r = -0.09) found 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.

2324 Board #337 June 1 3:30 PM - 5:00 PM

Proprioception,Postural Sway and Mobility in Parkinson'S Disease Patients And Healthy Individuals

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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 swayand 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 ECML, 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, 95% CI=-1.03~-0.01;p<0.01, 95% CI=-7.89~-3.52;p<0.01,95% CI=1.90~4.19, respectively) but no differences were evident in any postural sway measures. 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 ECML, specific exercise should be designed to address medio-lateral control in PD to promote mobility.

2325 Board #338 June 1 3:30 PM - 5:00 PM

Impact Of An Exercise Intervention On Human Balance Center Of Pressure Sway Parameters In Previously Sedentary, Overweight Adults

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(No relationships reported)

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 (Maffiuletti 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) ($p = 0.006$), and in the eyes open sway referenced (EOSRV) 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 shown to be a significant correlation between degree of weight change and the following variables: EOSRV medial-lateral (ML) VEL ($p = 0.002$), EOSRV ML RMS sway ($p = 0.011$), eyes open sway-referenced platform (EOSRP) ML RMS sway ($p = 0.029$), EOSRP AP RMS sway ($p = 0.049$), eyes closed sway-referenced platform (ECSRP) ML VEL ($p = 0.003$), ECRSP ML 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.

2326 Board #339 June 1 3:30 PM - 5:00 PM

Recovery Of Center Or Pressure Variability Following Total Ankle Arthroplasty

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Postural stability is achieved through the integration of multiple systems including proprioceptive, vestibular and visual systems. Following a total ankle arthroplasty (TAA), balance is compromised due to the loss of joint sensory input. Variability is an inherent aspect of performance and a measure of neuromuscular adaptability. No previous research has investigated the recovery of variability following TAA.

PURPOSE: To quantify the recovery of center of pressure variability following TAA. **METHODS**: Forty-six individuals (63.3±9.6 years; 1.70±0.10 m; 83.7±17.1 kg) with severe ankle arthritis were recruited for this study. Each patient completed three trials of quiet standing for a period of 10 seconds with their feet placed together at three time points: before surgery (PRE-OP), and then one-year (POST-1yr) and two-years (POST-2yr) following TAA. Center of pressure (CoP) was recorded bilaterally using two embedded force platforms (1200 Hz, AMTI, Watertown, MA). Standard deviation (SD) of the CoP time-series was calculated for each limb (surgical and non-surgical) at each of the three time points. SPSS was used to conduct two 2 x 3 (side by time) repeated measures ANOVAs were used to determine the effect of surgical limb and time on CoP variability in the mediolateral and anteroposterior directions. Significance was set at $p < 0.05$. **RESULTS:** No significant time by limb interaction existed for either the anteroposterior or mediolateral CoP. No main effects for time (p=0.35) or limb (p=0.44) were observed in the anteroposterior CoP SD. No significant effect of limb was observed (p=0.25) for the mediolateral CoP, however, a main effect of time was present (p=0.02). Post-hoc tests revealed smaller SDs in PRE-OP compared to POST-1yr (p=0.04; PRE: 5.4±2.4; POST1yr: 6.4±5.8) while no differences were observed between PRE-OP and POST2yr (p=0.11; POST2yr: 6.8±7.0) or POST1yr and POST2yr (p=0.43). s. **CONCLUSIONS:** CoP variability magnitude was increased and maintained at two years post-TAA surgery. These data may suggest the presence of altered somatosensory input to the central nervous system increasing adaptability of postural control. Alternatively, increased variability may represent changes in postural control associated with reduced pain and inhibition associated with osteoarthritis.

2327 Board #340 June 1 3:30 PM - 5:00 PM

A 6-week Rehabilitation Training Improves Single-leg Static Postural Control In Patients With Chronic Ankle Instability

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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 examine the effect of a 6-week ankle and hip rehabilitation program on center of pressure (COP) total distance and 95% ellipse area during single-leg static balance among groups of strength, strength with balance, 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 5 ankle and hip strength exercises (isometric, concentric, and eccentric contraction with theraband). 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 1.

	Strength (n=14)		Strength and balance (n=15)		Control (n=14)		F Value
	Pre	Post	Pre	Post	Pre	Post	
COP total distance (m)	18.9(4.2)	18.7(3.1)	18.8(3.7)	15.7(5.9)*	17.9(3.1)	17.5(3.8)	2,39 = 5.89 P < 0.05
COP 95% ellipse area (cm^2)	8.5(3.5)	8.0(3.0)	8.6(3.6)	5.9(1.9)§	8.0(3.6)	7.9(2.4)	2,39 = 5.88 P < 0.05

Values are mean (SD)
*Changes in COP total distance (m) are significantly different than the strength and control groups ($P < 0.05$).
§Changes in COP 95% ellipse area (cm^2) 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 proprioceptor 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.

2328 Board #341 June 1 3:30 PM - 5:00 PM

Maintenance of Postural Steadiness throughout Chemotherapy Treatment

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Chemotherapy negatively affects postural steadiness of cancer patients, contributing to an increased risk of falling. Physical activity improves postural steadiness, and has been shown to reduce toxic effects of chemotherapy such as peripheral neuropathy and vestibular dysfunction; two known causes of decreased postural steadiness.
PURPOSE: To determine whether postural steadiness improves in cancer patients undergoing chemotherapy following 12-weeks of exercise.
METHODS: Cancer survivors (n = 25; mass = 79.0 ± 22.6 kg; ht = 1.66 ± 0.08 m; age = 61.3 ± 10.0 yrs) receiving chemotherapy participated in this study. Postural stability was assessed prior to and following a 12-week individualized exercise intervention that included cardiovascular, muscular strength, flexibility, and balance training. In both pre- and post- measures, center of pressure (COP) data were collected (1000 Hz) for 10 seconds in four conditions: rigid surface eyes open (RSEO), rigid surface eyes closed (RSEC), compliant surface eyes open (CSEO), and compliant surface eyes closed (CSEC) using the Bertec BalanceScreener™ (Bertec Corporation, Columbus Ohio). Root-mean square (RMS), mean velocity (VEL), 95% confidence ellipse area (95CE), and mean frequency (FREQ) were investigated (Prieto et al., 1996). A MANOVA with repeated measures ($p < 0.05$) was used to identify main effects between pre- and post-training assessments.
RESULTS: From pre- to post- assessments mediolateral RMS decreased significantly for all conditions ($p < 0.04$ across all comparisons; RSEO by 35%, RSEC by 45%, CSEO by 43%, CSEC by 43%). A significant decrease was also observed in FREQ between pre- and post- assessments ($p < 0.044$ across all comparisons; RESEO by 29%, RSEC by 29%, CSEO by 31%, CSEC by 23%). No other variables changed significantly between pre and post assessments ($p > 0.05$).
CONCLUSIONS: Postural stability in the mediolateral direction was improved in cancer patients after 12-weeks of individualized exercise training. In addition, there was evidence of increased postural control based on an increased mean frequency of the COP trajectory after training. These results suggest that exercise training is beneficial to postural stability in cancer patients undergoing chemotherapy treatment.

2329 Board #342 June 1 3:30 PM - 5:00 PM

Preliminary Analysis: No Differences in Leg Strength Between Fallers and Non-Fallers

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Previous research suggests that increased leg strength in aging adults can decrease the risk of falling. Individuals with a history of falling are at increased risk for a recurrent fall. However, there is limited research in evaluating leg strength between Fallers and Non-Fallers.
PURPOSE: To evaluate isometric knee extension strength in aging adults that are classified as Fallers and Non-Fallers.
METHODS: Eighty-two aging adults (Fallers, n=39 age: 76±9.82 years, height: 1.61±.09 m, mass: 79.63±.74 kg, and Non-Fallers, n=43, age: 75±8.54 years, height: 1.61±0.07 m, mass: 78.99±20.38 kg) participated in this study. "Fallers" were defined as participants who had fallen within the year prior to the study, whereas "Non-Fallers" were participants that had not fallen within that time frame. A leg strength dynamometer (American Weight Scales, Inc.) was used to measure knee extension maximal voluntary isometric contractions (MVIC) for all participants. Participants were required to complete three valid trials of a unilateral knee extension MVIC for five seconds while sitting in a chair with the knee flexed at 90 degrees. Participants were given 20 seconds of rest between trials; the highest score was recorded. This protocol was performed for the right and left leg. Independent samples T-test were performed to compare leg strength values between Fallers and Non-Fallers ($p< 0.05$).
RESULTS: No significant differences ($p>0.05$) were found between the two groups for right leg (Fallers=15.22±7.63 kg, Non-Fallers=13.72±5.87 kg) or left leg (Fallers=15.33±6.92 kg, Non-Fallers=14.93±6.91 kg) strength values.
CONCLUSION: No difference in isometric knee extension strength between Fallers and Non-Fallers was found. However, leg strength remains an important modifiable factor suggested in the falls prevention literature. Furthermore, research should evaluate if intervention programs have similar effects on leg strength on both Fallers and Non-Fallers. The effects of intervention programs should particularly target aging adults with a history of falls. These examinations may provide information to develop targeted intervention programs focusing on leg strength for Fallers.
Research supported by grant from the Potomac Health Foundation.

2330 Board #343 June 1 3:30 PM - 5:00 PM

Postural And Cognitive Changes Observed During Re-Baseline Assessments

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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 (PRE) were administered before the first athletic season for each athlete and all athletes completed BESS and SAC evaluations. The same assessments 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±2.12). **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

2331 Board #344 June 1 3:30 PM - 5:00 PM

Effect Of Different Protein Ratio Beverages On Blood glucose Regulation

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(No relationships reported)

Whey 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 supplement protein or carbohydrate along. However different protein ratio on blood glucose regulation remains unclear.
PURPOSE: In this study we investigated a single supplement different protein beverage in different ratio on blood glucose regulation.
METHODS: We used cross-over 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 were 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, 1784±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 blood glucose was significantly lower than other groups (107±2 vs. 166±8, 139±6, 146±6mg/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 PRO75(2972±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±2mU/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

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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±1.5yr, 86.4±15.6kg; 175.4±6.7cm) were randomly assigned to complete 8 days of 0.22 g/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 pre-exercise, immediately post-exercise (IPE), and 2, 4, 24, 48, and 72hr. PBMC protein 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, and 24hr to assess glutathione/total glutathione ratio (GSSG/tGSH). **Results:** No group differences (p>0.05) were detected for protein expression of autophagy markers, HSP70, or GSSG/tGSH ratio at any time-point. When combining groups, LC3II decreased significantly (p<0.01) at 2 (0.51±0.38RQ) 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 (1.59±0.96RQ) and 72 (4.71±3.84RQ) hr PE. GSSG/tGSH ratio significantly (p<0.05) increased from baseline (0.11±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 phase immediately following exercise towards protein synthesis in the latter phases of the post-exercise period. The 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

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(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_2max = 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 (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 ^{0}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, -2, -9, and -10) and TIMPs (TIMP-1, -2, -3, and -4). Data were

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 difference 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

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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. **PURPOSE:** To compare the effect of a minimal dose (10 g) of WH provided after resistance exercise (REx) on skeletal muscle anabolism in young and older adults. **METHODS:** Twenty healthy recreationally active adults (YOUNG: M=8, F=2; 25±4yr, 25±4 kg·m^2| OLD: M=7, F=3; 65±4yr, 25±4 kg·m^2) were studied pre- and post-ingestion (PI) of 10 g of WH 1 h after high-intensity REx (8x10@~70% 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 asses 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. BCAA concentrations were modeled separately per time point using a 2 (group) x 2 (time) mixed-model ANOVA. Type I error for all analyses was set at α=0.05.

Effects on Post Resistance Exercise Mixed-Muscle FSR (%/h)				
Groups	Basal	(0-2h) Post Ingestion	(2-4h) Post Ingestion	Entire Post Ingestion Period (0-4h)
YOUNG (n=10)	0.058% ± 0.003	0.075% ± 0.003 †	0.100% ± 0.009 †	0.087% ± 0.005 †
OLD (n=10)	0.067% ± 0.005	0.106% ± 0.012 †*	0.091% ± 0.014 †	0.086% ± 0.005 †

Plasma BCAA Concentrations (Δ From Basal, umol·L)						
Time Post Ingestion	20min	40min	60min	80min	100min	180min
Leucine						
YOUNG	259 ± 29†	206 ± 24†	112 + ± 20†	68 ± 9†	50 ± 7†	42 ± 7†
OLD	247± 28†	255 ± 22†*	149 ± 20†	146 ± 22†*	114 ± 25†*	57 ± 16†
Isoleucine						
YOUNG	103 ± 12†	87 ± 13†	39 ± 8†	20 ± 4†	13 ± 3†	10 ± 3
OLD	90 ± 9†	98 ± 6†	54 ± 6†	45 ± 5†*	31 ± 4†*	13 ± 4
Valine						
YOUNG	126 ± 17†	123 ± 13†	62 ± 11†	31 ± 8†	16 ± 7	6 ± 6
OLD	99 ± 10†	128 ± 8†	74 ± 7†	70 ± 13†*	44 ± 6†*	10 ± 8

Data are means ± SE. † different from basal value; * different from the YOUNG group ($p < 0.05$)

RESULTS:
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 isolate. Future studies will be required to determine if WH may aid in the long-term preservation of muscle in this population.

2335 Board #348 June 1 3:30 PM - 5:00 PM

Recovery is Not Facilitated with Protein Supplementation Following Muscle-Damaging Concurrent Exercise

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Concurrent exercise is an important training modality for many sports and the dynamic nature of concurrent training imposes significant physiological stress that can lead to exercise-induced muscle damage (EIMD). Additional protein is frequently consumed with the intention to improve exercise recovery following EIMD; however the evidence for this practice is equivocal at best because of limitations in the research, which are attributable, at least in part to poor dietary control. **PURPOSE:** To investigate the efficacy of protein as a recovery aid following damaging exercise in a concurrent training paradigm, when rigorous dietary control and supplementation are provided. **METHODS:** Twenty-four well-trained male cyclists were randomised to three groups receiving supplement servings of 20 g protein, or an iso-caloric carbohydrate or low-calorific placebo. Supplements were provided twice daily from the onset of the muscle-damaging exercise and for a total of four days. During this time a controlled diet was consumed by all participants (6 $g \cdot kg^{-1} \cdot d^{-1}$ carbohydrate, 1.2 $g \cdot kg^{-1} \cdot d^{-1}$ protein, remainder fat). The concurrent exercise consisted of a simulated high-intensity road cycling trial followed by 100 drop-jumps; dependent measures were taken before and at 0, 24, 48 and 72 h following the concurrent exercise bout. **RESULTS:** Significant time effects for decrements in maximal voluntary contraction (MVC) and countermovement jump (CMJ) performance, along with increased muscle soreness, serum creatine kinase (CK) and C-reactive protein (CRP) concentrations provided evidence that EIMD had been induced ($p<0.001$). No group or interaction effects ($p>0.05$) were observed for any of the dependent measures, with both MVC and CMJ performance reaching a nadir immediately post-exercise (MVC: 83 ± 8, 85 ± 11 and 89 ± 11% of baseline for PRO, PLA and CHO; CMJ: 93 ± 8, 91 ± 8 and 93 ± 6% of baseline for PRO, PLA and CHO) and both CK and CRP values peaked at 24 h post-exercise (CK: 282 ± 166, 341 ± 167 and 291 ± 177% of baseline for PRO, PLA and CHO; CRP: 206 ± 110, 260 ± 207 and 241 ± 178% of baseline for PRO, PLA and CHO). **CONCLUSION:** Protein supplementation did not attenuate any of the indices of EIMD imposed by concurrent exercise, when employing high degrees of rigour around the habitual diet and the provision of appropriate supplemental controls.

2336 Board #349 June 1 3:30 PM - 5:00 PM

The Effects of Whey vs. Soy Protein at Breakfast on Satiety Response, Energy Intake and Metabolism

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(No relationships reported)

PURPOSE: To determine the effects of animal-based (whey) compared to plant-based (soy) protein on perceived satiety, hunger, fullness, desire to eat, prospective food consumption, thirst, energy metabolism and subsequent energy intake.
METHODS: Seventeen healthy men and women (age: 27 ± 7, BF%: 21.5 ± 6.9) consumed three isocaloric breakfast smoothies with 40% of energy from either whey, soy, or control (no protein) in a double blind, randomized crossover design. Participants completed a visual analog scale (VAS) of appetite profile and thirst (before, 0, 60, 120, 180 minutes). Indirect calorimetry was used to determine the effect of a meal (TEM) (at 45-60, 105-120, 165-180 minutes). In addition, energy intake at lunch was recorded.
RESULTS: There was a significant difference in hunger ($p = 0.03$), satiety ($p = 0.001$), fullness ($p = 0.001$), desire to eat ($p= 0.03$), and prospective food consumption ($p = 0.04$) between the three breakfast conditions. Measures of satiety and fullness were higher whereas hunger, desire to eat, and prospective food consumption were lower after consumption of whey protein compared to control. A significantly higher ($p < 0.05$) respiratory quotient (RQ) and lower oxygen consumption (VO2) was observed for whey and soy compared to control condition. In addition, a significantly higher (p

< 0.05) energy intake at lunch was observed after control (770 ± 289 kcals) compared to whey condition (654 ± 252 kcals). However, there was no significant difference (p > 0.05) in energy intake between soy (696 ± 296 kcals) and whey or control conditions. **CONCLUSIONS**: Consuming whey or soy protein at breakfast led to similar perceptions of appetite profile as well as lower energy intake at lunch, which may aid in weight management efforts among individuals following a vegan or vegetarian diet.

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

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American football athletes often report to practices and games in a hypohydrated state, potentially increasing the risk for performance and thermoregulatory impairments. However, the renal responses to progressive 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 preseason 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 (S_{osm}), urine specific gravity (U_{SG}), and urine color (U_{color}) 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). S_{osm} at Base (292 ± 4 mOsm/kg) was significantly lower than D10 (295 ± 4 mOsm/kg, p= 0.05). Further, S_{osm} >290 mOsm/kg was present in 67-73% of players reporting to practices on D4 and D7, and 80% finishing practice on D10. U_{SG} at Base (1.023 ± 0.007) and D10 (1.027 ± 0.005) were greater than D4 (1.018 ± 0.009) and D7 (1.019 ± 0.009, all p < 0.05). U_{color} on D4 (3 ± 1) was lower than Base (4 ± 1) and D10 (4 ± 1, all p < 0.05). pNGAL was not different throughout preseason (Base, 50.7 ± 12.5 ng/mL, D10, 52.8 ± 14.7 ng/mL, p = 0.19). Further, there was no relationship between S_{osm} and pNGAL (*r* = -0.03, p = 0.77) or U_{SG} and pNGAL (*r* = 0.05, p=0.63). Average WBGT ranged from 20.0°C to 31.1°C. **CONCLUSIONS:** At least two-thirds of players reported for or completed practice sub-optimally hydrated. However, renal stress assessed via pNGAL was not elevated throughout preseason. Thus, despite suboptimal hydration and environmental stress, these American football players experienced minimal renal injury as measured via pNGAL.

Supported by AMSSM-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

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(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 apparent 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 <1.32, women <0.792) and converted TUG to walking speed (<0.8 m/s), respectively. **RESULTS:** Of the subjects, the prevalence of 30≤ eGFR <45 mL/min/1.73m^2 was 16.2%. The subjects with 30≤ eGFR <45 mL/min/1.73m^2 showed significantly lower physical performance for muscular strength and functional mobility than those with 45≤ eGFR <60 and eGFR ≥60 mL/min/1.73m^2, respectively (all for p<0.05). Multinomial (polychotomous) logistic regression analysis, with three categories of eGFR as the dependent variable, showed the significant association between eGFR and skeletal muscle function status even after adjustment for potential confounders (odds ratios [95% CI] were 4.8 [1.3-17.2] for a GFR of 45 to 59, 12.9 [3.1-52.9] for above 60 mL/min/1.73m^2, p for trend <0.01). **CONCLUSION:** Taken together, skeletal muscle function status is associated with even moderately reduced eGFR in an older population. This finding suggests that maintenance of physical and functional fitness may be a contributory factor for preserving renal function in elderly persons.

2339 Board #352 June 1 3:30 PM - 5:00 PM

Impact of Moderate Intensity Endurance Exercise on Kidney Injury

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(No relationships reported)

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 89.3±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 cystatin C-corrected urinary NGAL levels (3.0±1.5 ng/10µg cystatin C) compared to baseline (2.3±1.3 ng/10µg 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/10µg 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. Trejo[1], Francisco J. Diaz[2], Carlos Kornhauser[2], Maciste Macias[2], Antonio Rivera[2], Magdalena Nájera[2], Citlalli Arce[1], Arturo Figueroa-Galvez, FACSM[3]. [1]*Universidad Autonoma de Baja California, Baja California, Mexico.* [2]*Universidad de Guanajuato, Guanajuato, Mexico.* [3]*Florida State University, Florida, FL.* (Sponsor: Figueroa Galvez Arturo, FACSM)
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(No relationships reported)

PURPOSE: Strenuous 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 of Creatinine-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.

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 afebrile with normal vital signs. There was no tenderness on palpation over the spinous processes or the paraspinal musculature. Her neurologic exam was significant for decreased sensation to light touch at the T8 dermatome and caudally with a proprioception deficit in the great toe bilaterally. Strength was 4/5 throughout the left lower limb. The patellar reflexes were 3/4 and the Achilles were 2/4 bilaterally. She demonstrated a wide-based gait with significant loss of balance.
DIFFERENTIAL DIAGNOSIS:
1. 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.

2342 Board #2 June 1 5:45 PM - 6:45 PM

Wrist Injury - Go karting

Jonathan T. Napolitano, Anastasia Fischer, FACSM. *Nationwide Children's Hospital, Columbus, OH.*

(No relationships reported)

HISTORY: A 15 year old right handed female basketball player presented to the sports medicine clinic of a pediatric hospital four months after a go-karting accident. The go-kart rolled and landed on her right wrist. With no significant pain or disability after the injury she did not seek immediate medical attention. Four months later she presented with increased pain and swelling in the wrist. She was immobilized with a cock-up splint and instructed to follow up after further imaging and occupational therapy. Her pain improved with bracing and she was lost to follow-up, attending only one occupational therapy visit. She presented again eight months later with improved pain and swelling but severe loss of range of motion. PHYSICAL EXAMINATION: Inspection of the right upper extremity revealed atrophy of right forearm, wrist, and hand, and a volar angular deformity of the wrist. No tenderness to palpation. Active and passive range of motion was severely limited in all directions. No soft tissue swelling or effusion. No temperature or skin texture changes. DIFFERENTIAL DIAGNOSIS: Post-traumatic arthritis, complex regional pain syndrome, juvenile idiopathic arthritis. TEST AND RESULTS: X-ray attached. MRI: Diffuse infiltrative process suggestive of ongoing inflammatory process. 3 Phase Bone Scan: Increased uptake along the right wrist and carpal joints. Sedimentation Rate: 45mm/h. Anti-CCP: 160 U. Rheumatoid Factor: 250 IU/mL. X-Rays of bilateral elbows reveal possible joint effusions. Ankle x-ray with irregular dorsal contour of the navicular. FINAL WORKING DIAGNOSIS: Rheumatoid factor positive, polyarticular, juvenile idiopathic arthritis. TREATMENT AND OUTCOMES: The patient was referred to rheumatology for further workup and close follow-up, started on methotrexate, etanercept, and prednisone, and subsequently referred to orthopedic surgery for evaluation forwrist fusion, and to physical and occupational therapy for joint range of motion and preservation.

2343 Board #3 June 1 5:45 PM - 6:45 PM

Hepatotoxicity Associated With Frozen Shoulder In A 47 Year Old Tennis Player; What's The Link?

Michael J. Murphy, Brian Keisler. *Palmetto Health Richland - University of South Carolina, Columbia, SC.*

(No relationships reported)

HISTORY: A 47 year-old female recreational tennis player with no past medical history presented with 4 months of increasing shoulder pain and stiffness. She was diagnosed with adhesive capsulitis and started on diclofenac sodium 75mg BID. Over the next month she started having abdominal pain and stopped taking diclofenac. Her pain continued to worsen and she developed intractable vomiting and jaundice and went to the hospital at that time.
PHYSICAL EXAMINATION: Alert and oriented. Scleral icterus and jaundice present. No spider telangiectasias or angiomata. No JVD. Lungs were clear. Heart regular rate and rhythm, no murmur, rub, or gallop. Abdomen soft with minimal RUQ tenderness and no ascites. Right shoulder with full ROM and normal strength. Left shoulder had severely restricted ROM in all directions with significant pain. Her neurologic exam was normal including no asterixis.
DIFFERENTIAL DIAGNOSIS: Primary Biliary Sclerosis, Viral Hepatitis, Wilson's Disease, Hemochromatosis, Medication Hepatotoxicity, Malignancy, Autoimmune Hepatitis, α1-Antitrypsin Deficiency, Porphyria, Granulomatous Liver Disease, Idiopathic Portal Fibrosis

TEST AND RESULTS: Bilirubin 24.4 (Direct 20.3), AST 650, ALT 859. Lipase, iron studies, ceruloplasmin, IgG, IgA, IgM, ANA, viral hepatitis panel, PT, INR, CBC, chem-7, alkaline phosphatase, and total protein all within normal limits. PPD negative. RUQ US: cholelithiasis without evidence of cholecystitis. CT Abdomen/pelvis with contrast: hepatosplenomegaly without any masses or ascites.
FINAL WORKING DIAGNOSIS: Diclofenac induced hepatotoxicity
TREATMENT AND OUTCOMES: 1.Cessation of diclofenac. 2.In addition to inpatient GI consult and outpatient follow up, she also saw hepatology who agreed with diagnosis and treatment. 3.Initially followed LFT's daily, which was spaced to bi-weekly at discharge and continued to be spaced as she improved. Her transaminases decreased and normalized within a week. Her bilirubin increased to 30.6, and then gradually decreased until normalizing 8 months later. 4.Her adhesive capsulitis gradually improved, although she continued to have decreased ROM at last follow up which continued to restrict her ability to play tennis. 5.NSAIDs are now completely contraindicated for her. 6.She has annual follow up with GI for labs.

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:
Afebrile. Muscle strength 4/5 with bilateral shoulder elevation and abduction. Strength 5/5 with elbow flexion and extension. Bilateral hip flexor strength 3/5. Sensation intact in upper and lower extremities bilaterally. Deep tendon reflexes 2+ bilaterally. Scaly erythematous rash on each side of nose. Erythema present across knuckles bilaterally.
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 rheumatology
3. Evaluation at NIH Myositis Clinic. Recommended increasing IVIG dosing and pulse doses of IV steroid with every IVIG infusion.

2345 Board #5 June 1 5:45 PM - 6:45 PM

Cardiovascular Injury-Marathon Running

Stephen Schaaf, 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, her right sided 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
TEST AND RESULTS: BMP, CBC, Troponin, UDS, EKG, and CT Head without contrast were all normal. CT angiography of the neck: Acute focal right vertebral artery dissection at C2-C3. MRI of the brain and MR angiography of the neck: Right cerebellar vermis infarct and confirmed right vertebral artery dissection at C2-C3 with associated thrombus. Cerebral angiography: Dissection of the right vertebral artery with associated non-occlusive thrombus and distal occlusion of the right PICA.
FINAL WORKING DIAGNOSIS: Right vertebral artery dissection and right cerebellar vermis infarct
TREATMENT AND OUTCOMES:
The patient was started on a heparin drip with transition to warfarin for anticoagulation and secondary stroke prevention. The patient will continue on warfarin for at least 3 months.
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.

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)[1], Richard Ma[2], Douglas E. James[3], Michael S. Wilinski[4], Answorth A. Allen[5]. [1]*Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY.* [2]*Missouri Orthopaedic Institute & Thompson Laboratory for Regenerative Orthopaedics, Columbia, MO.* [3]*3State University of New York Medical Center (Downstate), Brooklyn, NY.* [4]*Lake Erie College of Osteopathic Medicine, Bradenton, FL.* [5]*Hospital for Special Surgery, New York, NY.*

Reported Relationships: V. Lopez Jr: *Contracted Research - Including Principle Investigator; USAR New England and Empire GU RFU's and National Operating Committee on Standards for Athletic Equipment.*

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. Symmetrical radial pulses with brisk capillary refills. DIFFERENTIAL DIAGNOSIS 1. Cervical Neck Injury 2. Stroke 3. Fracture Clavicle 4. Rib Fracture 5. Scapular Fracture 6. Sternal Fracture TEST AND RESULTS: Chest anterior-posterior radiographs: -abnormal right SCJ MRI Brain no contrast: -Large area/acute infarction. Mass effect of right lateral ventricle. No hydrocephalus. Midline shift 1-2mm. CT brain no contrast: -Right MCA infarction with right frontal/parietal lobes, insular cortex, thalamus, caudate nucleus, internal/external capsule, and lentiform nucleus. -Mass-effect on the right lateral and third ventricles. Increased midline shift 8mm. No hydrocephalus. Carotid Duplex: -Arteries bilaterally, normal velocities/waveforms. CT chest: -Right clavicular head dislocated posterior to the sternum, in the superior mediastinum. Subperiosteal hematoma around proximal right clavicle. FINAL/WORKING DIAGNOSIS: Missed posterior sternoclavicular joint dislocation with brachiocephalic artery compromise leading to hemiparesis TREATMENT AND OUTCOMES: 1. Surgical Emergency. Often missed on radiograph. 2. Open repair of brachiocephalic artery, right clavicular reduction/SCJ capsulorraphy with hamstring tendon allograft. 3. Patient recovered with left sided hemiparesis. No return to sport. Sponsor: NOCSAE.org

2347 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.*

(No relationships reported)

Background: It is well established that >150 minutes of weekly physical activity significantly improves health and Kaiser Permanente Southern California (KPSC) has pioneered the use of an Exercise Vital Sign (EVS) to record Physical Activity (PA). However, there is less data on exercise and impact on healthcare utilization.
Purpose: To evaluate the correlation of EVS and healthcare utilization, in our SCKP patient population. Specifically, do those patients who report consistent exercise for >150 minutes per week have reduce utilization of the health care system.
Methods: KPSC Electronic Health Record data was abstracted to determine 3 cohorts of adults (18-65yrs) (N=2,534,895) who were Consistently Sedentary (CS) (EVS=0min/wk consistently), Insufficiently Active (IA) (EVS=1-149min/wk), or Consistently Active (CA) (EVS>150min/wk consistently), meeting the World Health Organization recommendations. Each cohort had at least 3 encounters and self reported EVS that were consistent. Each cohort was then compared to their health care utilization over a 1, 3 and 5 year period. Because KPSC is a closed system we were able to accurately capture utilization of pharmacy, hospital, radiology, laboratory and outpatient departments. Data was adjusted for age, gender and ethnicity.
Results: Compared to CS patients, CA patients have consistently lower use of the KPSC health care system. This relationships held true across the 1, 3 and 5 year analysis. Of note patients who were CA were 75% less likely to be hospitalized (OR 0.23-0.26), 43% less likely to use the ER (OR 0.55-0.58) and 45% less Urgent Care services (OR 0.54-0.56), 25% less laboratory blood draws (OR 0.73-0.74), and 27% less pharmaceuticals fills (OR 0.71-0.74). Other factors that were associated with lower health system utilization were female gender, caucasian ethnicity and
Conclusion: Based on EVS data, and analysis of health utilization we conclude that CA individuals have significantly lower utilization of the health care system than those who are CS.

2348 Board #8 June 1 5:45 PM - 6:45 PM

Association of Interrelated Neuromechanical Factors with Injury Occurrence among College Football Players

Gary B. Wilkerson, (Sponsor: Daniel C. Herman, FACSM). *University of Tennessee at Chattanooga, Chattanooga, TN.*

Reported Relationships: G.B. Wilkerson: *Honoraria; Arkansas Athletic Trainers' Association, American College of Sports Medicine, National Athletic Trainers' Association.*

PURPOSE: The purpose of this prospective cohort study was to assess the predictive value of injury risk screening methods that collectively assess aspects of environmental awareness, cognitive processing of neural input, and motor control, as well as any persisting effects of previous injuries.
METHODS: Prior to participation, 43 NCAA Division I-FCS college football players (20.2 ±1.2 years; 185.7 ±5.8 cm; 105.4 ±20.6 kg) completed the 10-item Sport Fitness Index (SFI) survey and performed both a 60-second Reactive Peripheral Response (RPR) test and a 10-second Unilateral Forefoot Squat (UFS) test of postural stability. The 0-100 SFI score quantified perceptions of persisting effects of previous injuries. The RPR represented the number of outermost target hits (rings 4 and 5 of 64 target buttons arranged in a pattern of 5 concentric rings on a 1.2 m x 1.2 m board) while simultaneously reciting text that scrolled across a centrally located screen. The UFS test utilized a smartphone accelerometer to quantify the root mean square (RMS) of instantaneous change in body mass acceleration (Jerk) on the dominant extremity. All sprains, strains, and head injuries sustained from the beginning of practice sessions to the end of the 13-game season were documented, along with the number of player appearances in games.
RESULTS: Injuries were sustained by 14 of 43 players (33%). Univariable associations of binary risk classification with injury occurrence were: SFI ≤ 86 (OR=1.77), UFS Jerk RMS ≥ 0.06 (OR=4.19), RPR ≤ 11 Hits (OR=2.95), and Games Played ≥ 8 (OR=3.16). A large SFI X UFS X RPR interaction effect was identified (OR=11.20). Logistic regression results for the combination of the 3-way interaction (Adjusted OR=21.32) with Games Played ≥ 8 (Adjusted OR=6.19) yielded a strong prediction model ($\chi 22 = 9.04$, p = .011; R2=.265). Cox regression results for a binary SFI X UFS X RPR risk classification, adjusted for the potentially confounding effect of differential game exposure among players (0-13 games), demonstrated a strong association with time to injury occurrence (HR=4.65; 90% CI: 1.74, 12.44).
CONCLUSIONS: The findings support the potential for reduction of football injury risk through targeted interventions that address modifiable deficiencies in peripheral visual awareness, reaction time, and postural stability.

2349 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. Schaefer, Madeline M. Miller, Adam Y. Pfaller, Scott B. Hetzel, M. Alison Brooks, Timothy A. McGuine. *University of Wisconsin-Madison, Madison, WI.*

(No relationships reported)

Female adolescent athletes are at greater risk for 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<.05). RESULTS: Females were more likely than males to participate in high competition volume (23.2% vs 11.0%, $\chi 2=84.7$, p<0.001), participate on a club team (61.2% vs 37.2%, $\chi 2=88.3$, p<0.001), and be highly specialized (16.4% vs 10.4%, $\chi 2=19.7$, 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%, $\chi 2=15.9$, p<0.001) and when the sample was restricted to sex-equivalent sports (37.3% vs. 28.2%, $\chi 2=9.0$, 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.
Supported by grants from the American Medical Society for Sports Medicine and the National Federation of State High School Associations.

2350 Board #10 June 1 5:45 PM - 6:45 PM

An Analysis of Female Athlete Triad Components in Elite Para-Athletes

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(No relationships reported)

The Female Athlete Triad (Triad) is a syndrome defined as the interaction of three interrelated conditions: low energy availability with or without disordered eating, menstrual dysfunction, and low bone mineral density (BMD). The Triad may also impact males, and may have long term health consequences if unaddressed. Although participation in elite para-sport is rapidly growing, no studies have assessed the prevalence of Triad risk factors in this population.
PURPOSE: To evaluate the prevalence of Triad risk factors in an elite para-athlete population and association to sex and para-sport type.
METHODS: Subjects were United States para-sport athletes who were training to qualify for the 2016 Summer or the 2018 Winter Paralympic Games. Participants completed an online questionnaire characterizing nutrition, menstrual status (if female), bone health, and awareness of the triad. Responses were analyzed to determine overall prevalence of Triad components, and significant differences based on sex and sport type (leanness vs. non-leanness).
RESULTS: A total of 248 (144 male, 104 female) athletes completed the survey. Of these, 137 athletes competed in leanness sports and 109 athletes in non-leanness sports. Of the cohort, 40% (53 male, 45 female) of athletes indicated that they were currently trying to lose weight, and 61% (n = 151; 90 male, 61 female) indicated they were attempting to change their body composition to improve sport performance. Only 3% (1 male, 6 female) of athletes indicated that they had been previously diagnosed with an eating disorder. For pre-menopausal women, 32% (n = 29) reported less than 9 menstrual cycles in the past year. A total of 21% (27 male, 25 female) of athletes reported a history of a bone stress injury, yet 9% (8 male, 13 female) reported a diagnosis of low BMD based on DXA scan. There were no differences in risk factor prevalence between sexes or those competing in leanness versus non-leanness sports. Only 9% of athletes were aware of the Triad.

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.

2351 Board #11 June 1 5:45 PM - 6:45 PM

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

Martin Peter Schwellnus, FACSM[1], Karen Schwabe[2], Sonja Swanevelder[3], Esme Jordaan[3], Wayne Derman[4]. [1]*University of Pretoria, Pretoria, South Africa.* [2]*University of Cape Town, Cape Town, South Africa.* [3]*South African Medical Research Council, Cape Town, South Africa.* [4]*Stellenbosch University, Cape Town, South Africa.*

(No relationships reported)

We previously reported a high rate of medical complications (1/121 race starters) in a cohort of 65 865 runners participating in 21.1km and 56km races over a 4-year period (2008-2011) (SAFER study 1). PURPOSE: To determine if an online pre-race medical screening and educational intervention program reduces medical complications in distance running events. METHODS: An online pre-race medical screening (based on the European guidelines for pre-screening of leisure athletes participating in moderate- to high-intensity sports) and an educational intervention program was designed and introduced as part of the race registration process, in the period 2012 to 2015 at the Two Oceans Marathon races (21.1km and 56km). The incidence of medical complications (per 1000 race starters; all and serious life-threatening) during the 4-year post-intervention period (2012-2015: 87 343 race starters) was compared with the pre-intervention period (2008-2011: 65 865 race starters). RESULTS: Compared to the pre-intervention (baseline) period, there was a significant reduction in the incidence (per 1000 starters, 95% CI; adjusted for age group, gender and race distance) of all medical complications in all runners by 29% [pre=8.6 (7.9-9.4); post=6.1 (5.6-6.7), $p<0.0001$], 21.1km runners by19% [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.