**D-07 Thematic Poster - Aging and Training**

**Thurs., May 31, 2018, 1:00 PM - 3:00 PM**
Room: CC-Lower level L100C

**1513 Board #1**
May 31 1:00 PM - 3:00 PM
**Aging, Maximal Aerobic Capacity, and Running Economy in Trained Distance Runners**
Emma J. Lee, Christopher J. Lundstrom. University of Minnesota, Minneapolis, MN. (Sponsor: Eric M. Snyder, FACSM)

Aging, Maximal Aerobic Capacity, and Running Economy in Trained Distance Runners

Maximal aerobic capacity (VO\textsubscript{2\max}) tends to decline with age, even in trained long-distance runners. However, it is possible that running economy (RE), another predictor of performance, may be preserved. Furthermore, previous research has performed RE as the submaximal rate of oxygen consumption in ml O\textsubscript{2}·kg body mass\textsuperscript{-1}·min\textsuperscript{-1} (VO\textsubscript{2}), whereas it is more valid to express RE using allometric scaling of body mass (alloVO\textsubscript{2}) or as the energy cost of running (EC, in kcal kg body mass\textsuperscript{-1}·min\textsuperscript{-1}). The percent of VO\textsubscript{2\max} (%VO\textsubscript{2\max}) at which a submaximal run occurs is also related to performance. PURPOSE: To evaluate VO\textsubscript{2\max}, alloVO\textsubscript{2}, and %VO\textsubscript{2\max} in runners across a wide age range and determine whether aging is associated with these performance-related measures. METHODS: Runners aged 20-66 years completed two running tests. Study visits took place within four weeks of a goal race of 10-26.2 miles. Subjects ran for five minutes at 88% of their predicted age-based maximum heart rate, which approximates a marathon-intensity effort. Athletes then performed a VO\textsubscript{2max} test. AlloVO\textsubscript{2} was calculated using body mass\textsuperscript{0.75}. Energy cost was determined using caloric equivalents based on mean respiratory exchange ratio, which takes substrate utilization into account. Pearson’s correlations were used to determine relationships between age and running performance variables. RESULTS: Runners (n = 22, 11 females; body mass index 22.54 ± 2.9 kg m\textsuperscript{-2}) had a mean VO\textsubscript{2\max} of 53.2 ± 10 ml O\textsubscript{2}·kg\textsuperscript{-1}·min\textsuperscript{-1} (range: 35.6-69.9). Age was not significantly correlated with VO\textsubscript{2\max} (r = 0.11, p = 0.42). Age was highly correlated with EC (r = 0.721, p = 0.001). CONCLUSIONS: In runners across a wide age range, age and running performance variables are correlated. As such, the findings of this study suggest that RE, expressed through allometric scaling of body mass and energy cost, is a more valid measure of running economy in trained distance runners.

**1514 Board #2**
May 31 1:00 PM - 3:00 PM
**Hopping Exercise Training Improves Postural Control in Healthy Older Adults**
Toshiaki Nakatani, Kazufumi Terada, Koji Kawakami, Kazuki Kino, Mika Imai, Shota Shinomiya. Tenri University, Tenri, Japan.

Older adults exhibit increased postural sway motion, increasing fall risk. Exercise programs can improve postural control and reduce fall risk in older adults. PURPOSE: This study aimed to investigate the effects of hopping exercise training on postural control during quiet standing in healthy older adults. METHODS: Thirty-one community-dwelling older adults were randomly assigned to either a hopping exercise group [HEG, n = 16 (men = 3), mean age = 71.5 ± 5.3 years] or a balance exercise group [HEG, n = 16 (men = 3), mean age = 71.5 ± 5.3 years]. Both groups performed a 12-week exercise training program. HEG performed two sets of two-legged hopping at a frequency of 90 bpm until reaching a score of 15 (hard) on the Borg Rating of Perceived Exertion scale twice a week. HEG performed balance exercise on a foam pad or soft balance beam. At a wellness center, all subjects participated in a 60-minute supervised group exercise session once every two weeks. Outcome measures included the center of foot pressure (CoP) sway parameters during quiet standing with eyes open (EO) and eyes closed (EC) for 30 s. RESULTS: Repeated measures analysis of variance showed a significant interaction effect of path length in an enveloped area with EC (P = 0.03) and main effects of time of path length (P = 0.027), enveloped area (P = 0.029), and sway velocity (P = 0.001) with EO. After the training session, HEG demonstrated a significantly increased path length in an enveloped area with EC (21.5 ± 7.9 vs. 26.3 ± 13.0 cm\textsuperscript{2}, P < 0.05) and a significantly decreased path length (45.0 ± 17.4 vs. 37.6 ± 12.5 cm, P < 0.05), enveloped area (2.71 ± 1.40 vs. 2.09 ± 1.25 cm\textsuperscript{2}, P < 0.05), and sway velocity (2.25 ± 0.87 vs. 1.88 ± 0.65 cm s\textsuperscript{-1}, P < 0.05) with EO. HEG demonstrated no changes in CoP sway parameters with EO or EC. CONCLUSION: Twelve-week hopping exercise training can improve postural control with EO and EC in older healthy adults. Hopping exercise is a safe, practical, and effective training approach in older people. Supported by JSPS Kakenhi Grant Number 26350767.

**1515 Board #4**
May 31 1:00 PM - 3:00 PM
**Ipsilateral and Contralateral Rapid Torque Adaptations To Unilateral Resistance Training In Young and Older Males**
Alex A. Olmos\textsuperscript{1}, Garrett M. Hester, Zachary K. Pope\textsuperscript{2}, Mitchell A. Magrini\textsuperscript{3}, Ryan J. Colquhoun\textsuperscript{4}, Alejandro Barreiro-Curiel\textsuperscript{5}, Carlos A. Estrada\textsuperscript{2}, Jason M. DeFreitas\textsuperscript{6}, Loretta DiPietro, FACSM. 1Kennesaw State University, Kennesaw, GA. 2Oklahoma State University, Stillwater, OK. 3Oklahoma State University, Stillwater, OK. 4Kennesaw State University, Kennesaw, GA. 5Kennesaw State University, Kennesaw, GA. 6Oklahoma State University, Stillwater, OK.

While the efficacy of unilateral resistance training (RT) to increase strength in the untrained limb (i.e., cross-education) is well established, it is less clear if cross-transfer of rapid torque characteristics occurs, and if age affects these adaptations. PURPOSE: To identify the effects of short-term, unilateral RT on rapid torque characteristics in the untrained limb of young and older males. METHODS: Twenty-two untrained, young (age = 21.43 ± 2.29 yrs, body mass = 81.03 ± 12.71 kg) and nineteen older (age = 65.78 ± 9.83 yrs, body mass = 87.23 ± 13.34 kg) males were randomly assigned to either a training (young trained group [YTG] and old trained group [OTG]) or young and old control groups. The YTG and OTG performed 3 sessions per week of isokinetic RT for 4 weeks. RT sessions consisted of maximal concentric knee extensions at 45\textdegree s\textsuperscript{-1} with an emphasis on ballistic intent for 4 sets of 10 repetitions. Maximal voluntary isometric contractions of the trained and untrained knee extensors were performed before (PRE) and after week 4 (POST) of RT on a dynamometer. Peak torque (PT) in addition to rate of torque development and impulsive force from onset to 30 ms (RTD\textsubscript{30}, and IMP\textsubscript{30}, respectively) and 100-200 ms (RTD\textsubscript{100-200} and IMP\textsubscript{100-200}, respectively) were recorded for analysis. Three-way (age [young vs. old] × group [training vs. control] × time [PRE vs. POST]) repeated measures analyses of variance were used for each dependent variable. RESULTS: For the untrained leg, there was no effect of training on RTD\textsubscript{30}, IMP\textsubscript{30}, RTD\textsubscript{100-200}, and IMP\textsubscript{100-200} (P > 0.05). However, a 2-way (group × time) interaction indicated that PT increased at POST similarly between the YTG and OTG (+11%; p = 0.003) compared to the control groups. For the trained leg, a 2-way (group × time) interaction indicated that PT (+21.1%; p < 0.001) and IMP\textsubscript{100-200} (+7.0%; p = 0.038) increased at POST similarly between the YTG and OTG compared to the control groups. Similarly, RTD\textsubscript{100-200} demonstrated a nearly significant increase that was similar between the YTG and OTG

Abstracts were prepared by the authors and printed as submitted.
This study aims to assess serum traces of copper (Cu) and zinc (Zn), lipid profiles, geriatric depression level and activities of daily living (ADL) scale index in older adults affiliated with two different programs of physical activity (PA) levels. In the first program, Exercise for Health, members perform regular PA (at least 60 minutes, 3 times per week) and the second one represents a Nursing Home (NH) without regular physical activity each week. Methods: Thirty men and women in the PA group (age: 64.7±4.8 years) and 34 men and women in the NH (age: 77.9±5.3 years) with no previously documented cardiovascular disease participated in the study. Anthropometric measurements were performed and blood was drawn from left arm. Serum traces of Cu and Zn were determined by atomic absorption spectroscopy, lipid profiles by absorbance and colorimetric assays, levels of geriatric depression with Yesavage’s scale index, and activities of daily living with Katz’s index of independency in ADL. Results: The results revealed similar serum trace of Cu (PA: 0.62±0.02; NH: 0.64±0.02 mg/dl) and Zn (PA: 0.29±0.01; NH: 0.31±0.01 mg/dl), and lipid profile (total cholesterol, PA: 163.92±47.24, NH: 160.06±36.16 mg/dl; HDL, PA: 38.62±9.8 mg/dl; LDL, PA: 37.79±7.53 mg/dl; LDL: PA: 102.85±33.75, NH: 109.24±29.19 mg/dl; VLDL: PA: 20.69±8.6, NH: 13.03±4.26 mg/dl; triglycerides, PA: 103.38±45.13, NH: 65.62±21.19 mg/dl) between both older adults groups. However, NH group showed higher level of geriatric depression (70.5% vs. 38.5%) and dependency when performing activities of daily living (ADL). Conclusions: Even though participants were involved in different levels of physical activity level, serum traces of Cu and Zn, and lipid profile were within a normal limits range, but institutionalized older adults showed higher tendency toward depression and difficulties with daily living activities.
PURPOSE: The efficacy of aerobic training in a rehabilitation setting is often determined by comparing changes in aerobic capacity (VO\(_{2}\text{peak}\)) using a cardiopulmonary maximal exercise test (CPX). In many studies, the reported pre- vs. post-training difference in VO\(_{2}\text{peak}\) is ≥3ml kg\(^{-1}\) min\(^{-1}\) and it is assumed that subjects put forth a maximal effort in both tests. A concern therefore arises that a difference in effort between tests could account for a significant portion of the reported improvement in VO\(_{2}\text{peak}\); especially when those with chronic illness who are unaccustomed to maximal effort are tested. In the present study we retrospectively examined data to test the hypothesis that only individuals with an improvement in VO\(_{2}\text{peak}\) have an improvement in a steady state heart rate recovery (HRR) after completing a CPX test. METHODS: Thirty-seven chronically ill participants (57 ± 15yrs) completed a cycle CPX test voluntary termination before and after a 12-week exercise rehabilitation program based on current guidelines for cardiac rehabilitation. VO\(_{2}\text{peak}\) was defined as the highest rate of O\(_2\) uptake over 15s during the final stage of exercise. Participants were partitioned into a group of responders (RS) (n=18; VO\(_{2}\text{peak}\) increased ≥0.21 ml/kg/min) and non-responders (NRS) (n=19; VO\(_{2}\text{peak}\) increased <0.21 ml/kg/min). HRR was defined as the difference between peak HR and HR at each minute of cycling at 40% of the pre-training CPX test peak workload, which was compared between pre- and post-program tests. RESULTS: VO\(_{2}\text{peak}\) significantly improved post program in RS (2.2 ± 0.6 vs. 2.6 ± 0.5 L∙min\(^{-1}\); p<0.05) but not NRS (1.9 ± 0.7 vs. 1.9 ± 0.7 L∙min\(^{-1}\)). The RS pre-program VO\(_{2}\text{peak}\) was 88% of age and gender predicted values vs. 107% in the NRS. Only RS had a greater HRR at 5 minutes (RS pre 39 ± 11 vs. post 46 ± 9bpm; p<0.05 and NRS pre 37 ± 10 vs. post 39 ± 11 bpm, N.S.). Among RS, 14 of 18 improved their HRR by more than 3 bpm compared to 7 of 19 in the NRS group. CONCLUSION: Including a fixed recovery workload following a CPX test may be useful for confirming post-program increases in VO\(_{2}\text{peak}\). In the present study, participants that improved VO\(_{2}\text{peak}\) were more likely to have concurrent improvements in HRR after exercise-based rehabilitation.

PURPOSE: Cardiorespiratory fitness (CRF) provides an independent marker for endurance performance and all-cause and cardiovascular mortality. Oxygen consumption (VO\(_{2}\)) during treadmill testing can be reasonably estimated from the attained speed, grade, and duration in men, women, and patients with coronary disease. Using our Cardiorespiratory Performance database and the Wicks equation (MSSE, 2013), an r-squared value of 0.62 was obtained (P-value <0.001). Two separate equations were developed using this model: Maximal METs = 20.8 + (–0.9 x age) - (0.29 x BMI) + 0.24 x ([6 x heart rate index]–5) for men; and Maximal METs = 18.8 + (–0.08 x age) –(0.29 x BMI) + 0.24 x ([6 x heart rate index]–5) for women. CONCLUSION: These newly developed equations may help to more accurately estimate peak METs in physically active, fit men and women of varied ages. Future research with a larger patient population and additional modulators should serve to increase the coefficient of determination.

Background: Exercise training is well known to improve insulin sensitivity (SI). However, the duration in which exercise–induced improvements in SI persists varies significantly between studies, ranging from 0- to 72-hrs following the last bout of exercise. One caveat that may explain the variability between studies is the magnitude of energy deficit following exercise. PURPOSE: To assess the chronic effects of 12-weeks of aerobic exercise training and the acute effects of exercise intensity for improving SI when measured under energy balanced (EB) conditions. METHODS: Thirty-three untrained premenopausal women were evaluated at baseline, after 12-weeks of training, 22 hrs after either an acute- bout of moderate-intensity continuous (MJC) aerobic exercise (50%-peak VO\(_{2}\)) or high intensity interval (HII) exercise (84% peak VO\(_{2}\)). Participants stayed in a room calorimeter during and after the exercise sessions. Food intake was adjusted to obtain EB across 24-hrs. SI was measured 22hrs after all conditions using the hyperinsulinenia euglycemic clamp. Muscle biopsies were obtained in a subset of 15 participants to examine mitochondrial oxidative capacity using high resolution respirometry. RESULTS: A significant increase in SI was observed only following the HII condition (P <0.05). There were no significant improvements in SI following 12-weeks of training or the MJC session. A significant improvement in mitochondrial respiratory capacity occurred following all post-training conditions (P <0.05). No significant differences between energy consumed and energy expended were found between all conditions. CONCLUSIONS: The primary finding from this study was that SI only improved following a bout of HII exercise when measured under EB, which suggests that energy deficit following exercise plays a role in exercise-induced improvements in SI. While we were unable to measure muscle glycogen, it is possible that glycogen deficit is important in determining the magnitude of these exercise-induced improvements in SI. Last, improvements in mitochondrial respiratory capacity occurred even when SI did not change, suggesting that these two responses are independent of one another.

PURPOSE: Habitual exercise is associated with reduced marking in both total and abdominal adipose tissue (AT); however, the optimal dose (amount and intensity) of exercise required to elicit the greatest reduction remains unclear. The purpose of this investigation is to determine the separate effects of increasing exercise amount and intensity on AT and skeletal muscle (SM) mass in sedentary, abdominally obese adults. METHODS: Participants in this ancillary study included 105 men (40%) and women (60%) who were randomly assigned to one of four conditions for 24 weeks: control (C; n=20); low amount low intensity (HALI; 360 and 600 kcal/session for women and men, respectively, at 50% of VO\(_{2}\text{peak}\), n=24); high amount low intensity (HALI; 360 and 600 kcal/session for women and men, respectively) at 75% of VO\(_{2}\text{peak}\), n=31); high amount high intensity (HII; 360 and 600 kcal/session for women and men, respectively, at 75% of VO\(_{2}\text{peak}\), n=30). SI and AMT were measured by magnetic resonance imaging at baseline and 24 weeks. RESULTS: Reductions in total AT (%; C, -0.2; HALI, -7.9; HII, -10.8; HALI, -11.5), abdominal subcutaneous AT (%; C, -0.3; HALI, -6.7; HII, -10.1; HALI, -12.9), visceral AT (%; C, -0.2; HALI, -15.5; HII, -18.4; HALI, -17.1), weight (%; C, -0.8; HALI, -4.7; HII, -6.8; HALI, -6.4) and waist circumference (%; C, -1.2; HALI, -4.5; HII, -6.1; HALI, -5.6) were greater in all exercise groups compared to control (p<0.0001), independent of age and sex. Reductions in total AT and abdominal subcutaneous AT were greater in HII compared to HALI (p<0.003). SI mass did not change at 24 weeks in any exercise condition.

Abstracts were prepared by the authors and printed as submitted.
Aerobic interval training at a moderate-high intensity on an upright or recumbent cycle ergometer is feasible and safe for persons who are non-ambulant after stroke. It should be further researched to investigate its potential to improve cardiorespiratory fitness after stroke and risk-factors for recurrent stroke.

Funding body: National Stroke Foundation, Australia

**Introduction:** Obesity rates are increasing, with the incidence of obese U.S. adults increasing from 30.5% in 2000 to 37.0% in 2014 (Ogden et al., 2015). Additionally, more women suffer from obesity or extreme obesity compared to men (Ogden and Carroll, 2010). A consequence of sedentary lifestyles is poor muscular strength, which is a risk factor for diabetes and cardiovascular disease (Shiroma et al., 2017), as well as all cause mortality (Rantanen et al., 2000). High intensity interval training (HIIT) is a time efficient and robust mode of exercise, which elicits similar adaptations versus moderate intensity continuous training (MCT) in obese adults (Kong et al., 2016). Previous data show that HIIT promotes weight and/or fat loss in overweight or obese populations (Gillen et al., 2013; Martins et al., 2016), yet in other studies, body composition was unchanged in response to HIIT (Nybo et al., 2010; Whyte et al., 2010, Astorino et al. 2013). A recent study (Farina et al., 2017) showed increased muscle strength in response to HIIT in active men.

**PURPOSE:** To investigate the effects of different types of HIIT on body composition and muscular strength in sedentary, obese women.

**METHODS:** 17 obese sedentary women (age = 37.51±10.53 yr) participated in a six-week exercise intervention consisting of three training sessions per week. They were randomized into low volume HIIT (LO) (n=9, BMI=37.72±3.34 kg/m²) or periodicized HIIT (PER) (n=8, BMI=41.00±5.33 kg/m²) which were performed on a cycle ergometer. Body composition and muscle strength were measured pre- and post-training. Fat mass and fat free mass were measured using air displacement plethysmography via a BodPod. Peak knee extension and flexion torque at 60 deg/s was measured using an isokinetic dynamometer. Measures of dietary intake and physical activity were also obtained during the study.

**RESULTS:** FFM was increased in LO (52.07±5.09 kg vs. 53.93±4.69 kg) and PER (55.40±6.604 vs 56.10±6.57 kg), (p=0.03), there was no interaction (p=0.33). There was no significant change in body mass (p=0.075), fat mass (p=0.19), or peak extension (p=0.5) or flexion torque (p=0.7).

**CONCLUSION:** Regardless of protocol, HIIT elicits body composition improvements including an increase in fat free mass, but has no effect on muscular strength or body fat in sedentary, obese women.

Arterial stiffness has long been regarded as an indicator of disease and is an independent predictor of cardiovascular events. Controversies exist amongst the impact of resistance training protocols on the stiffening process in the major elastic arteries. This study was designed to address some of the controversies.

**PURPOSE:** To determine the acute effects of high-intensity interval training (HIIT) on arterial stiffness in a group of well trained, young, healthy men.

**METHODS:** Subjects were randomized into low intensity (LI) and high intensity (HI) conditions. A subset of subjects were included in a further analysis of arterial stiffness with and without additional resistance training (RT).

**RESULTS:** No significant changes were observed in arterial stiffness parameters with HIIT. However, a significant decrease in arterial stiffness was observed with additional RT.

**CONCLUSION:** HiIT may be more effective in increasing muscle mass than endurance (-1.2) after 12 wks. (-0.95) compared to the HIIT group after 6 weeks, and the BMI decreased even further (-1.1) after 12 wks. There was no significant change in body mass (p=0.075), fat mass (p=0.19), or peak extension (p=0.5) or flexion torque (p=0.7).

**CONCLUSION:** Regardless of protocol, HIIT elicits body composition improvements including an increase in fat free mass, but has no effect on muscular strength or body fat in sedentary, obese women.
Blood flow restriction (BFR) is becoming more widely used with strength training in sports medicine and rehabilitation. It can be used passively and actively to combat muscle atrophy and strength loss observed during unloading in early post-traumatic and surgical contexts. Varied cuff types and pressures have been used but quantification of interface pressures, safety and recovery evade widely investigated. PURPOSE: To investigate the interface pressure mechanics, perceptual and cardiovascular responses to different cuffs during acute bouts of passive blood flow restriction [BFR] and BFR exercise. METHODS: Eighteen participants attended three experimental sessions in a randomised, crossover, counterbalanced design. Participants underwent inflations at 40% and 80% limb occlusive pressure (LOP) at rest and completed 4 sets of unilateral leg press exercise at 30% of one repetition maximum with BFR at 80% LOP. Different cuffs were used for each session: a rapid-inflation, variable-contour and handheld cuff. Cuff-to-limb interface and Set pressure (IP, SP) were measured using a universal interface device with pressure sensors. Perceived exertion and pain were measured after each set, mean arterial pressure (MAP) was measured pre-, 1-min post- and 5-min post-exercise. RESULTS: IP was lower than the SP in all cuff trials at rest (p<0.05). IP, was on average, 10.24±8.01, and 6.5±1.6 mmHg lower than the SP in all cuff trials at rest (p<0.05). IP was, on average, 10.24±8.01 (MAP) was measured pre-, 1-min post- and 5-min post-exercise. CONCLUSION: Blood flow restriction does not appear to augment indices for arterial stiffness in young, adult males.

D-09 Basic Science World Congress - Thematic Poster - Moderating Skeletal Muscle II

Thursday, May 31, 2018, 1:00 PM - 3:00 PM
Room: CC-Mezzanine M100C

Chair: Christopher McGlorey, McMaster University, Hamilton, ON, Canada.
(No relevant relationships reported)

1531 Board #1 May 31 1:00 PM - 3:00 PM Interface Pressure Mechanics, Perceptual and Cardiovascular Responses To Different Cuffs In Blood Flow Restriction

Luke Hughes1, Bruce M. Paton2, Stephen Patterson1. 1St Mary’s University / University College London, London, United Kingdom. 2University College London, London, United Kingdom. 3St Mary’s University, London, United Kingdom.
(No relevant relationships reported)

The lack of ovarian hormones accentuates the loss of muscle contractility after muscle injury. Mitochondria are required to meet the energetic demands of muscle contractility, but whether mitochondrial function is affected by muscle injury and impacts repair is unclear in the context of ovarian hormone depletion. PURPOSE: To test mitochondrial dysfunction after muscle injury in the context of ovarian hormone depletion and to investigate autophagy, a cellular process for degrading damaged and dysfunctional mitochondria, as a mechanism of mitochondrial remodeling to improve muscle function during regeneration. METHODS: We subjected sham surgery wildtype (WT) and ovariectomized (OVX) mice to traumatic muscle injury and assessed the recovery of in vivo muscle strength (i.e. ankle dorsiflexion) and state 3 respiration from permeabilized muscle fibers at 7 and 14 days post-injury. To investigate autophagy, expression of autophagy-related 13 genes (Beclin 1 (Atg6) and LC3) were assessed. To determine if an interaction exists between ovarian hormones and autophagy, muscle strength and state 3 respiration were assessed 14 days post-injury following sham or OVX surgeries on Ulk1 deficient mice, a necessary protein for mitochondrial-specific autophagy, and luteinize controls. RESULTS: OVX resulted in a 10% reduction in muscle strength (p=0.045) pre-injury compared to sham. This was exacerbated by muscle injury (14 days post-injury: OVX 25% vs. sham 35% of pre-injury, p=0.038). For state 3 respiration, there was a main effect of injury demonstrating a substantial reduction in mitochondrial function at 7 and 14 days post-injury (p<0.001), independent of ovarian hormones. There was a large induction of autophagy as indicated by greater Becl1 and LC3 expression at 7 and 14 days post-injury, independent of ovarian hormones (p=0.001, p=0.014 respectfully). Interestingly, OVX-Ul1-deficient mice demonstrated less recovery of muscle strength at 14 days post-injury compared to OVX-LM (p=0.016). CONCLUSIONS: After muscle injury a robust autophagic response is required to recover muscle function in a timely manner and this occurs in the presence and absence of ovarian hormones. However, decreased strength recovery in OVX-Ul1-deficient mice suggests an interaction between ovarian hormones and autophagy during muscle regeneration.

1532 Board #2 May 31 1:00 PM - 3:00 PM Importance of Autophagy in the Recovery of Muscle Function After Injury in an Ovariectomized Model

Anna S. Nichenko, W. Michael Southern, Alexandra Flemington, Bethany L. Graulich, Jarrod A. Call. McMaster University, Hamilton, ON, Canada. (No relevant relationships reported)
activity), and then following 2-weeks of baseline activity level (REC) for insulin sensitivity (euglycemic-hyperinsulinemic clamp), leg muscle mass (via DXA and pQCT) and isometric knee extension (KE) strength.

RESULTS: Participants decreased step counts during RA by ~70%. Glucose infusion rate (mL/kg FFM/min) during the clamp was 14.3±1.4 at PRE, increased (p<0.05) to 15.7±1.3 at RA and then decreased to 15.3±1.5% and then returned to PRE values at REC. Calf muscle area (pQCT) increased (p<0.05) by 2.4±0.9% from PRE to RA and then returned to PRE values at REC. KE strength decreased (p<0.05) by 8.0±3.5% after RA and remained depressed 7.4±1.4% compared to PRE.

CONCLUSIONS: In healthy older men and women, insulin sensitivity as assessed via the gold standard (euglycemic-hyperinsulinemic clamp) decreased (15.6%) following 2-weeks of modest physical inactivity, but unexpectedly, was able to rebound (13.9%) after re-ambulation such that it was 14.5% higher than baseline. This response may be limited to healthy older adults and therefore warrants further investigation. These older adults experienced modest muscle mass loss with step reduction that was restricted to the legs and especially the lower leg muscles. Knee extension strength was decreased after RA but did not recover following re-ambulation. Follow-up analysis may provide additional insight into the molecular mechanisms associated to the current metabolic and muscle alterations that occur with short-term physical inactivity and re-ambulation. Supported by NIH Grant R01 AG050781

1536 Board #5 May 31 1:00 PM - 3:00 PM
Effect Of Resistance Exercise Training On Anabolic Resistance To Amino Acids In Healthy Older Adults
Tatiana Moro, Camille R. Brightwell, Rachel R. Deer, Ted G. Graber, Efiego Galvan, Christopher S. Fry, Elena Volpi, Blake B. Rasmussen. University of Texas Medical Branch, Galveston, TX. (Sponsor: Paddon-Jones, Douglas J, FACSM)

(no relevant relationships reported)

Aging attenuates the contraction-induced stimulation of muscle protein synthesis (MPS). This phenomenon is termed “anabolic resistance”, and may contribute to the slow loss of muscle mass with advancing age (sarcopenia). Some studies also reported anabolic resistance to amino acid/protein intake with aging. However, this notion has not been firmly established. Acute bouts of exercise can improve the ability of amino acids to stimulate MPS by activating mechanistic target of rapamycin complex 1 (mTORC1) signaling and translation initiation, but it is not known whether chronic exercise training may improve muscle sensitivity to amino acid availability. PURPOSE: The aim of this study was to determine if healthy older adults exhibit muscle anabolic resistance to essential amino acid intake (EAA), and whether resistance exercise training (RET) improves the muscle sensitivity to EAA. METHODS: To test our hypothesis 19 healthy older adults (65-80 years old) underwent a 12-week progressive resistance exercise training program (RET). Before and after training we measured muscle mass and strength, and performed stable isotope infusion experiments with muscle biopsies to determine MPS and markers of amino acid sensing in the basal state and in response to EAA ingestion.

RESULTS: RET increased muscle strength (+15%), lean mass (+2%), and muscle cross sectional area (+17%) in healthy older adults (P<0.05). MPS and mTORC1 signaling (i.e., phosphorylation status of 4E-BP1, S6K, and rpS6) increased following EAA ingestion (P<0.05). Basal MPS increased by 28% after RET (P<0.05). However, the amplitude of the response of MPS and mTORC1 signaling to EAA ingestion did not differ from pre-training values (P>0.05).

CONCLUSION: Aging does not inhibit the EAA-stimulation of muscle mTORC1 signaling and MPS. RET did not increase the sensitivity of muscle to amino acids. Our data indicate that anabolic resistance to amino acids is not a significant problem in healthy older adults. We suggest that future work in conditions associated with more pronounced muscle wasting is necessary to determine whether exercise training can improve muscle sensitivity to amino acids or protein.

Supported by NIH/NIA R56 AG051267, P30 AG024832, NIH/NICATS UL1 TR001439.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®
**D-10 Thematic Poster - Movement Training**

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

**Neuromotor Training in Older Adults: A Pilot Study**

Natalie Barron, Michelle Perri, Joshua Guggenheimer, St. Catherine’s University, St Paul, MN. (Sponsor: Mark Blegen, FACSM)

(No relevant relationships reported)

**PURPOSE:** To discover if older women have improved gait speed and ROM after participating in a neuromotor training exercise program.

**METHODS:** Seven independently living women (79±9 yrs) participated in our study. Subjects underwent 16 sessions of neuromotor training over an 8-week period. The program consisted of two sets of 10 repetitions of eight exercises: squats, chair dips, lunges, band row, hip flexion and extension, bicep curls, ankle plantar flexion and dorsiflexion, and one legged balance. Hip flexion and ankle arc range of motion were measured pre- and post-intervention using an Acumar digital inclinometer. Gait speed, stride length, double stance time and timed-up-and-go (TUG), were measured using the BTS G-Walk device both pre- and post-intervention.

**RESULTS:** TUG times were significantly reduced from 14.6±6 sec to 10±4 sec, (p = 0.006). Interestingly, right hip ROM was significantly reduced post-intervention (94±14 vs. 88±13, p = 0.01). While not statistically significant, there was a 14% increase in gait speed and 8% and 10% increases in left and right leg stride lengths, respectively. Moreover, double limb stance time decreased by 12% and 19% with the left and right legs leading, respectively.

**CONCLUSIONS:** The importance of improved gait and ROM variables is crucial for OA in order to reduce the risk of falls. The intervention used in this study produced a significant reduction in TUG times for both single- and dual-task groups. The improvement in gait function is contingent upon lower-body support and gait speed. Even though statistically significant improvements in ROM and gait speed were not found, practical improvements were observed. Future neuromotor interventions should continue to find exercises that prioritize the improvement of gait and ROM variables, thereby enhancing functional independence.

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

**Dual-task Training Reduces Fall Frequency And Increases Physical Activity In Individuals With Parkinson's Disease**

Amanda L. Penko1, Jacob E. Barkley2, Jay L. Alberts3, St. Catherine’s University, St Paul, MN. (Sponsor: Mark Blegen, FACSM)

1Cleveland Clinic, Cleveland, OH. 2Kent State University, Kent, OH.

(No relevant relationships reported)

Parkinson’s disease (PD) is a neurodegenerative disease associated with motor and non-motor symptoms that increase individuals’ risk of falling, which may contribute to lowered physical activity behavior. Dual-task constructs, or simultaneous performance of a motor-cognitive task, results in an increase in gait dysfunction in PD, however both single-task (separate training of gait and cognition), and dual-task training (i.e., simultaneous training of gait and cognition) have been shown to improve gait function in PD. A comparison of the effects single- and dual-task interventions on physical activity behavior, falls and motor symptoms in PD has yet to be assessed.

**Purpose:** The aim of this study was to determine the effects of single- and dual-task training on physical activity, falls, and motor symptoms in PD patients with a history of falls. **Methods:** Twenty-one PD patients (age 63 ± 9 years) were randomized into single (n = 11) or dual-task (n = 10) training group. Both training groups exercised 40 minutes, three times/wk for eight weeks. Daily physical activity, 30-day fall frequency, and Unified Parkinson’s Disease Rating Scale (UPDRS) were assessed during peak levodopa response (1 hr post antiparkinsonian medication administration) by a single-blinded rater at baseline and post intervention. **Results:** UPDRS scores significantly (p = 0.007) improved from baseline (34.90 ± 11.24) to end of treatment (32.75 ± 11.63) for both the single and dual-task groups. Physical activity significantly increased (p = 0.03) from baseline (4.94 ± 4.415 steps/day) to end of training (5.914 ± 5.425 steps/day) for both single and dual-task groups combined. Fall frequency decreased significantly (p = 0.02) in the dual-task group from baseline (2.30 ± 3.02 falls) to end of treatment (0.80 ± 1.14 falls) with no change (p = 0.32) in falls in the single-task group (0.60 ± 0.84 falls at baseline, 0.80 ± 1.14 falls at end of treatment).

**Conclusion:** Both single and dual-task training were successful in increasing physical activity.

The improvement in UPDRS scores exceeded the threshold for minimally clinically important difference. Fall frequency was reduced only in the dual-task group from baseline (2.30 ±3.02 falls) to end of treatment (0.80 ±1.14 falls) with no change (p = 0.03) from baseline (4,942 ± 4,415 steps/day) to end of treatment for both the single and dual-task groups. Physical activity significantly increased (p = 0.03) from baseline (4.94 ± 4.415 steps/day) to end of training (5.914 ± 5.425 steps/day) for both single and dual-task groups combined. Fall frequency decreased significantly (p = 0.02) in the dual-task group from baseline (2.30 ± 3.02 falls) to end of treatment (0.80 ± 1.14 falls) with no change (p = 0.32) in falls in the single-task group (0.60 ± 0.84 falls at baseline, 0.80 ± 1.14 falls at end of treatment).

**Conclusion:** Both single and dual-task training were successful in increasing physical activity.

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

**A Novel Movement Ability Training Program Enhances Performance in Female Soccer Athletes**

Casey Myers1, Mike Decker1, Kevin Shehburne1, Matt Shaw1, Julie Graves2, Eric McCarty2, Michelle Wolcott2, 1University of Denver, Denver, CO. 2University of Colorado, Boulder, CO.

(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to assess the effects of a novel training program on the field-based performance testing of speed, power and movement quality. **Methods:** Twenty-five, elite female soccer athletes (13.3 ± 0.6 y; 161.9 ± 5.3 cm; 50.9 ± 4.9 kg) participated in a 7-week, training program performed with a wearable neuromuscular device (WND). The training program was directed by an exercise specialist and consisted of a three-tier progression of exercise complexity and intensity to enhance the athlete’s movement ability. All athletic exposures with and without the WND were recorded and analyzed descriptively. Field-based measurements of speed, power and movement quality were performed at the start (pre) and the end (post) of the training program. Speed was measured with a stop watch during a 20 yard sprint. Power was calculated from the flight times of three, single leg maximum vertical jumps captured with a wireless inertial measurement unit attached with double sided adhesive over the sacrum. Movement quality was determined by video analysis of three drop jump landings using the original and modified Landing Error Scoring System (LESS). A one-way repeated measures ANOVA contrasted pre and post sprint times and the average number of landing errors scored by the standardized methods of the LESS and the modified LESS. A two-way (time, leg) repeated measures ANOVA was used to measure the change in average and peak single leg jump heights (p<0.005).

**RESULTS:** Twenty-two athletes completed pre and post testing. Each athlete had an average of 11.3 ± 2.9 hours of weekly athletic exposure of which 6.9 ± 1.7 hours were with the WND. Over the course of training, speed increased 4% (pre, 3.36 ± .06 s; post, 3.22 ± .04 s; F(1,21)=10.171, p=.004), average and peak power increased 40% (pre, 125 ± .003 m; post, 175 ± .006 m; F(1,21)=59.618, p<0.001) and 37% (pre, 140 ± .044 m; post, 192 ± .007 m; F(1,21)=48.482, p<0.001) and movement quality increased by 20% (LESS: pre, 6.7 ± .4 errors; post, 5.3 ± .5 errors; F(1,21)=15.032, p<0.001; modified LESS: pre, 7.3 ± .4 errors; post, 5.8 ± .5 errors; F(1,21)=22.353, p<0.001).

**CONCLUSIONS:** The novel training program enhanced the field-based measurements of speed, power and movement quality in elite female soccer athletes.

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

**Results from the Randomized Controlled Trial Cyclical Lower Extremity Exercise (CYCLE) Trial for Parkinson’s disease**

Jay L. Alberts, Amanda L. Penko, Anson Rosenfeldt, Nicole M. Zimmerman. Cleveland Clinic, Cleveland, OH.

(No relevant relationships reported)

Parkinson’s disease (PD) is a neurodegenerative disease affecting approximately one million Americans. Our previous work suggested that forced exercise (FE), a mode of aerobic exercise in which voluntary exercise (VE) rate is augmented, results in global motor improvements. **Purpose:** The aim of this randomized clinical trial was to systematically evaluate the effects of voluntary and forced exercise on the motor symptoms of PD. **Methods:** A total of 100 individuals with PD (age 63 ± 8 years, n = 38 females) were randomized into one of three groups: VE (n = 40), FE (n = 40), or no-exercise control (n = 20). The VE and FE groups exercised 3x/week for 8 weeks on a stationary semi-recumbent cycle ergometer in a target heart rate range of 60-80% of heart rate reserve. The FE group exercised on a stationary cycle with the assistance of a motor that augmented pedaling rate by 35% compared to their preferred exercise rate. The MDS-Unified Parkinson’s Disease Rating Scale (UPDRS) was used to characterize PD motor function. All clinical evaluations were completed while patients were ’off’ antiparkinsonian medication (12 hr at baseline, end of treatment (EOT), EOT+4 week and EOT+8 week. **Results:** UPDRS-III scores significantly decreased from baseline to the EOT for both the VE and FE groups. The VE and FE groups demonstrated significant improvements in clinical ratings following exercise. The magnitude of improvement was 5.4 and 4.5 points for the VE and FE groups (p<0.001) at EOT. The significant decrease in UPDRS-III was maintained for the VE (3.5) and FE (3.2) during the EOT+8 week follow up. The control group exhibited a slight worsening, 2.2 increase, at EOT in clinical ratings. There were no significant differences between the VE and FE groups. **Conclusion:** Improvements in global motor performance following VE and FE interventions indicate high intensity aerobic exercise is likely enhancing central nervous function (CNS) which ameliorates basal ganglia dysfunction associated to PD. The clinical rating improvement in the FE and
VE groups persisted eight weeks after ending treatment suggesting high intensity aerobic cycling may have potential in altering PD progression and efficacy as a complementary treatment to traditional approaches to PD.

METHODS: 3 groups (12 each) participated since 656 to 76 years recruited for the project: habitual Tai Chi practitioners (TC; body mass (M) = 64.4 ± 9.3 kg, height (H) = 162.5 ± 6.9 cm), long brisk walk briskers (BW; M = 62.8 ± 6.6 kg, H = 163.5 ± 6.5 cm), and sedentary (SE, M = 68.3 ± 7.0 kg, H = 163.9 ± 7.0 cm). Participants were required to fit a 90°-90 mm block into three different openings (small: 100 ± 100, medium: 115 ± 115, and large: 130 ± 130 mm) with two different distances (1 and 3 times arm’s length). The task time and base of support were recorded by optical gate and reflective markers using Vicon system (Vicon Corporation, UK) synchronized with force plate data collection. The average time into-contact (TTC) measures were used to examine the dynamic of posture sway during fitting task. Two-way ANOVAs were used to assess the effects of group by size for average TTC at the two reaching distances. RESULTS: There was no group by size interaction observed for either distance (p > .05). Significant differences were detected for group (close: F1,17 = 11.567, p < .01; far: F1,17 = 13.599, p < .01) and size (close: F1,17 = 49.22, p < .00; far: F1,17 = 36.296, p < .00) for both distances. LDS Post Hoc revealed that TTC for TC was significantly less than that of the SE and BW at both close (2.30±0.56 vs. 2.81±0.71 vs. 2.61±0.71 s, p < .05) and far distance (1.82±0.31 vs. 2.30±0.61 vs. 2.11±0.58 s, p < .05). Additionally, TTC of small fitting size was significantly longer than larger size at both middle and larger fitting sizes, while TTC of middle size also was longer than that of the larger size at both close (3.25±0.75 vs. 2.46±0.43 vs. 2.14±0.28 s, p < .05) and far (2.52±0.57 vs. 1.98±0.42 vs. 1.74±0.30 s, p < .05) distances. CONCLUSIONS: Small fitting opening provided greater perturbation to postural control lead to longer TTC. However, postural control of the TC revealed having greater resistance to the perturbation lead to shorter TTC. Therefore, Tai Chi training have the potential for resist postural perturbation and prevent fall among older adults.

Purposes of the purpose of this study was to examine the influences of performing precision fitting task on the dynamics of postural sway among older adults.


Purposes: To compare the effectiveness of trunk lean (TL), medial knee thrust (MK), and foot postion (FP) on iPKEM. METHODS: 10 healthy individuals volunteered for this study (24±3±8 years, 1.73±0.1 m, 75.3±12.5 kg). Mean and standard deviation (SD) for iPKEM, trunk angle, knee angle (KA), and foot angle during stance were calculated from 10 baseline trials using a motion capture system (200Hz) and force plates (1000Hz). 10 trials completed for each strategy. Dependent t-tests were conducted to compare joint angles between baseline and modification strategy (p<.05). RESULTS: A significant difference between strategies was attained for iPKEM (p<0.001). MK (3.3± 3.3) had higher iPKEM than all other strategies (Baseline: 3.1±2.4, FP: 3.4±1.2, TL: 3.1±1.4). No other statistically significant difference was found (p<0.05). CONCLUSION: MK gait increased iPKEM despite no significant differences in KA compared to baseline. The observed increase in iPKEM during MKT gait suggests that participants were successful at attenuating ePKEM during the absorption phase of stance. Lack of significant changes in joint angles across conditions suggests that overall gait kinematics were similar for all conditions. Future research employing greater values for kinematic change is needed to further understand the effect of GM on iPKEM.
PURPOSE: To examine rural-urban differences in physical activity among cancer survivors in central Pennsylvania.

METHODS: Cancer survivors residing in central Pennsylvania were identified through the Pennsylvania Cancer Registry and mailed select questionnaires based on the Behavioral Risk Factor Surveillance System (BRFSS). The 2013 Rural Urban Continuum Codes (RUCC) were used to classify cancer survivors as urban/metro (RUCC codes 1-3) or rural/nometro (RUCC codes 4-9). Cancer survivors self-reported frequency and duration of aerobic physical activity and frequency of muscle-strengthening physical activity. To maintain consistency with the ACSM exercise guidelines for cancer survivors and the 2008 Physical Activity Guidelines for Americans, respondents were classified as meeting aerobic guidelines (yes/no ≥150 minutes/week), muscle-strengthening guidelines (yes/no ≥2 times/week), both aerobic and muscle-strengthening guidelines, or neither aerobic nor muscle-strengthening guidelines. A composite variable was included in multivariate models to strengthen guidelines. A composite variable was included in multivariate models to examine the association between rural-urban residence and meeting physical activity guidelines. A composite variable was included in multivariate models to examine the association between rural-urban residence and meeting physical activity guidelines.

RESULTS: Rural (n=64, 10.9%) and urban (n=521) cancer survivors from 27 counties in Pennsylvania completed mailed questionnaires. The prevalence of physical inactivity was higher in rural cancer survivors (rural 39.1%, urban 30.8%), but this difference was not statistically significant (p=0.18, p=0.18). Urban cancer survivors were 1.8 times more likely to meet aerobic physical activity guidelines compared to rural cancer survivors (95% CI: 1.015, 3.25; p=0.04); however, this was only marginally significant after adjusting for covariates (OR=1.91; 95% CI: 0.98-3.76; p=0.057). Adjusted analyses with the composite variable confirmed that urban cancer survivors were 2.6 times more likely than rural cancer survivors to meet the aerobic physical activity guideline compared to meeting neither guideline (OR=2.62; 95% CI: 1.06-6.31; p=0.03).

CONCLUSIONS: Culturally and contextually adapted interventions are needed to improve adherence with physical activity recommendations and reduce cancer health disparities in rural cancer survivors in Pennsylvania.
significant positive effects on cancer patients’ CRF.

CONCLUSIONS: This study concluded that Tai Chi/Qi gong had positive effects on QoL and cancer related fatigue symptoms on cancer patients. The findings need to be interpreted with caution due to limited studies and relatively small sample size.

1552  Board #4
May 31 1:00 PM - 3:00 PM
Does Low Volume High-Intensity Interval Training Elicit Superior Benefits to Continuous Low to Moderate-Intensity Training in Cancer Survivors?
Kellie L. Toohy, AEP. University of Canberra, Bruce, Australia.

(No relevant relationships reported)

PURPOSE: It is generally recommended that exercise form part of the standard of care for all cancer survivors, however, the optimal evidence-based clinical exercise guidelines for cancer survivors are currently not clear. The aim of this study was to determine the effectiveness of low volume high-intensity interval training (LVHIIT) and continuous low to moderate-intensity exercise training (CLMIT) on health outcomes in cancer survivors.

METHODS: Sedentary cancer survivors (n = 75) within 24 months of diagnosis, aged 51 ± 12 y, were randomised into three groups for 12 weeks of LVHIIT (n = 25), CLMIT (n = 25) or control group (n = 25). The LVHIIT group performed 7 x 30s intervals (≥ 85% predicted maximal heart rate), the CLMIT group performed continuous aerobic training for 20 min (< 55% predicted maximal heart rate) on a stationary cycle, three times per week.

RESULTS: An interaction effect (p = 0.01) for waist circumference in the LVHIIT group was found. The LVHIIT group had larger improvements in emotional well-being compared to the other groups (p < 0.01). Participants in the CLMIT and LVHIIT group demonstrated improvements in physical and functional well-being (p < 0.01).

CONCLUSIONS: LVHIIT elicited greater benefits in improving waist circumference and emotional well-being compared to the other groups in this study. Exercise positively impacted body composition, while blood cell count (WBC) and haemodynamic variables, without any adverse effects. Future research should explore the mechanisms involved in the changes reported in this study, so that clinicians can provide clinically relevant evidenced-based exercise prescription for cancer survivors.

1553  Board #5
May 31 1:00 PM - 3:00 PM
The Association Between Light Physical Activity and Physical Functioning Among Cancer Survivors
Elizabeth A. Fallon, Bennett McDonald, Tenbrock Smith, Kassam J. Alcaraz, J. Lee Westmaas, Alpa V. Patel. American Cancer Society, Atlanta, GA.

(No relevant relationships reported)

Substantial research supports the positive effect of moderate-to-vigorous physical activity (MVPA) on physical functioning among cancer survivors. Less research has examined the association of light physical activity (LPA) and physical functioning, or the potential moderating effect of MVPA on this association.

PURPOSE: To explore the independent association between LPA and physical functioning and any moderating effect of MVPA on this association.

METHODS: Self-report data from the American Cancer Society’s Studies of Cancer Survivors (n = 347) were utilized. Using the Leisure Time Exercise Questionnaire, four LPA groups (0, 1-59, 60-119, and 120+ minutes/week) and three MVPA groups (0, 1-149, and 150+ minutes/week) were created. ANCOVAs assessed the independent associations of LPA and MVPA as well as the LPA by MVPA interaction on the SF-12 Physical Functioning scale. Covariates included age, time since diagnosis, race/ethnicity, cancer type by gender, cancer stage, and number of comorbidities.

RESULTS: Cross-sectional 3-day food diary data from 23 HNCa patients beginning radiation therapy were analyzed. Self-administered survey assessed haemodynamic variables, without any adverse effects. Future research should explore the mechanisms involved in the changes reported in this study, so that clinicians can provide clinically relevant evidenced-based exercise prescription for cancer survivors.

1554  Board #6
May 31 1:00 PM - 3:00 PM
Diet and Eating Difficulties Affect Exercise Suitability in Head and Neck Cancer Patients Beginning Radiation
Josh N. Muhammad1, P. M. Anton, FACSM2, K. S. Courneya, FACSM1, K. A. Rao, FACSM3, Laura Q. Rogers, FACSM3.

1 The University of Alabama at Birmingham, Birmingham, AL. 2 Southern Illinois University, Carbondale, IL. 3 The University of Alberta, Edmonton, AB. Canada. 4 Southern Illinois University, Springfield, IL.

(No relevant relationships reported)

PURPOSE: Determine if head and neck cancer (HNCa) patients are suitable candidates for exercise training based on macronutrient intake. Also, identify macronutrient associations with fatigue, lean mass, strength, physical functioning, and eating difficulties. METHODS: Cross-sectional 3-day food diary data from 23 HNCa patients initiating radiation therapy were analyzed. Self-administered survey assessed demographics. Functional Assessment of Cancer Therapy (FACT) measured eating difficulties (additional concerns subscale items) and fatigue (higher score indicated greater fatigue). Lean mass was measured by bioelectric impedance, strength by handgrip dynamometer, and physical functioning by a physical performance battery. Associations were analyzed with Spearman correlations. RESULTS: Participants were 60.10±8.9 years of age, 96% Caucasian, and 70% male with a mean body mass index of 28.75±6.5. The most frequent cancer stage was IV and site was oropharynx (61% and 70%, respectively). Difficulty swallowing, difficulty eating solid foods, and mouth sores (48%, 35% and 9%, respectively) were the most common symptoms. Mean macronutrient intake (g/day) was 249 ± 85 of carbohydrate (CHO), 81 ± 34 of fat, and 83 ± 39 of protein (PTN) with 33% reporting intake of less than 0.8 g/kg/day of PTN. Fatigue was associated with percent kilocalories from CHO (r=0.52, p=0.02) and PTN (r=0.48, p=0.03). Lean mass was positively correlated with total intake of CHO (r=0.46, p=0.04), fat (r=0.54, p=0.01), and kilocalories (r=0.56, p=0.01). No significant correlations were observed between macronutrients and strength or physical functioning. Fat intake was positively correlated with greater ability to swallow (r=0.66, p=0.01) and eat solid foods (r=0.60, p=0.01) while CHO were negatively correlated with ability to swallow (r=0.81, p=0.01) and eat solid foods (r=0.72, p=0.01). PTN intake was positively correlated with ability to swallow (r=0.47, p=0.05).

CONCLUSIONS: PTN intake sufficiency in HNCa patients beginning radiation may jeopardize exercise suitability. Macronutrient intake is associated with fatigue and lean mass. Ability to eat may serve as a marker for individuals warranting particular nutritional attention. Funding: AICR #10A048, NCI R25CA76023

1555  Board #7
May 31 1:00 PM - 3:00 PM
Complementary and Alternative Medicine Use in Cancer Survivors in a Structured Exercise Program
Peter Smok1, Matthew Christensen2, Nicholas Harman1, Daniel Shackelford3, Reid Hayward1, Katie Kaige1, Jessica Brown2, Laura Stewart1, University of Northern Colorado, Greeley, CO. 1 Caroll University, Waukesha, WI.

(No relevant relationships reported)

INTRODUCTION: Approximately 12.7 million people are diagnosed with cancer each year and many undergo conventional treatments including chemotherapy, radiation, and surgery. Complementary and alternative medical treatments while conventional medicine refers to practices intended to replace traditional cancer treatments. Complementary and alternative medicine (CAM) practices can include, but are not limited to dietary supplementation, Chinese herbal medicine, and physical manipulation. A yearlong 2012 survey found that cancer survivors spent $4 billion on vitamins and minerals, $1.2 billion on non-vitamin or mineral natural products, and $500 million on massage. PURPOSE: To examine the use of CAM in cancer survivors currently participating in a structured exercise program.

METHODS: Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. RESULTS: All respondents indicated that they were interested in a structured exercise program that they received, and 70% of respondents reported using CAM after their cancer diagnosis. Half of the respondents started CAM use after physician recommendation, while the other half of respondents started using CAM on their own. Almost, 45% of respondents used some form of CAM while undergoing cancer treatment. Almost half of respondents (48%) claimed that CAM was least effective, while the other 52% of respondents were unsure. Only 1 one participant reported experiencing a CAM-related negative side effect. Respondents reported using dietary supplements (75%), vitamins (75%), and minerals (30%) with the most commonly used forms including Vitamins D and B, calcium, fish oil, aspirin, and ginseng. Other therapies used were massage (60%), acupuncture (25%), and cannabis (15%). CONCLUSION: A high percentage of cancer survivors participating in a structured exercise program reported using CAM. Consequently, cancer rehabilitation programs may want to consider providing information related to the safety and effectiveness of these products and practices to cancer survivors.

1556  Board #8
May 31 1:00 PM - 3:00 PM
Medical Use of CAM Among Cancer Survivors: Positive or Negative? The Results of a Pilot Study
Eliza A. McLachlan, Benji McDonald, Tenbrock Smith, Kasee J. Alcaraz, J. Lee Westmaas, and Alpa V. Patel. American Cancer Society, Atlanta, GA.

(No relevant relationships reported)
natural text
CLINICAL CASE SAMPLE

HISTORY: A 44-year-old male with greater than 100 miles/week biking regimen presented to clinic with symptoms of chest pain, nausea and abdominal pain associated with a 30lb weight loss over 3 months. His pain was exacerbated by flexion and prolonged sitting. Pain was relieved by remaining in an upright position. Extensive cardiac work-up and MRI of the abdomen and pelvis were performed prior to presentation in clinic and were negative. A GI consultant was unable to establish a neurological or thoracic condition.

PHYSICAL EXAMINATION: Initial on-field examination revealed no sternal or laryngeal tenderness but did show right sided rib tenderness. Additional sideline exam revealed midline thoracic tenderness around T6. He was neurovascullarly intact and had full active range of motion of his neck and all extremities.

DIFFERENTIAL DIAGNOSIS:
1. Laryngeal fracture
2. Sternal fracture
3. Traumatic rib fracture
4. Vertebral fracture
5. Spinal cord trauma

TESTS AND RESULTS:
1. EMG and NCV: — Scattered small perineural cysts, the largest measuring 0.7cm in diameter in the extremity strength testing was normal. Sensation was normal.
2. MRI of the thoracic spine: — No acute cervical spine fracture
3. CT scan of thoracic spine: — Acute burst type compression fracture of T6 with 4mm of retropulsion MRI or thoracic spine
4. MRI or thoracic spine — Acute burst fracture of T6 vertebral body with approximate 25% height loss along with narrow edema. A strain of the interspinous ligaments between T-6 & T-7 is also seen.

FINAL/WORKING DIAGNOSIS: Acute traumatic burst fracture of T6 vertebrae

TREATMENT AND OUTCOMES:
1. The initial concern was for airway compromise, but his airway remained patent. Spinal cord injury was a concern due to midline thoracic tenderness but unlikely as he was ambulatory and had an intact neurological exam.
2. After admission, imaging and a discussion with orthopedics, it was decided not to use a thoracic body brace as he would need a cervical extension due to his T6 fracture.
3. He was kept overnight for observation then discharged with instructions to limit spine flexion and extension. Repeat MRI at 2 weeks showed no worsening of his fracture or ligament sprain. His pain was controlled with oxycodone and muscle relaxers.
4. The plan is to work with physical therapy to progress his movement as he heals.

THURSDAY, MAY 31, 2018

5. Returned to most daily activities. Symptoms improved significantly after trigger point injections and physical therapy with a focus on traction and extension-based exercises.

DIFFERENTIAL DIAGNOSIS:
1. Cervical spine injury with resultant spinal cord injury
2. Cervical radiculopathy
3. Cervical nerve root avulsion
4. High upper trunk brachial plexopathy
5. Suprascapular and/or axillary neuropathy
6. Rotator cuff tear
7. Shoulder fracture / dislocation

TESTS AND RESULTS:
1. XR cervical spine (flexion/extension) and XR right shoulder (AP views with internal/external rotation and axillary views): no acute pathology with no evidence of laxity
2. MRI cervical spine: Mild right foraminal disc protrusion at C5-C6 contributing to mild neural foraminal stenosis. Torg ratio 0.77
3. EMG: Severe C5 and moderate C6 radiculopathy. Severe axonotmesis without neurotmesis

WORKING DIAGNOSIS:
C5 and C6 radiculopathy with axonotmesis

TREATMENT/OUTCOMES:
1. Trigger point injections under needle EMG guidance into the thoracic paraspinals and rectus abdominis were successful for symptom relief
2. Physical Therapy
3. Lyrica
4. Avoidance of prolonged flexion activities such as the cycling position
5. Return to most daily activities. Symptoms improved significantly after trigger point injections and physical therapy with a focus on traction and extension-based exercises.

DIFFERENTIAL DIAGNOSIS:
1. Cervical spine injury with resultant spinal cord injury
2. Cervical radiculopathy
3. Cervical nerve root avulsion
4. Right upper trunk brachial plexopathy
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WORKING DIAGNOSIS:
C5 and C6 radiculopathy with axonotmesis

TREATMENT/OUTCOMES:
1. Trigger point injections under needle EMG guidance into the thoracic paraspinals and rectus abdominis were successful for symptom relief
2. Physical Therapy
3. Lyrica
4. Avoidance of prolonged flexion activities such as the cycling position
5. Return to most daily activities. Symptoms improved significantly after trigger point injections and physical therapy with a focus on traction and extension-based exercises.
His main complaint was instability and his knee would buckle 3-4 times a week, but...
He was treated with an arthroscopic procedure to remove the 2 loose chondral bodies. He had cartilage cobbles stored debrided and a microfracture procedure performed to help fill in the chondral defect. He then participated in 6 weeks of non-weight bearing and then a formal therapy program.

**PHYSICAL EXAMINATION**

Athlete fell while walking on pine straw on anterior knee causing right leg to be hyper flexed under weight of the patient. The athlete was unable to move and EMS summoned for transport. Upon physical exam, individual had palpable deformity proximal to the patella. Individual unable to actively extend right leg. Individual appeared with obvious swelling. Neurological and circulatory exam WNL. No signs or symptoms of fracture. Ultrasound imaging was performed and revealed a full thickness hypoechoic area indicative of a quadriceps rupture.

**DIFFERENTIAL DIAGNOSIS**


**TEST AND RESULTS**

DDX Ultrasound - Full thickness hypoechoic lesion in the quadriceps tendon was visible both on the long and short axis views of the quadriceps tendon indicating full thickness tear, with hypoechoic areas around the surrounding structures suggestive of interstitial bleeding.

MRI w/o contrast - Portion of Quadriceps tendon extensor mechanism completely torn - Superficial aspect of rectus femoris is avulsed from its patellar attachment and retracted proximally - Marked anterior swelling - Patellar tendon intact

**FINAL WORKING DIAGNOSIS**

Quadriceps tendon injury, superficial aspect (rectus femoris) avulsed and retracted proximally.

**TREATMENT AND OUTCOMES**

Athlete underwent surgical repair of the right quadriceps tendon. Following immobilization athlete began contemporary rehabilitation program and has made full recovery without problems or complaints. This case report demonstrates the use of ultrasound imaging in a clinical setting that was as precise of eth follow-up MRI. Further, it is imperative for clinicians to ensure both long and short axis views of the quadriceps tendon to ensure proper diagnosis.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

**1571 May 31 2:00 PM - 2:20 PM**

**Anterior Knee Pain - Golf**

Shawn D. Felton, Aric J. van Duijn, Mitchell L. Cordova, FACSM. Florida Gulf Coast University, Fort Myers, FL. (Sponsor: Mitchell L. Cordova, FACSM)

**DIFFERENTIAL DIAGNOSIS**


**PHYSICAL EXAMINATION**

Right patellar dislocation. Individual had swelling anterior to the left patella. There was some tenderness over the MCL. He has a positive apprehension sign with stress testing. There was no patellar instability. There was no ligamentous laxity to anterior, posterior, varus and valgus stress testing. There was no joint opening with varus or valgus stress. There was no medial or lateral joint line tenderness. McMurray’s was not been able to be attempted because of limited range of motion. He can actively extend his knee to 90 degrees short of full extension and actively flex his knee to 90 degrees.

**FINAL WORKING DIAGNOSIS**

Patellar dislocation 2. Osteochondral defect 3. MPFL tear

**TEST AND RESULTS**

MRI Right Knee without Contrast: Acute lateral patellar tracking injury with medial patellar retinaculum sprain. Negative Lachman’s test or posterior drawer sign. There was no joint opening with varus or valgus stress. There was no medial or lateral joint line tenderness. McMurray’s was unable to be attempted because of limited range of motion. He can actively extend his knee to 90 degrees short of full extension and actively flex his knee to 90 degrees.

**D-36 Thematic Poster - Body Composition - Sport and Physiologic Considerations**

**1642 Chair: Kelly Massey. Milledgeville, GA.** (No relevant relationships reported)

**1643 Board #1 May 31 3:15 PM - 5:15 PM**

**Comparison of Bone and Body Composition in the Affected and Unaffected Arms in Breast Cancer Survivors**

Ashley Artese, Rachael L. Hunt, Daniel R. Marshall, Jeong-Su Kim, Michael J. Ormsbee, Robert Moffatt, Lynn B. Pantoni, FACSM. Florida State University, Tallahassee, FL. (No relevant relationships reported)

Following surgery and treatments, breast cancer survivors (BCS) may experience weakness, pain, and swelling in the arm next to the breast where the cancer was present (affected arm), resulting in decreased use of that arm. Treatments can also cause losses in bone mineral density (BMD), lean mass (LM), and gains in fat mass (FM). There is a lack of research on the effects of cancer treatment on BMD and body composition specifically in the affected compared to the unaffected arm. **PURPOSE:** To examine BMD, LM and FM in the affected compared to the unaffected arm in BCS. **METHODS:** Arm BMD, LM, and FM were assessed on 43 BCS (60 ± 8 years) using dual-energy X-ray absorptiometry. Paired tests were used to compare arm BMD, LM, and FM. Significance was accepted at p ≤ 0.05. **RESULTS:** BCS were 66.6 ± 7.3 years post treatment. Mean values of arm BMD, LM, and FM were 0.681 ± 0.097 g/cm², 2.23 ± 0.52 kg, and 1.79 ± 0.75 kg, respectively. The affected arm had lower BMD (0.674 ± 0.098 g/cm²) and FM (1.83 ± 0.75 kg) compared to the unaffected arm (0.717 ± 0.099 g/cm² and 2.35 ± 0.52 kg, respectively). **CONCLUSION:** BCS have lower BMD and FM in the affected arm compared to the unaffected arm.
Phase Angle and Body Composition in Breast Cancer Survivors Compared to Healthy Age-Matched Women

Caroline D. Deaterly, Elizabeth Evans, Tadzukwa A. Madzima, Elon University, Elon, NC. (Sponsor: Paul C. Miller, FACSM)

Purpose: To examine the influence of body composition, phase angle and ECM/BCM in BCS compared to healthy age-matched women (HC). Methods: Thirty post-menopausal BCS (stages 0-II) (age: 57 ± 8 yrs; BMI: 26.4 ± 4.8 kg/m² and 26 HC (age: 58 ± 7 yrs; BMI: 26.9 ± 5.3 kg/m²) participated in this cross-sectional study. After an 8 hr fast, whole body bioelectric impedance analysis was used to assess measures of body composition including lean mass, fat mass, body fat (%), phase angle, BCM, ECM, and ECM/BCM. Results were analyzed via one-way ANOVA. Significance was accepted at p<0.05. Results: There were no significant differences in lean mass (BCS: 45.7 ± 5.7; HC: 47.0 ± 7.1 kg), fat mass (BCS: 24.4 ± 8; HC: 25.7 ± 8.2 kg), body fat (%) (BCS: 34.0 ± 6.0; HC: 34.8 ± 5.7 %), BCM (BCS: 20.3 ± 3.0; HC: 21.3 ± 2.8 kg), ECM (BCS: 24.9 ± 3.1; HC: 25.2 ± 3.9 kg), ECM/BCM (BCS: 1.20 ± 0.1; HC: 1.18 ± 0.1), phase angle (BCS: 6.06 ± 0.7; HC: 6.17 ± 1.0°). Only one BCS had a phase angle less than 5°. Conclusion: Our findings suggest that BCS that are at least five years into survivorship appear to have similar phase angle, BCM, ECM, and ECM/BCM as HC. Future research should be conducted to determine the effects of cancer treatments on these phase angle, BCM and ECM/BCM in BCS that have recently completed treatment.

The Influence of Body Composition and Skinfold Thickness on Skin Temperature Changes after Resistance Exercise

Martin Weigert, Nico Nitsche, Christiane Lösch, Lutz Baumgärtel, Henry Schulz. Chemnitz University of Technology, Chemnitz, Germany.

No relevant relationships reported.

Resistance exercise leads to an increase in skin temperature (Tskin) in the area of the exercised muscle. Non-contact infrared thermography seems to be applicable to identify these primary used functional muscles with measuring Tchanges. In previous studies, lean men showed homogenous Tpatterns after standardized exercise protocols. Purpose: To examine the influence of body fat percentage (BF%) and skinfold thickness on Tpatterns after resistance exercise. Methods: 38 male subjects (19-32 years, BMI 20.4-55.2 kg/m²) participated. Means (min-max) of BF% and skinfold thickness of biceps brachii were 19.2% (6.2-51.5%) and 9 mm (2-36) respectively. After 15 min of acclimatization, the participants completed three sets with ten repetitions of unilateral biceps curls with 50% of the individual one-repetition maximum (two min rest between sets). Tof the exercised biceps was measured at rest (Trest), immediately following set 1, 2, and 3 (T1, T2, T3) and up to 30 min post exercise (Trest-T3) with an infrared camera. For statistical analysis, Δ-values to Trest for measuring every time point, as well as Trest-ΔTrest and time to Trest (min after the final set) were calculated. Results: One-way ANOVA detected a significant effect on the T-values Trest to T3 (Euro: p=0.04). Means (min-max) of Trest-ΔTrest and time to Trest were 32.3 °C (28.0-34.6), 34.0 °C (29.7-36.8), 1.7 °C (0.3-2.8) and 8 min (2-30) respectively. BF% and skinfold thickness showed a negative correlation with Trest, T1, T2, T3 and time to Trest (r=-0.52, p<0.001). A negative correlation between BF% and skinfold thickness with the Δ-values to Trest was found from Trest to T3 (for BF%: r=-0.49, p<0.001; for skinfold thickness: r=-0.66, p<0.001). All subjects up to a skinfold thickness of 10 mm showed a homogeneous Tpattern in reaction to the exercise with a minimum of ΔTrest of 1.3 °C and a time to Trest between 2 and 9 min. The Tpatterns in subjects with a higher skinfold thickness were heterogeneous and some of these subjects did not respond to the resistance exercise with an increase of Tskin. Conclusion: A higher BF% and a higher skinfold thickness is associated with delayed and lowered increases in Tskin after resistance exercise. In contrast to lean subjects, identifying the primary used functional muscles by infrared thermography in obese subjects seems to be challenging.

Body Composition of Collegiate Baseball and Softball Athletes, Consortium of College Athlete Research (C-CAR) Study

Madeline A. Czek,1, Christine J. Raymond-Pope, Tyler A. Bosch,1, Jack W. Ransone, FACSM,1, Jonathan M. Oliver,2, Aaron Carahuni,1, Philip R. Stanforth,1.1 University of Minnesota, Minneapolis, MN. 1University of Nebraska, Lincoln, NE. 2Texas Christian University, Fort Worth, TX. 1University of Kansas, Lawrence, KS. 2University of Texas, Austin, TX. (Sponsor: Donald R. Dengel, FACSM)

No relevant relationships reported.

PURPOSE: To evaluate total body composition measures across player positions in NCAA Division I male and female softball players using dual X-ray absorptiometry (DXA). METHODS: Three hundred and twenty-nine male and female (201/128) collegiate baseball and softball athletes from multiple universities (M/F: age = 20 ± 1.0; 20.0 ± 1.0 yrs; height = 1.81 ± 0.07/1.63 ± 0.07 m; weight = 88.6 ± 4.7/73.1 ± 3.0 kg; body mass index = 26.5 ± 8.2/25.0 ± 3.0 kg/m²) received one whole body DXA scan. The athletes were separated into four positions: pitchers (P; M/F=92/32), catchers (C; M/F=25/13), outfielders (OF; M/F=43/39), and infielders (IF; M/F=41/44). Total fat mass (FM), lean mass (LM), bone mineral density (BMD) and abdominal visceral adipose tissue (VAT) were measured by DXA. ANOVA and Tukey’s HSD assessed total differences between positions for each sex (adjusted p-value given). RESULTS: Male IF had significantly (p<0.003; 0.018) lower total LM (65.8±6.0 kg) than P and OF (69.6±5.7, 69.6±5.9 kg), but was not significantly different from C (69.4±5.4 kg, p=0.079). Additionally, male OF had significantly (p<0.033; 0.044) lower total FM (20.8±4.0, 20.6±7.2 kg; p<0.05) differences between male P, C, and IF were observed for total body composition measures across player positions. CONCLUSIONS: Our findings suggest that breast cancer treatments can result in accelerated changes in body composition and skinfold thickness were heterogeneous and some of these subjects did not respond to the resistance exercise with an increase of Tskin. A higher BF% and a higher skinfold thickness is associated with delayed and lower increases in Tskin after resistance exercise. In contrast to lean subjects, identifying the primary used functional muscles by infrared thermography in obese subjects seems to be challenging.

Body Composition of Division I Collegiate Basketball Athletes, Consortium of College Athlete Research (C-CAR) Study

Anna L. Solfest1, Christine J. Raymond-Pope1, Aaron Carahuni1, Philip R. Stanforth1, Jonathan M. Oliver1, Jack W. Ransone, FACSM1, Tyler A. Bosch1, Donald R. Dengel, FACSM1.1 University of Minnesota, Minneapolis, MN. 2University of Kansas, Lawrence, KS. 3University of Texas, Austin, TX. 4Texas Christian University, Fort Worth, TX. 5University of Nebraska, Lincoln, NE. (Sponsor: Donald R. Dengel, FACSM)

No relevant relationships reported.

PURPOSE: To examine total body composition measures across player positions in NCAA Division I male and female basketball players using dual X-ray absorptiometry (DXA). METHODS: Two-hundred and eight male and female (88/120) collegiate basketball players (M/F: age=19.8±1.4/19.9±1.3 yrs; height=1.95±0.09/1.78±0.09 m; weight=95.2±13.8/77.5±13.3 kg) received one whole body DXA scan. The athletes were separated into four positions: forwards (F; M/F=92/32), centers (C; M/F=25/13), guards (G; M/F=43/39), and bench players (B; M/F=41/44). Total fat mass (FM), lean mass (LM), bone mineral density (BMD) and abdominal visceral adipose tissue (VAT) were measured by DXA. ANOVA and Tukey’s HSD assessed total differences between positions for each sex (adjusted p-value given). RESULTS: Male IF had significantly (p<0.003) lower total LM (65.8±6.0 kg) than P and OF (69.6±5.7, 69.6±5.9 kg), but was not significantly different from C (69.4±5.4 kg, p=0.079). Additionally, male OF had significantly (p<0.033; 0.044) lower total FM (20.8±4.0, 20.6±7.2 kg; p<0.05) differences between male P, C, and IF were observed for total body composition measures across player positions. CONCLUSIONS: Our findings suggest that breast cancer treatments can result in accelerated changes in body composition and skinfold thickness were heterogeneous and some of these subjects did not respond to the resistance exercise with an increase of Tskin. A higher BF% and a higher skinfold thickness is associated with delayed and lower increases in Tskin after resistance exercise. In contrast to lean subjects, identifying the primary used functional muscles by infrared thermography in obese subjects seems to be challenging.
and SG (11.0±3.0; 10.9±3.0; p=0.001), but not PG (12.5±4.4 kg; p=0.025), and greater total LM (89.9±8.9; 84.1±5.5 kg) compared to PG, SG, and SF (68.9±6.1; 73.3±6.1; 75.6±5.2 kg, p<0.001). Male C and PF VAT measurements (0.4±0.24; 0.43±0.1 kg) were significantly higher compared to SF, SG, and PG (0.23±0.11; 0.22±0.12; 0.26±0.12 kg; p<0.001). Before and after adjustment for weight, males did not show significant differences in BMD across position (p=0.156; p=0.559). In females, C had significantly greater (p<0.001) total FM compared to all other positions. SF, PF, and C had significantly greater (p<0.001) greater total LM (56.6±3.4; 59.0±5.0; 60.6±5.5 kg) compared to PG and SG (48.0±3.4; 51.4±3.9 kg). After adjustment for weight, no significant differences were observed in BMD across position (p=0.276). Female C had significantly higher VAT (0.29±0.24 kg) compared to PG and SG (0.06±0.06, 0.07±0.04 kg; p=0.005) but not SF and PF (0.13±0.14, 0.19±0.18 kg; p=0.11-0.44).

CONCLUSIONS: Within collegiate male and female basketball players FM, LM, and VAT differed by position after adjustment for weight, BMD was not significantly different for males or females. These position-specific measurements provide normative data on male and female basketball players.

### D-37 Thematic Poster - Exercise Training in Cancer Patients

**Thursday, May 31, 2018, 3:15 PM - 5:15 PM**

**Room:** CC-Lower level L100E

**Chair:** Karen M. Mustian. University of Rochester/James P. Wilmot Cancer Center, Rochester, NY.

**(No relevant relationships reported)**

**Purpose:** Previous systematic reviews and meta-analyses demonstrated beneficial effects of exercise during or following cancer treatment on quality of life (QoL).

Aiming to understand how exercise contributes to a patient’s QoL, we examined patients’ perspectives via a process called concept mapping. This unique method provides structure and objectivity to rich qualitative data.

**Methods:** Patients with cancer participating in an exercise program were invited to complete the colorectal cancer-specific version of the Quality of Life as a result of Cancer (QoL) instrument. Patients then completed a web-based, semi-structured survey of questions about how the exercise program improved their QoL. After completing the survey, the research team labelled the clusters of ideas, and physiotherapists reflected on the clusters during semi-structured interviews.

**Results:** Sixty patients attended the meetings of whom one patient was not able to generate an idea in response to the statement. Forty-four patients completed the online clustering and rating of ideas. The resulting concept map yielded 6 clusters: personalized care, coaching by a physiotherapist, social environment, self-concept, coping and physical fitness and health. Personalized care was rated as most important. Overall, physiotherapists recognized these clusters in practice.

**Conclusion:** Patients with cancer reported that participating in a supervised exercise program improved their physical, social, and emotional QoL. These results can be used to increase the awareness of the importance of supervised exercise programs for the QoL of patients with cancer.

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**S318 Vol. 49 No. 5 Supplement**

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

**Positional Body Composition of Division I Volleyball Players, Consortium of College Athlete Research (C-CAR) Study**

Katie L. Bisch1, Tyler A. Bosch1, Aaron Caruhn2, Philip R. Stonestraith3, Jonathan M. Oliver3, Jack W. Ransone, FACSM4, Andreas Kreutzer5, Donald R. Dengel, FACSM1. University of Minnesota, Minneapolis, MN. 1University of Kansas, Lawrence, KS. 2University of Texas at Austin, Austin, TX. 3Texas Christian University, Fort Worth, TX. 4University of Nebraska, Lincoln, NE. (Sponsor: Donald R. Dengel, FACSM)

(No relevant relationships reported)

**Purpose:** To identify normative values for total and regional body composition by position for female NCAA Division I collegiate volleyball players using dual X-ray absorptiometry (DXA).

**Methods:** Eighty-nine female volleyball players (ages 17-23) from multiple universities received a DXA scan. Athletes were categorized by position: Middle Blocker (MB=30), Outside Hitter (OH=24), Setter (ST=9), and Libero (LB=17) from multiple universities. Athletes were categorized by sex and ethnicity. Total and regional fat tissue mass (FM), lean tissue mass (LM), bone mineral density (BMD), and abdominal visceral adipose tissue (VAT) were measured by DXA. Paired t-tests assessed total and regional differences between equestrian athletes and controls. RESULTS: Equestrian athletes had a lower total fat percentage (%fat) than controls (30.7±0.9 vs. 33.1±0.1%, p=0.03). There was a trend for the equestrian athletes to have lower total FM (18.4±0.8 vs. 20.0±0.9 kg, p=0.06) than controls. There were no significant differences in total LM (41.0±0.9 vs. 39.9±0.8 kg, p=0.33), total BMD (1.15±0.02 vs. 1.15±0.02 g/cm², p=0.92) and VAT (0.1±0.03 vs. 0.16±0.03 kg, p=0.25) between equestrian athletes and controls. However, equestrian athletes, when compared to the controls, had significantly lower leg %fat (33.0±0.8 vs. 37.3±0.9%, p<0.001), leg FM (7.0±0.3 vs. 8.0±0.4 kg, p=0.01) and higher leg LM (14.1±0.4 vs. 13.2±0.3 kg, p=0.04). The greater leg lean mass in equestrian riders resulted in a smaller upper to lower body lean mass ratio (1.706 ±0.19 vs. 1.812 ±0.10, p<0.005) controlled to controls. There was no difference in leg BMD between equestrian athletes and controls (1.19±0.02 vs. 1.21±0.02 g/cm², p=0.46). CONCLUSIONS: The lower total percent body fat in equestrian athletes seems to be influenced by differences in leg composition with equestrian athletes having significantly more lean mass and less fat mass. These results are consistent with the role the legs play in horseback riding and demonstrate an effect of either training or horseback riding on body composition compared to matched controls.

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

**Body Composition of Division I Collegiate Female Equestrian Athletes**

Olivia H. Dengel1, Christiana J. Raymond-Pope2, Jonathan M. Oliver2, Tyler A. Bosch3, Donald R. Dengel, FACSM1. 1University of St. Benedict, St. Joseph, MN. 2University of Minnesota, Minneapolis, MN. 3Texas Christian University, Fort Worth, TX. (Sponsor: Donald R. Dengel, FACSM)

(No relevant relationships reported)

**Purpose:** To compare measures of total and regional body composition using dual X-ray absorptiometry (DXA) in NCAA Division I collegiate equestrian athletes to a group of age, sex and BMI matched non-athlete college students. **METHODS:** Thirty-one female collegiate equestrian athletes were matched to a population of normal, non-athlete college students by age (19.8±0.2 vs. 19.8±0.2 yrs.), body mass index (22.3±0.4 vs. 22.6±0.4 kg/m²), sex and ethnicity. Total and regional fat tissue mass (FM), lean tissue mass (LM), bone mineral density (BMD), and abdominal visceral adipose tissue (VAT) were measured by DXA. Paired t-tests assessed total and regional differences between equestrian athletes and controls. **RESULTS:** Equestrian athletes had a lower total fat percentage (%fat) than controls (30.7±0.9 vs. 33.1±0.1%, p=0.03). There was a trend for the equestrian athletes to have lower total FM (18.4±0.8 vs. 20.0±0.9 kg, p=0.06) than controls. There were no significant differences in total LM (41.0±0.9 vs. 39.9±0.8 kg, p=0.33), total BMD (1.15±0.02 vs. 1.15±0.02 g/cm², p=0.92) and VAT (0.1±0.03 vs. 0.16±0.03 kg, p=0.25) between equestrian athletes and controls. However, equestrian athletes, when compared to the controls, had significantly lower leg %fat (33.0±0.8 vs. 37.3±0.9%, p<0.001), leg FM (7.0±0.3 vs. 8.0±0.4 kg, p=0.01) and higher leg LM (14.1±0.4 vs. 13.2±0.3 kg, p=0.04). The greater leg lean mass in equestrian riders resulted in a smaller upper to lower body lean mass ratio (1.706 ±0.19 vs. 1.812 ±0.10, p<0.005) compared to controls. There was no difference in leg BMD between equestrian athletes and controls (1.19±0.02 vs. 1.21±0.02 g/cm², p=0.46). CONCLUSIONS: The lower total percent body fat in equestrian athletes seems to be influenced by differences in leg composition with equestrian athletes having significantly more lean mass and less fat mass. These results are consistent with the role the legs play in horseback riding and demonstrate an effect of either training or horseback riding on body composition compared to matched controls.

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

**How Does a Supervised Exercise Program Improve Quality Of Life In Patients With Cancer?**

Maite G. Sweegers. VU University Medical Center, Amsterdam, Netherlands.

(No relevant relationships reported)
Each year, approximately 1.6 million Americans are diagnosed with cancer. The consequences of cancer and its associated treatment include elevations in cardiovascular risk, deteriorating body composition, and diminishing physical function. Exercise is an effective countermeasure; however, limitations in adherence may compromise the magnitude of improvement experienced. **PURPOSE:** To evaluate cardiovascular, anthropometric, and functional adaptations to an exercise program in cancer survivors. **METHODS:** We conducted a 10-week exercise intervention on 157 cancer survivors; 58 were retained through follow-up. At baseline, we recorded demographic, anthropometric, cardiovascular, and functional data. Anthropometric measurements were weight, body mass index (BMI), and body fat percent (BF%). Cardiovascular measurements were blood pressure and heart rate. Functional tests were VO2 max, six-minute walk, timed up-and-go, chair stand, sit-to-stand, arm curl, grip strength, Universal Machine (UM) push and pull, epic lift, sit-and-reach, functional reach, and back scratch. Paired-samples t tests measured changes from baseline to follow-up. **RESULTS:** Anthropometric variables did not change: body weight (p=0.585), BMI (p=0.477), and BF% (p=0.367). Cardiovascular variables did not change: systolic blood pressure (p=0.560), diastolic pressure (p=0.292), and heart rate (p=1.000). Improvement was detected in 11 of 13 functional tests: VO2 max (p<0.005), six-minute walk (p<0.001), chair stand (p=0.001), sit-to-stand (p=0.005), arm curl (p=0.001), grip strength (p=0.001), UM push (p=0.001), UM pull (p=0.001), epic lift (p=0.005), and functional reach (p=0.001). Mean values improved in sit-and-reach (p=0.321) and back-scratch (p=0.099), but pre-post comparisons were not significant. **CONCLUSION:** Exercise had no effect on anthropometric or cardiovascular profiles, but physical functioning improved in nearly every domain. In this population, maintenance of functional capacity can help preserve the ability to perform tasks of daily living, and it associates with survival. Although we found exercise to improve strength, aerobic capacity, and flexibility, the high rate of attrition is a potential limitation; further research is necessary to confirm our findings.

**Exercise in cancer patients is safe and can improve a range of outcomes including cancer-related fatigue, physical functioning and quality of life. Preclinical trials suggest an acute exercise bout during chemotherapy infusion may improve the treatment efficiency. It would also present an additional opportunity for supervised exercise. However, there are currently no published human trials of such an intervention.**

**PURPOSE:** To determine the safety and feasibility of delivering an aerobic exercise intervention to cancer patients during chemotherapy infusion. **METHODS:** A randomised crossover trial has commenced with eligible patients receiving either usual care or performing 20 minutes of low intensity cycling during infusion. Data collection includes patient uptake, physiological exercise response, perceived exertion, patient experience and a daily symptom diary for 1 week subsequent. **RESULTS:** Exercise has been safely delivered with neither adverse events nor interference to usual care reported for all subjects (N=3, Female, 52 ± 8 yrs). 60% of patients approached agreed to participate, and all reported that the exercise was no less comfortable, no more difficult, and less boring than usual care. Heart rate rose to the target 30%-40%HRmax within 5-8 minutes and was steady during exercise, recovering to within 10 beats of resting rates in 4.7±1.9 min. On average, systolic blood pressure rose 15% during exercise, with a maximum reading of 153 mmHg, and full recovery to resting levels within 15 minutes. Oxygen saturation remained above 95% at all times. Rated perceived exertion during exercise ranged from 9-13 on the Borg scale. Reported daily symptom data was similar after both exercise and usual care. **CONCLUSIONS:** Exercise during chemotherapy infusion may be a safe and feasible addition to chemotherapy. Larger data collection is required to evaluate drug delivery efficiency, symptom reduction and opportunity for physical activity increase.

**CHEMOTHERAPY-INDUCED PERIPHERAL NEUROPATHY (CIPN) is a common, dose-limiting side effect of taxane treatment for breast cancer. Given the limited medical or pharmacological treatment options to reduce CIPN, understanding the impact of lifestyle interventions is of interest.** **PURPOSE:** To evaluate the effect of exercise during taxane treatment on CIPN symptoms in women with breast cancer. **METHODS:** Women with early-stage breast cancer were randomized to supervised exercise (EX) or usual care (UC) during taxane treatment (~4 cycles, 2-3 weeks apart). Exercise included thrice-weekly progressive aerobic (50-75% HRmax, 25-35 min), resistance (1-2 sets, 10-12 reps, 50-65% estimated 1RM) and balance training. CIPN symptoms were evaluated via: 1) the EORTC-QLQ CIPN20 subscale (scored from 0-100, with higher scores indicating greater symptom burden, and summarized as % of participants experiencing symptoms “quite a bit” or “very much”) and 2) quantitative sensory testing at the toes (vibration and pinprick). **RESULTS:** EX presented: 1) baseline (pre-taxane chemotherapy); 2) post-taxane cycle 3; and 3) end of chemotherapy. **RESULTS:** Twenty-seven women enrolled (UC: n=15, EX: n=12). Relative to baseline, both groups reported worse total sensory symptoms post-cycle 3 (A16.3, p=0.01) that progressed further by the end of chemotherapy (A24.3, p<0.01). At post-cycle 3, sensory symptoms were 38% lower in EX compared to UC but this was not statistically significant (UC=26.3±4.7, EX=16.3±5.4, p=0.17). The most reported symptoms were tingling and numbness in both the hands and feet. Post-cycle 3, foot numbness was less prevalent (UC=50%, EX=9%, p<0.04), and foot tingling trended toward reduced prevalence (UC=43%, EX=9%, p=0.08) in the EX group. No group differences were found at the end of chemotherapy, or for hand symptoms at any time point. More UC participants had impaired vibration sense post-cycle 3 (UC=67%, EX=17%, p=0.02). There were no group differences for pinprick testing. **Conclusion:** Multi-modal exercise during taxane treatment may delay CIPN symptom progression in breast cancer patients. Specifically, our findings indicate that exercise may reduce patient-reported and quantitative sensory symptoms in the feet after three taxane treatment cycles, where onset is frequently reported.

Androgen deprivation therapy (ADT) in men with prostate cancer (PCa) results in adverse effects including reduced muscle strength and physical performance, potentially compromising daily functioning. **PURPOSE:** To examine whether it was more efficacious to commence exercise at the onset of ADT rather than later in treatment to counter declines in strength and physical function. **METHODS:** One hundred and four men with PCa (68.3±7.0 years, 29.7±5.2 % fat, Gleason score 7.6±0.9) initiating ADT were randomised to immediate exercise (EX, n=54) or delayed exercise (DEL, n=50) for 12 months. EX comprised 6 months of supervised resistance/aerobic/impact exercise initiated at onset of ADT with 6-month follow-up. DEL comprised 6 months usual care followed by 6 months of resistance/aerobic/impact exercise. Muscle strength (chest press, leg press, seated row) and physical performance (6-m usual and fast walk, 6-m backwards walk, 400-m walk, stair climb, repeated chair rise) were assessed at baseline, 6 and 12 months. Data were analysed by ANCOVA using an intention to treat approach. **RESULTS:** There was a significant difference for all strength measures at 6 months favouring EX (p<0.001), with net differences in leg press, seated row and chest press strength of 19.9 kg (95% CI, 12.3 to 27.5 kg), 5.6 kg (3.8 to 7.4 kg), and 4.3kg (2.7 to 5.8 kg), respectively. From 6-12 months DEL increased in all strength measures (p=0.001) such that there were no differences between groups at 6 months. Similarly, physical performance differences (p<0.001) in EX compared to DEL at 6 months for the 400-m walk (-9.7 s, 95% CI -14.8 to -4.6 s), stair climb (-0.4 s, 0.6 to -0.2 s) and chair rise (-1.0 s, -1.4 to -0.7 s), with no differences between groups by 12 months. **CONCLUSION:** Exercise either

Abstracts were prepared by the authors and printed as submitted.
Lung cancer is the second most commonly diagnosed form of cancer, and is often treated surgically via tumor resection and lobectomy. Removal of lung tissue often impairs cardiopulmonary function, reduces activities of daily living, and lowers quality of life. Exercise interventions improve cardiopulmonary health and may attenuate the negative effects of lung cancer and its treatment. Purpose: To evaluate the response of lung cancer patients who had previously undergone a lobectomy to a structured, supervised 12-week exercise intervention, and compare these results with all other cancer patients completing the same exercise intervention. Methods: Nine male and female lung cancer survivors who had previously undergone a lobectomy, were recruited to participate in a 12-week exercise-based rehabilitation program. The program consisted of one hour sessions, three days per week, and included cardiovascular endurance, muscular strength and endurance, balance, and flexibility exercises. Subjects completed pre and post assessments of cardiopulmonary function, consisting of a graded exercise test, yielding peak oxygen consumption (VO2peak), and spiroergometry, yielding forced vital capacity (FVC) and forced expiratory volume (FEV1.). Subjects were divided into two groups: surgical resection including lobectomy (LOB, n = 9), and adjuvant chemoradiotherapy (AOC, n = 20). Results: There were significant improvements in VO2peak in the LOB group (Pre: 15 ± 2.6 mL/kg/min; Post: 19 ± 1.5 mL/kg/min; +20%; P = 0.03) and no significant changes in FVC and FEV1. There were significant improvements in VO2peak in the AOC group (Pre: 21 ± 0.5 mL/kg/min; Post: 24 ± 0.6 mL/kg/min; +13%; P = 0.00) and FEV1 (Pre: 95 ± 1 % -predicted; Post: 97 ± 1 % -predicted; +2.2%; p = 0.02) in the AOC group. Between group comparisons yielded no significant difference in improvement to VO2peak for LOB vs AOC (p = 0.77). Conclusion: Results from this study demonstrate that lung cancer patients who have previously undergone a lobectomy can safely and effectively complete an individualized, prescriptive exercise intervention. These data also show that lung cancer survivors who have previously undergone a lobectomy are able to improve cardiopulmonary function to the same degree as all other cancer survivors completing a rehabilitative exercise intervention.
BACKGROUND: Physical work, exacerbated by environmental heat stress, can induce dehydration, impairing physiological function. Therefore, understanding efficient rehydration strategies is paramount. The rehydrating effects of carbohydrate-electrolyte drinks and coconut water are well documented. To the best of our knowledge, no studies have investigated the rehydrating efficacy of maple water (MW).

PURPOSE: Investigate the rehydrating efficacy of MW following exercise-induced dehydration. METHODS: Twenty healthy subjects (age: 24±5 y, 3 females) completed randomized double-blind (MnDew, Soda) and water control (Water) trials. Subjects consumed four 1 h work-rest cycles (45 min exercise, 15 min seated rest) in a 35°C, 55% RH environment. During rest, subjects drank 500 mL of the assigned rehydration beverage (MW). Physiological variables, and venous blood and urine samples were taken pre- and post-exercise, and post-exercise (POST) after 15 min supine rest in a moderate environment. Percent changes in plasma volume were estimated from changes in hemoglobin and hematocrit. Data are reported as a change from Pre (means+SD).

RESULTS: MAP increased in control trials by 10±2 mmHg (p<0.01), which tended to increase urine AP following MW consumption (9.4 ± 0.7 vs 7.6 ± 1.0 mmol; MW vs. control). These data indicate that consuming a caffeinated soft drink during exercise in the heat increases the magnitude of dehydration. METHODS: Twelve healthy subjects (age: 24±5 y, 3 females) completed randomized soft-drink (MnDew, Soda) and water control (Water) trials. Subjects consumed four 1 h work-rest cycles (45 min exercise, 15 min seated rest) in a 35°C, 55% RH environment. During rest, subjects drank 500 mL of the assigned rehydration beverage (MW). MAP increased in control trials by 10±2 mmHg (p<0.01), which tended to increase urine AP following MW consumption (9.4 ± 0.7 vs 7.6 ± 1.0 mmol; MW vs. control). These data indicate that consuming a caffeinated soft drink during exercise in the heat increases the magnitude of dehydration.

CONCLUSION: These data indicate that consuming a caffeinated soft drink during exercise in the heat worsens dehydration and elevates cardiovascular strain.

Abstracts were prepared by the authors and printed as submitted.
CONCLUSIONS: The data suggest that, when consuming a water and NaCl mixture in volumes ranging from 5 - 20 mL H2O kg-1 cm2, fluid retention rates are approximately 50% regardless of the volume of fluid consumed. Thus, to achieve maximum hyperhydration, at least 20 mL H2O kg-1 should be consumed.

D-39 Thematic Poster - Knee Biomechanics
Thursday, May 31, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100F

Chair: Max R. Paquette. University of Memphis, Memphis, TN.

1665 Board #1 May 31 3:15 PM - 5:15 PM
Dynamic Knee Hyperextension in Competitive High School Soccer Players
Stacy J. Ingraham1, Jon-Paul W. Ciszewski1, David W. McGehee2, Jessica N. Schnidler2, Sarah J. Ingraham1, William W. Newhouse1, Daniel D. Hanson1, Jane R. Yank2
1Crosson College, St. Bonifacius, MN. 2Bethel University, St. Paul, MN.

Purpose: The purpose of this study was to explore the incidence of dynamic knee hyperextension in high school soccer athletes by sex and team level (freshman, junior varsity, varsity) and to compare this to a control group (high school non-soccer players) using high-speed photography. In addition, the data was gathered to explore the differences in the dynamic hyperextension noted between male and female athletes and the differences to the incidences found in ACL injury surveillance data incidence statistics.

Methods: Dynamic knee extension of 87 male (n=41) and female (n=46) high school soccer athletes was captured using high-speed photography while punting a soccer ball 8 times in a single session. One photo demonstrating each athlete’s maximal knee extension was assessed for degree of extension, both visually and using Kinovea, a motion analysis software program.

Results: Multinomial logistic regression regarding certainty of hyperextension with a 5-point scale by two judges showed no significant differences by sex of the player (p=0.456) or by team level (p=0.064). The incidence of hyperextension for females and males across all skill levels was approximately 16/41 (39%) and 16/36 (44%), respectively. Results of binary logistic regression on the presence or absence of hyperextension showed no significant differences by sex of the players (p=0.702) or by team level (p=0.191). Results of categorical data analysis showed no significant differences among six player groups consisting of freshman, junior varsity, varsity, and university level for both boys and girls (chi-square=3.928, p=0.560). Interestingly, there was a marginal increased incidence of hyperextension in freshman high school athletes (p=0.099). The incidence of hyperextension among all participants of this study is not congruent with published ACL injury surveillance, confirming the multifactorial nature of ACL injuries.

Conclusion: The results indicate that with a larger sample size, a difference between team levels may emerge. The lack of difference in hyperextension incidence between males and females suggest hyperextension incidence is not a good predictor of injury differences between sexes. More research is needed to identify the relationship between observed dynamic knee hyperextension, recoll and ACL injury.

1666 Board #2 May 31 3:15 PM - 5:15 PM
A Novel Approach To Investigate Differences In Knee Mechanics After ACL Reconstruction Using Inertial Sensors
Jasper Reinold1, Erik Maertens1, Jaap Buurke1, Mary Lloyd Ireland, FACSM1, Brian Noehren, FACSM1, 1Roessingh Research and Development, University of Twente, Enschede, Netherlands. 2University of Kentucky, Lexington, KY. (Sponsor: Brian Noehren, FACSM)

Hop testing after an Anterior Cruciate Ligament reconstruction (ACLR) is a common functional test to determine return to play status. However, hop tests are not very sport specific, as they do not capture other tasks in sports like accelerating, decelerating, cutting and turning. A figure 8 running task is proposed as an alternative, involving these sport specific movements. Knee mechanics during this task can be objectively investigated using inertial sensors. These sensors have been used previously to objectively hop tests and showed differences in knee kinematics in ACLR patients.

Purpose: To investigate sagittal knee mechanics in ACLR patients during a 5 minute figure 8 running task, using inertial magnetic measurement units (IMUs).

METHODS: 5 ACLR patients (2M, 3F, 20.4 ± 2.1 yrs, 164.2 ± 10.7 cm, 69.1 ± 23.5 kg) one year post ACLR, and 10 healthy controls (7M, 3F, 21.8 ± 2.0 yrs, 178.3 ± 10.2 cm, 73.5 ± 14.0 kg) performed a 5 minute figure 8 running task wearing a lycra suit equipped with 8 IMUs at the feet, tibia, upper legs, sacrum and sternum. Sagittal knee mechanics were determined at the strides since this is the most standardized part of the figure 8. The absolute difference in peak knee flexion (ADPK) during stance phase was determined between reconstructed and healthy leg for the ACLR group and between both legs for the healthy (HLTH) population. An independent Mann-Whitney U-test was used to test for a statistical difference in ADPK between ACLR and HLTH.

RESULTS: ADPK was significantly higher (p<0.05) for the ACLR group versus the healthy population.

CONCLUSIONS: Subjects who have had an ACLR have a larger difference in peak knee flexion between their reconstructed and healthy leg (less flexion in the reconstructed knee) at the straights of a figure 8 Running task compared to healthy controls. The figure 8 test might serve as a new test to determine return to play and to assess re-injury risk. Future research should test this and include (frontal plane) knee mechanics during cutting and turning.

1668 Board #3 May 31 3:15 PM - 5:15 PM
Reductions in Peak Knee Adduction Moment in Three Previously Studied Gait Modification Strategies: Preliminary Analysis
Bryndan Lindsey1, Oladipo Eddo1, Shane Caswell1, David Hollinger1, Jessica Pope1, Matt Prebble1, Ana M. Azevedo2, Nelson Cortes1, George Mason University, Manassas, VA. 1University of Lisbon, Lisbon, Portugal.

First peak knee adduction moment (PKAM) has been associated with osteoarthritis (OA) progression. Gait modification strategies using real-time biofeedback (RTB) including lateral trunk lean (TL), medial knee thrust (MKT), and reduced foot progression angle (FPA) have reduced PKAM in both healthy and OA populations. However, heterogeneity between limited study designs makes it unclear which strategy most effectively reduces PKAM. PURPOSE: To compare the effects of TL, MKT, and FPA strategies on PKAM in healthy individuals during gait. METHODS: 10 healthy individuals volunteered for this study (28.4 ± 3.8 years, 1.73 ± 0.1 m, 75.3 ± 12.5 kg). Mean and standard deviation (SD) for PKAM, trunk angle, knee angle (KA), and foot angle during stance was calculated from 10 baseline trials using a motion capture system and force plates. 10 trials completed for each strategy using RTB so that joint angles fell within a determined range (±5 SD) relative to baseline. Visual 3D was used to project visual RTB as a line graph displaying real-time joint angle during stance. Visual 3D was used to calculate joint angles (*) and internal moments (Nm/kgm). Participants modified their gait so the line fell within a highlighted bandwidth representing target range. Repeated measures ANOVA was used to assess differences in PKAM between conditions. Dependent t-tests were conducted to compare joint angles between baseline and modification strategy (p<0.05). RESULTS: Compared to baseline (0.10±0.04) only MKT (1.85±0.9) showed a statistically significant difference in PKAM (p=0.014). No other statistically significant difference was found (p>0.05). CONCLUSION: Contrary to prior studies, results showed no differences in PKAM during TL and FPA gait. Lack of significant changes in joint angles across conditions suggest that gait modifications were too small to significantly alter PKAM. MKT gait increased internal PKAM despite no significant differences in KA compared to baseline. It is possible that reductions in PKAM during gait modification are offset due compensatory mechanisms that remain poorly understood. More research is required to identify the magnitude of kinematic change needed to reduce PKAM and understand mechanical changes occurring along the entire kinetic chain during gait modification.
PURPOSE: To examine the acute effects of two hip flexor stretching techniques on hip extension range of motion (ROM), knee JPS and dynamic balance performance (DB). Methods: Thirty-six healthy college age students (24 males, 11 females, mean age 22.37 ± 1.63 years, height 171.05 ± 9.64 cm, and weight 72 ± 13.70 kg) with THP participated in this study. Hip extension ROM, knee JPS and DB were measured pre- and post-stretching using a digital inclinometer, an iPod touch and the Y-balance kit, respectively. Subjects were randomly divided into dynamic stretching (DS), and hold-relax proprioceptive neuromuscular facilitation (HR-PNF) groups. Three-way mixed analysis of variance (ANOVA) was used to explore if an interaction existed between the groups (DS vs. HR-PNF), time (pre-and post) and side of hip (right vs. left) in hip extension ROM, knee JPS and DB measurements. Results: There was a significant effect of time on hip extension ROM in both stretching groups (pre = 9.37°, 9.64°, vs post = 0.18°, 0.27°, right and left hips, respectively, p < 0.001). Also, there was a significant effect of stretch type on hip extension ROM (3.87°, -2.48°) and (-0.90°, -0.26°) right, left, PNF versus DS group, post- stretching time points, respectively; p = 0.004 favoring HR-PNF over DS. There was a non-significant effect of time on mean knee JPS replication error in both groups. In DB measurement, there was a significant main effect of time and directions of reach on the Y-balance test’s mean distance. The total mean distance of reach to posterolateral direction for both stretching groups (pre = 110.96 %, post = 113.48 %) was larger than the total mean distance of reach to posteromedial direction (pre = 103.82 %, post = 107.94 %) which was in turn larger than the total mean distance of reach to the anterior direction (pre = 66.49 %, post = 65.64 %, p < 0.001). Conclusions: DS and HR-PNF stretching resulted in a significant improvement in hip extension ROM and DB measures. However, knee JPS replication error results showed nonsignificant improvement over time in either stretching group.
and 7.5% longer step lengths. METHODS: Sixteen male Army ROTC Cadets (20.1 ±2.5 years, 77.4 ±15.4 kg) completed walking treadmill trials (1.3 m/s) with and without 20-kg lead carg. Trials were then collected with altered step lengths (±7.5%) with lead carg. Joint contact forces normalized to body weight (BW) per step and per 1-km were estimated for the mTFJ and PFJ via musculoskeletal modeling. RESULTS: At preferred step length, the load carriage increased peak mTFJ contact force per step by 19.3% (p<0.001, d=1.13) and mTFJ impulse per 1-km by 22% or 89 additional BW*s per km (p=0.01, d=1.49). Relative to body mass, the load carriage increased peak PFJ contact force per step by 14.2% (p=0.001, d=0.66) and PFJ impulse per km by +18.7% or 19 additional BW*s per km (p=0.01, d=0.69). There was a 1:2 relationship between the load carriage and absolute peak mTFJ contact force increase versus a more modest 1:1 relationship between load carriage and absolute peak PFJ contact force increase. Compared with preferred step length with load carg., a short step with lead carg. did not alter mTFJ or PFJ contact forces (all p>0.05). In contrast, a long step magnified the effect of load carriage on all metrics of mTFJ and PFJ contact forces. Specifically, a long step with load carriage increased peak mTFJ contact force by 9.0% (p=0.004, d=0.63) and mTFJ impulse per 1-km by 6.6% or 32.8 additional BW*s per km (p=0.001, d=0.48). A long step increased peak PFJ contact force by 26.6% (p=0.004, d=0.68) and PFJ impulse per 1-km by 22.7% or 27.1 additional BW*s per km (p<0.001, d=0.48) compared with preferred step length with load carg. A long step with load carg. resulted in 1:3.2 and 1:2.4 relationship between added load weight and absolute increases in peak mTFJ and PFJ contact forces, respectively. CONCLUSIONS: The added load carriage was preferentially borne by the mTFJ with a smaller increase in PFJ contact forces. A short step was not an effective strategy to reduce mTFJ and PFJ loads. A longer than preferred step length, often observed in shorter individuals during formation marching, increased both mTFJ and PFJ contact forces with greatest increases noted in the PFJ.

**Estimates are weighted and age-standardized to the 2000 US standard population.**

1Walking volume was calculated by multiplying the number of walking bouts in the past week by the average minutes per bout among those reporting walking participation.

2Significant linear trend from 2005 to 2015 (p<0.05).

3Significant quadratic trend from 2005 to 2015 (p<0.05).
Built environments (BE) may influence health behaviors and subsequently obesity. However, most research in the BE literature has been fraught with methodological problems including self-selection bias and structural confounding. Twin studies provide a quasi-experimental approach to address these issues. PURPOSE: This study examined relationships among BE walkability, health behaviors, and body mass index (BMI) between and within twins, and how these relationships differ when considering walkability of the home neighborhood and each twin’s full activity space. METHODS: Geocoded home addresses and continuous physical activity data from accelerometers and GPS loggers were obtained in 144 identical twin pairs over 2 weeks. Dietary energy density (DED) was assessed by food frequency questionnaire, and BMI was derived from measured height and weight. Walk Score™ (WS) was used to estimate walkability; home WS refers to walkability of the home neighborhood and GPS WS refers to the mean of individual WS values matched to every GPS point collected by each participant, reflecting the walkability of each twin’s activity space. RESULTS: Home WS was related to GPS WS between-pairs (r = 0.52; 95% CI: 0.38, 0.63); the relationship was attenuated but significant within-pairs (r = 0.25; 95% CI: 0.08, 0.41). DED was related to GPS WS but not home WS (r = -0.20; 95% CI: -0.36, -0.04) between-pairs; this relationship was not significant within-pairs. Moderate-to-vigorous physical activity (MVPA) performed outside of the home neighborhood, defined using both ≥33 and ≥166 m buffers, was related to GPS WS between-pairs (both r = 0.22; 95% CI: 0.06, 0.38); the relationship was attenuated but significant within-pairs (both r = 0.18; 95% CI: 0.00, 0.35). BMI was related to GPS WS but not home WS (r = -0.23; 95% CI: -0.36, -0.04) between-pairs; this relationship was not significant within-pairs. BMI was related to walking bouts and MVPA performed within the 1,666 m home neighborhood buffer (both in r = 0.25; 95% CI: -0.36, -0.08), but not within-pairs. However, BMI was not related to DED levels either between or within-pairs. CONCLUSIONS: Twins support the concept that aspects of the BE are indirectly associated with BMI through its influence on health behaviors, particularly physical activity. Supported by R01AG042176.
is an independent effect of LTPA on the incidence of kidney stones. Also, there is a strong joint effect of LTPA and WRW on the incidence of kidney stones in Japanese workers.

Approximately 30% of Canadian adults have one or more chronic diseases. This number is expected to grow as the Canadian population ages and risk factors for chronic disease continue to climb.

**PURPOSE:** 1) To evaluate the effectiveness of HealthSteps (HeS), a 6-month lifestyle prescription program, on increasing physical activity (PA) and decreasing systolic blood pressure (SBP) in adults at-risk for chronic disease; 2) To explore long-term maintenance of these outcomes.

**METHODS:** Pragmatic randomized controlled trial where adults from 5 primary care settings in Ontario, Canada (N = 118; mean age 57 (SD=12); years; 76% female) with ≥1 chronic disease risk factor (metabolic syndrome or type 2 diabetes; body mass index ≥25 kg/m²; exercise ≤150 minutes/wk; ≥2 h/d; eat ≥8 servings of fruit and vegetables) were randomized to intervention (HeS) or comparator (wait-list control; WL). Over 6 months, HeS included 4 bi-monthly coaching sessions (setting lifestyle prescriptions and strategies to achieve goals) and access to eHealth technologies (phone coaching; social network; smartphone apps; website). From 6 to 12 months, in-person coaching was removed but participants could access all eHealth technologies. By 12 months, participants only had access to publically available technologies. We examined within and between group differences in mean steps/day (Yamax Digi-Walker SW-200 pedometers) and SBP (BP-Tru BPM-100 automated BP monitors) using linear mixed models adjusted for age, sex and site.

**RESULTS:** By 6 months, HeS increased their steps/day more than WL [mean change (95% CI) HeS: 1646 (786, 2507); WL: -1486 (-2312, -659); p=0.001]. By 12 months, the increase in PA was still evident within HeS [mean change from baseline (95% CI): 1890 (888, 2892)]. Although there were no differences between groups (p=0.93), both groups decreased their SBP (mmHg) over 6 months [mean change (95% CI): HeS: -6.38 (-10.43, -2.33); WL: -6.61 (-10.52 to -2.70)]. HeS maintained this to 18 months [mean change from baseline (95% CI): HeS: -6.58 (-11.35, -1.81)].

**CONCLUSION:** HeS was effective in improving physical activity over 6 months, compared to usual care, in adults at risk for chronic disease; these improvements were maintained 1-year later. Results also suggest that HeS may reduce SBP in both the short and long-term.

Physical activity is related to many benefits for metabolic impairments such as type 2 diabetes. However, it remains unclear whether different physical activity programs affect blood glucose in the same way. **Purpose:** The present study examined changes on HbA1c in sedentary employees exposed to two different walking programs during 10-week intervention. **Methods:** 67 sedentary employees were enrolled in a 10-week walking intervention. Participants were randomly assigned to one of three groups: intermittent walking (Age = 46±9.9, BMI=30.33±5.79 kg/m²), continuous walking (Age = 48±9.9, BMI=30.53±6.7 kg/m²), or a no intervention control group (Age = 42±10, BMI=27.66±5.11 kg/m²). Notably, the two walking groups were instructed to complete a program time and intensity matched. A1eNOW was used to test HbA1c from finger prick blood and accelerometer assessed physical activity. **Results:** Statistically significant changes were observed in HbA1c as the overall analysis (F1,64) = 4.229, p=0.044 with a medium size effect of n²=0.06. Bonferroni Post-Hoc test shows that the continuous walking group was significantly affected, F=8.463, p=0.009, with a large size effect n²=.297. There were no changes within the multiple break group or control group (p>0.05). Accelerometry showed a main effect of time by group interaction (F4,212) = 5.091, p<0.001, with a large effect size n²= .14. The Post-Hoc indicated that the continuous walking group took significantly longer bouts at moderate to vigorous intensity at week-6 compared to pre-test (p=0.009). There were no changes in the length of bouts in the intermittent or control groups.
May 31 4:00 PM - 4:15 PM
Inflammatory Cytokine Production is Elevated in MAIT Cells in Obese Individuals

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PURPOSE: To evaluate the effects of high-intensity interval training (HIIT) in monocyte subtypes distribution patterns of obese individuals.

METHODS: Nine lean control (CON, BMI = 20.8 ± 1.7 kg·m⁻²), nine obese insulin sensitive (OBS, BMI = 35.1 ± 3.8 kg·m⁻²) and nine obese insulin resistant (OBR, BMI = 37.8 ± 4.6 kg·m⁻²) subjects were used in this study. The OBS and OBR underwent 8 weeks of HIIT, 3x/week, using a cycle ergometer, with progressive increases in intensity and volume (8 to 12 bouts of 1 min at 80 to 110% of the maximum power output separated by 1 min active recovery at 30 W). Insulin resistance was defined as homeostasis model assessment index (HOMA-IR) ≥ 2.71. Venous blood was collected after 12 hours fasting, before and after HIIT for the quantification of monocyte subtypes (classics, intermediaries and non-classics) and metabolic parameters (insulin, glucose, triglycerides and cholesterol fractions). β-pancreatic cell function (HOMA-β) were also calculated. Volunteers also underwent an oral glucose tolerance test (OGTT).

RESULTS: Body composition was evaluated using dual-energy X-ray absorptiometry (DXA). Blood samples were collected via forearm vein access prior to exercise and at 20 (T20), 30, 60, 90, 120, 150, 180 A complete blood count and with different stimulation with phorbol 12-myristate 13-acetate and ionomycin, MAIT cells counts and intracellular interferon gamma (IFNγ), tumor necrosis factor alpha (TNFα) and interleukin 17 (IL-17) production were quantified using flow cytometry. Data were analyzed using one-way ANOVA and expressed as mean (SD). RESULTS: Stimulated Vα7.2 + CD161+ MAIT cells were 2.3 (1.2%) of all T cells at rest and increased to 3.2 (2.2%) at 0h but this did not reach significance (p=0.134). MAIT cells expression of CD69 was 76.0 (13.4%) and remained constant with exercise. TNFα expression significantly increased with exercise before returning to baseline [rest: 7(18%), 0h: 79(13%), 1h: 65 (19%); p=0.017] whereas IL-17 and IFNγ were unchanged. The total number of circulating cells significantly increased at 0h for MAIT cells (CON [87,931 ± 13,505] × 10⁶; p=0.015) and MAIT cells with different stimulation with phorbol 12-myristate 13-acetate and ionomycin (CON [99.4 (139.9%); p=0.018], IL-17 [275.4 (370.5%); p=0.026], but not IFNγ [64.5 (127.5%); p=0.01]) with all counts returning to baseline at 1h. CONCLUSIONS: Submaximal aerobic exercise transiently increased the percentage and total number of MAIT cells expressing TNFα, which may aid in activation and recruitment of additional immune cells. The total number of MAIT cells positive for IL-17 and IFNγ are higher but are driven by the exercise-stimulated lymphocytosis. The increase in proinflammatory cytokine production is part of the enhanced immune response seen immediately following vigorous exercise and suggests that MAIT cells may play an important role within this response.

May 31 4:15 PM - 4:30 PM
Hematopoietic Stem Cells With Exercise, Compression, And Cooling


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PURPOSE: To determine if the combination of compression and cooling during exercise can mobilize HSC in PC. Exercise was hypothesized to that combination of environmental stress and exercise can mobilize HSC to PC. Mechanisms for environmental mobilization will aid in understanding healing and rehabilitation mechanisms and may provide a more convenient method to harvest HSC.

METHODS: Ten healthy, active males (height 1.78 ± 0.06 m, weight 85.1 ± 13.3 kg, age 30.4 ± 4.7 y) completed a 20-min exercise protocol on the VasperTM recumbent cross trainer. The protocol entailed a 5-min warm up 30% grade followed by 2 min of a 150, 180 min and 24h post exercise. Compression cuffs were placed around the upper arms and thighs and inflated to 40 and 65 mmHg, respectively. Subjects sat on a cooling pad and wore a cooling vest to decrease body temperature. Blood samples were collected via forearm vein access prior to exercise and at 20 (T20), 30, 60, 90, 120, 150, 180 A complete blood count and with different stimulation with phorbol 12-myristate 13-acetate and flow cytometry was performed on each sample. A linear mixed model analysis was used to evaluate differences in each variable.

RESULTS: A spike in white blood cell (WBC) count was seen between baseline and T20 (Mdiff = 1.740, SE = 0.48, p = .004). The WBC differential revealed a decrease in neutrophils (Mdiff = -4.51, SE = .48, p = .014) from baseline to T20, with no change in basophils, monocytes, or immature granulocytes. Flow cytometry indicated an increase in CD34+ (a cell surface marker for HSC), from baseline to T20 (Mdiff = -1.25, SE = 0.48, p = 0.025) with no change in the viability of the WBCs.

CONCLUSIONS: The VasperTM conveniently mobilizes HSC to PC when used to a high level of exertion. Further study is required to determine if these cells can be consistently harvested from PC after mobilization.

May 31 4:30 PM - 4:45 PM
Effects of Acute Eccentric Exercise on Immune Responses to Vaccination in Young and Aged Mice.

Yi Sun, Jeffrey A. Woods, FACSM.

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PURPOSE: To determine the effects of acute eccentric exercise on immune responses to vaccination in young and aged mice.

METHODS: Effects of acute eccentric exercise on immune responses to vaccination in young and aged mice were assessed.

RESULTS: Acute eccentric exercise significantly increased the expression of TNFα and IL-17, but not IFNγ, in young mice. In aged mice, acute eccentric exercise did not significantly increase the expression of any immune response markers.

CONCLUSIONS: Acute eccentric exercise may have differential effects on immune responses to vaccination in young and aged mice.
antibody and cell-mediated immune responses in young and aged mice. Methods: C57BL/6 male mice, aged 6-8 week (n=19) and 27 months (n=16) were randomized into either eccentric exercise (Y-EC, A-EC) or sedentary (Y-SED, A-SED) groups. For the Y-EC and A-EC groups, mice were exercised at 175nm at -20% grade for 45 min on a treadmill. Y-SED and A-SED mice remained in their home cages. All mice were inoculated in the gastrocnemius with 10ng of OVA and 200 μg aluminum hydroxide (a suboptimal dosage based on titration experiments) immediately after the exercise. Blood was collected prior to, and one, two and four weeks after vaccination. ELISA was performed to analyze anti-OVA IgG. At three weeks post exercise, all mice were injected with 100ng OVA into the dorsolateral side of the right pinnae to determine the delayed-type hypersensitivity (DTH) response. Left pinnae were treated as controls. Ear thickness was measured immediately before and every 24hr after intradermal injection. Results: Acute eccentric exercise did not improve primary antibody responses in either young (p=0.06) or aged (p=0.76) mice, compared to their sedentary control groups. We did not find significant differences between Y-EC and Y-SED in their DTH responses (p=0.25). However, acute eccentric exercise enhanced DTH responses in aged mice, especially at 1 day post intraadermal injection (p=0.001). We also documented a significant immunosuppressive effect in antibody (p=0.001), but cell-mediated (p=0.81), immune responses to vaccination. Conclusion: Our results suggest that acute eccentric exercise improved the cell-mediated immune response to OVA vaccination in aged, but not in young mice and failed to affect the anti-OVA antibody response in young or aged mice.

Evidence has shown that replacing sedentary time with equivalent amounts of light-intensity physical activity (LIPA) or moderate-to-vigorous intensity physical activity (MVPA) yielded associated health benefits on body composition. Therefore, because time is finite, to know these associations is relevant for physical activity promotion strategies.

**Purpose:** To analyze the effect of the sedentary and active times proportions on body composition in overweight and obese subjects. **Methods:** Ninety-six (46 males and 50 females) overweight and obese participants (body mass index 25-34.9 kg/m²), aged 18-50 years, participated in this study. Body composition was assessed by DXA and physical activity was measured by accelerometer. Pearson correlations were used to determine the association between body composition and physical activity behaviours. Sedentary time (≤1.5 METs), LIPA (>1.5 - <3.0 METs) and MVPA (≥3.0 METs) were expressed in percentage of the daily time.

**Results:** Significant correlations were found between sedentary time and fat mass (r = 0.36; p < 0.001), android fat mass (r = 0.23; p = 0.03) and lean body mass (r = -0.36; p < 0.001). In the same way, MVPA was correlated with these variables (fat mass: r = -0.39; p < 0.001), android fat mass: r = -0.21; p = 0.04 and lean body mass r = -0.39; p < 0.001). LIPA only was correlated with body weight (r = -0.28; p = 0.01).

**Conclusions:** Our results highlight the importance of reducing sedentary time and promoting MVPA, which may improve body composition in overweight and obese people. LIPA seems to have less impact in the body tissues distribution. **Supported by Spanish Government Grant DEP2008-06354-C04-01.**
Greater left ventricular mass (LVM) has been associated with incidence of cardiovascular events in cohort studies. LVM has been shown to be associated with larger body mass index (BMI), which may partially explain the association between obesity and cardiovascular disease (CVD). However, despite the importance of cardiorespiratory fitness (CRF) to lower CVD, few studies have examined how CRF contributes to LVM within the context of weight loss. **PURPOSE:** To examine the change in weight, cardiorespiratory fitness, and LVM in response to a behavioral weight loss intervention, and to examine the association between change in body weight, CRF and LVM in relation to a behavioral weight loss intervention.

**METHODS:** Data were examined from sedentary adults (N=290; BMI: 32.2±3.8 kg/m²) that engaged in a 12-month behavioral weight loss program. All participants received weekly in-person intervention sessions for months 1-6, with combined in-person and telephonic sessions for months 7-12. Participants were prescribed weight loss through diet or diet + physical activity. Diet was prescribed at 1200-1800 kcal/day and physical activity was progressively increased to 150-250 min/wk. Assessment of body weight, CRF expressed as time to termination from a graded exercise test (GXT) and oxygen uptake, along with LVM using cardiac magnetic resonance imaging were assessed at both baseline and 12 months.

**RESULTS:** There was a significant change in body weight (90.4±13.9 to 80.2±13.5 kg; p<0.001), CRF (22.6±4.5 to 25.6±5.5 ml/kg/min; p<0.001) and LVM (88.5±21.3 to 84.1±20.0 g; p<0.001). Weight loss was correlated with reduced LVM (r=-0.26, p=0.001), but the reduced LVM was not correlated with the increase in CRF (r=0.07; p=0.10) or increase in GXT termination time (r=-0.04; p=0.35).

**CONCLUSIONS:** LV mass is associated with poor cardiovascular health outcomes. It appears that weight loss reduces LVM, suggesting that a lifestyle intervention for inducing weight loss may be effective in reducing cardiovascular disease risk.

**Attenuation of Excessive Weight Gain One Year Post Pediatric Obesity Treatment Initiation**

Kate A. Heelan, FACSM, Holly Bower, Bryce M. Abbey, Roderick T. Bartee. University of Nebraska - Kearney, Kearney, NE.

(No relevant relationships reported)

In the United States, the prevalence of obesity among 6 to 11 year-old children is 18.4% (Hales et al., 2017). Over the past 30 years, family-based pediatric obesity treatment programs have been implemented demonstrating both short-term and long-term results (Epstein et al., 1998). Building Healthy Families (BHF) was adapted from Epstein’s efficacious family-based weight control treatment program and implemented for 6-12 year-olds in a rural mid-western community. Fifty-eight families including 69 obese children (BHF percentile 96.5 ± 3.9%) participated in BHF; a 12-week nutrition, physical activity and lifestyle modification program. Child health outcomes included a clinically and statistically significant reduction in child BMI z-score (-0.27 ± 0.22) at 12-weeks. **PURPOSE:** To determine long-term weight loss success by assessing body mass and stature one-year post BHF initiation and compare to a match control group that participated in yearly health screenings at school.

**METHODS:** BHF participants (n=69, age: 9.30 ± 1.84 years) and 70 match control participants (n=70, age: 9.30 ± 1.84 years) were measured for body mass and stature at baseline and one year later. BMI, BMI percentile, and BMI z-scores were calculated based on age and gender. **RESULTS:** After one year, BHF participants grew 5.72 ± 2.46 cm and gained 3.48 ± 0.69 kg resulting in a BMI z-score change of -0.22 ± 0.40. In comparison, the match control group grew 5.97 ± 2.67 cm (p=0.05), gained 6.12 ± 5.01 kg (p=0.05) resulting in a BMI z-score change of -0.07 ± 0.21 (p=0.05). **CONCLUSION:** The match control group gained 43% more body mass in one year compared to the BHF participants (p=0.05). Previous data have suggested normal weight children of the same age gain approximately 3.2 ± 1.5 kg per year (Holt et al., 2009) suggesting that BHF participants demonstrated an attenuation in excessive weight gain. A BMI z-score change of -0.22 ± 0.40 in one year presents clinically significant changes that may enhance health. Family based intensive treatment programs are time consuming, expensive, and require family commitment; but appear to have long-term positive influence on growth and maturation among participants.

**Association Between Family Health Behaviors and Obesity Severity: Does Weight Metric Matter?**

Karissa L. Peyrer, Joani Jack, Gregory W. Heath, FACSM. University of Tennessee at Chattanooga, Chattanooga, TN. University of Tennessee College of Medicine Chattanooga and Children’s Hospital at Erlanger, Chattanooga, TN.

(No relevant relationships reported)

**PURPOSE:** Family behaviors regarding physical activity (PA), nutrition and screen time are associated with increased risk for obesity. With increased levels of severe obesity in American youth, the association of these factors with extremely high weight status should be evaluated. The purpose of this study was to examine potential differences in screen, nutrition, and PA activity behaviors among children attending a youth obesity clinic.

**METHODS:** Subjects included 484 youth (mean age = 11.5) attending their first visit at a Childhood Healthy Eating and Active Living clinic. Height, weight, and age assessed and used to calculate sex- and age-reference Body Mass Index Percentile (BMI%) as well as percent over the 50th (BMI50) and 95th (BMI95) percentiles. Parents completed a behavioral survey including questions about a number of health behaviors including whether their child consumed second helpings (rarely, sometimes, or always), had a TV in the Bedroom (yes/no), or ate with the TV on (yes/no). Parents also reported typical screen (< 2 hours, 2-4 hours, 5+ hours) and PA (< 30 minutes, 30-60 minutes, 60 minutes, ≥ 1 hour per day) behaviors. Analysis of Variance and T-tests were used to examine differences in BMI variables based on reported behaviors. All analyses were performed using SAS Enterprise Guide 7.1 with alpha set at 0.05.

**RESULTS:** Average BMI% was over 99 while BMI50 and BMI95 median splits were 185% and 137%, respectively. BMI50 and BMI95, but not BMI% were significantly higher in children obtaining ≥ 1 hour of PA compared to those obtaining < 30 minutes per day (p < 0.004). BMI50 and BMI95, but not BMI%, were significantly higher for children who had a TV in the Bedroom than for those who did not (p < 0.0001 and 0.002). Only BMI50 was significantly lower among Screen Time categories (p = 0.0104). All BMI variables were significantly higher for children who ate with the TV on compared to those who did not (p < 0.001) and for children who always asked for seconds compared to those who rarely did (p < 0.05).

**CONCLUSIONS:** Among obese children/youth, commonly targeted health behaviors resulted in differences in weight status, although the extent of these relationships depends on the weight metric being used. Further analysis should examine the influence of interventions to alter these behaviors and the change captured by these weight metrics.
**1698**  
May 31 5:00 PM - 5:15 PM  
**Anthropometric Changes in Elementary School Children Receiving Varying Amounts of Obesity Prevention Programming**  
Abigail E. Duffine, Emily N. Werner, Brianna D. Higgins, Dorothy Hanrahan, Kristen Kohenour, Patricia A. Shewokis, Stella L. Volpe, FACSM. Drexel University, Philadelphia, Pa.  
(Sponsor: Stella L. Volpe, FACSM)  

_Purpose:_ To assess the change in body mass index (BMI) and waist circumference of elementary school students receiving varying amounts of obesity prevention programming during the first year of a multi-year, ecological school-based health intervention.  

**Methods:** These data were collected from 214 students enrolled in the fourth grade of four schools. The intervention included programs focused on improving nutritional intake and increasing physical activity. Two schools received a high amount of programming (HP) (>40 programs/year), while two schools received a low amount of programming (LP) (<20 programs/year). Height, body weight and waist circumference were measured at baseline and post-intervention.  

**Results:** At baseline, BMI (± standard deviation [SD]) in HP and LP schools were 18.9 ± 4.8 kg/m² and 19.4 ± 3.6 kg/m² (p=0.319), respectively. Post-intervention BMI for HP and LP schools were 19.3 ± 4.4 kg/m² and 19.4 ± 3.5 kg/m² (p=0.775), respectively. Waist circumference (± SD) at baseline in HP and LP schools were 63.3 ± 4.7 cm and 67.5 ± 10.2 cm (p=0.002), respectively. Post-intervention waist circumference were 64.4 ± 9.8 cm and 66.8 ± 10.0 cm (p=0.081) for the HP and LP schools, respectively.  

**Conclusions:** The high and low program schools both exhibited increases in BMI after program implementation; though, there were no significant differences between the groups over time. However, BMI alone is not the most effective assessment of adiposity in children; utilizing waist circumference may provide additional information. At baseline, the HP schools had a significantly lower waist circumference compared to the LP schools. Although there was a slight increase in waist circumference in the HP schools and a slight decrease in the LP schools at post-intervention, these were not significantly different. Though the difference in programming did not significantly influence BMI or waist circumference, assessing the changes in anthropometric measures throughout the larger, multi-year intervention may reveal more meaningful impact on the change in adiposity in children.  

This study was funded by Independence Blue Cross Foundation.  

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**D-43**  
Clinical Case Slide - Head  
Thursday, May 31, 2018, 3:15 PM - 4:55 PM  
Room: CC-200E  

**Chair:** Anastasia Noel Fischer, FACSM. Nationwide Children's Hospital, Columbus, OH.  
(No relevant relationships reported)  

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

**Discussant:** Robert B. Kinningham, FACSM. University of Michigan, Ann Arbor, MI.  
(No relevant relationships reported)  

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**1699**  
May 31 3:15 PM - 3:35 PM  
**Different Strokes for Different Folks - Football**  
Tu Dan Nguyen¹, Mark Chassay, FACSM¹, Jocelyn Szeto¹, Noor Alzarka².¹University of Texas Health Science Center at Houston, Houston, TX. ²Memorial Family Medicine Residency, Sugar Land, TX.  
(No relevant relationships reported)  

_History:_ 22-year-old D1 University Football Long Snapper presents to the training room for migraines. He’s had migraines for 6-7 years and 4 concussions since HS. The night prior he had a migraine in the temporal region associated with transient left-sided vision loss & left arm numbness for 30-40 minutes. A diffuse headache lasting for 4-5 hours followed. Sumatriptan relieved the pain. He’s had increased migraine frequency for the past 6 months. Episodes were described to his neurologist. MRI of the Brain & Cervical Spine were ordered.  

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**1700**  
May 31 3:35 PM - 3:55 PM  
**Head Injury - Trampoline**  
Michael J. Cools, Jason Mihalik, Kevin Carneiro. University of North Carolina, Chapel Hill, NC. (Sponsor: Kevin Guskiewicz, FACSM)  
(No relevant relationships reported)  

**History:** A 14-year-old boy was jumping on a trampoline when he struck his right mastoid on a netting support pole. He did not lose consciousness or have other symptoms at that time. He had a small abrasion at the impact site, but no visible hematoma. The following day, he noted a droop on the right side of his face and inability to close his right eye. He also noted that sounds in his right ear were much louder than sounds in his left.  

**Physical Examination:** He presented to a sports concussion clinic the following week. Examination of the patient’s head demonstrated a small abrasion on his right mastoid. No other signs of traumatic injury were noted. Neurologic examination demonstrated a right-sided facial droop (House-Brackmann grade 4). Hearing was now symmetric. No abnormalities were noted when examining the other cranial nerves. The rest of his neurologic examination was normal and he exhibited no signs or symptoms of a concussion.  

**Differential Diagnosis:**  
1. Bell’s Palsy  
2. Temporal bone fracture  
3. Facial nerve edema  

**Test Results:**  
Head and temporal bone computed tomography (CT) scan:  
— No acute intracranial process  
— No temporal bone fracture  
Magnetic Resonance Image (MRI) with focus on the facial nerve:  
— No facial nerve abnormality  
— No evidence of microfractures within the temporal bone.  

**Final Working Diagnosis:**  
Traumatic facial nerve edema without temporal bone fracture  

**Treatment and Outcomes:**  
He was placed on valacyclovir and prednisone taper. He was instructed to use eye lubricant frequently and tape his eye closed at night to prevent corneal abrasions. He was referred to an otoaryngologist, who saw him 1 month later. At that time, his facial nerve function had returned to normal.
HISTORY: A 16-year-old female with hypermobility experienced a whiplash injury on a flight due to sudden turbulence and immediately developed headache and nausea. She subsequently suffered from persistent headaches, dizziness, motion sickness, nausea, and fatigue for weeks following the incident. A full laboratory workup was within normal limits. The family worried her symptoms were due to a concussion and began struggling with inventing numbers and letters. She exhibited impairments in language processing, working memory, and concentration. In addition to sustained emotional dysregulation and excessive irritability, learning and memory difficulties have persisted for more than four years.

PHYSICAL EXAM: 10-year-old girl with mildly restricted affect. Cooperative but with latency of speech. The remainder of the physical and neurological exam, including cranial nerves, gait, coordination, strength, reflexes, and sensation, was within normal limits.


TESTS AND RESULTS: 1. MRI Brain obtained at age 6 - normal for age. 2. Neuropsychological Evaluation - consistent with severe dyslexia as well as ADHD, inattentive type, notable understood as secondary to her learning disability and exacerbated by emotional factors.

TREATMENT AND OUTCOMES: 1. IEP implemented with minimal improvement academically. 2. Stimulant trial resulted in mild improvement in attention difficulties, but was discontinued after 5 months due to intolerable side effects. 3. Currently treated with alpha-agonist with moderate improvement in irritability and aggressive behaviors. 4. Patient continues with significant learning disorder including severe dyslexia and dyspraxia, as well as sustained impairments in working memory.

Severe Emotional Dysregulation In A Pediatric Patient


d. No esotropia was present during NPC assessment.
e. Assessment for monocular accommodation of the right eye was successful.

1706 May 31 4:35 PM - 4:55 PM
Sustained Post-concussive Learning Disorder And Severe Emotional Dysregulation In A Pediatric Patient

Mary Daley, Tufts Medical Center, Boston, MA.
(No relevant relationships reported)

HISTORY: A 16-year-old male soccer player twisted his neck awkwardly while heading a ball. He continued to play despite neck soreness. Six days later he headed the ball several more times during a game and developed worsening pain and swelling. The next morning, he had a headache, dizziness and photophobia. He felt very tired, sleeping more than usual. He was seen by his pediatrician and referred to sports medicine with concern for concussion and cervical strain. When evaluated 13 days after the initial injury, symptoms included intermittent headache, pressure in his head, earache and occasional dizziness. He reported good sleep, but still felt tired. He denied cognitive or emotional symptoms. Neck pain and swelling was the most concerning symptom. He endorsed odynophagia but had no difficulty breathing. He denied radicular or neurologic symptoms. He denied fevers. He had one prior concussion 5 months ago. Symptoms included memory problems, difficulty concentrating, and headache. Recovery time was two weeks.


DIFFERENTIAL DIAGNOSIS: Concussion, cervical strain, cervical spine fracture, infection, hematologic malignancy

TESTS AND RESULTS: Ultrasound right sternocleidomastoid: No evidence of hematoma or disorganized muscle architecture. There was a large lymph node just posterior to the muscle measuring 2.5 cm in diameter with a mixed echogenic appearance. Labs: WBC 9.7, Hemoglobin 13.7, Hematocrit 40, Platelets 130, Basic Metabolic Panel normal, ALT 148, AST 87, Alkaline Phosphatase 131, albumin 4.0, Bilirubin 0.5, ESR 5, EBV IgM Positive, EBV IgG Positive. FINAL WORKING DIAGNOSIS: Infectious Mononucleosis.

TREATMENT AND OUTCOMES: Patient was held from sports participation for two additional weeks. Symptoms improved over that time period. He was seen by his pediatrician and was cleared to return to contacts and sports increase activity level as tolerated.

1704 May 31 3:55 PM - 4:15 PM
Head And Neck Injury-Soccer

Tracy Bras. Evergreen Sports Medicine Fellowship, Augusta, ME. (Sponsor: Jim Dunlap, FACSM)
(No relevant relationships reported)

HISTORY: A 16-year-old male soccer player twisted his neck awkwardly while heading a ball. He continued to play despite neck soreness. Six days later he headed the ball several more times during a game and developed worsening pain and swelling. The next morning, he had a headache, dizziness and photophobia. He felt very tired, sleeping more than usual. He was seen by his pediatrician and referred to sports medicine with concern for concussion and cervical strain. When evaluated 13 days after the initial injury, symptoms included intermittent headache, pressure in his head, earache and occasional dizziness. He reported good sleep, but still felt tired. He denied cognitive or emotional symptoms. Neck pain and swelling was the most concerning symptom. He endorsed odynophagia but had no difficulty breathing. He denied radicular or neurologic symptoms. He denied fevers. He had one prior concussion 5 months ago. Symptoms included memory problems, difficulty concentrating, and headache. Recovery time was two weeks.


DIFFERENTIAL DIAGNOSIS: Concussion, cervical strain, cervical spine fracture, infection, hematologic malignancy

TESTS AND RESULTS: Ultrasound right sternocleidomastoid: No evidence of hematoma or disorganized muscle architecture. There was a large lymph node just posterior to the muscle measuring 2.5 cm in diameter with a mixed echogenic appearance. Labs: WBC 9.7, Hemoglobin 13.7, Hematocrit 40, Platelets 130, Basic Metabolic Panel normal, ALT 148, AST 87, Alkaline Phosphatase 131, albumin 4.0, Bilirubin 0.5, ESR 5, EBV IgM Positive, EBV IgG Positive. FINAL WORKING DIAGNOSIS: Infectious Mononucleosis.

TREATMENT AND OUTCOMES: Patient was held from sports participation for two additional weeks. Symptoms improved over that time period. He was seen by his pediatrician and was cleared to return to contacts and sports increase activity level as tolerated.
upon activity resumption, with knee extension even against gravity. He noted no mechanical symptoms, swelling or discoloration. Patient had been receiving physical therapy for presumed distal quadriceps tendinosis but was soon unable to tolerate even topical treatments to the region.

PHYSICAL EXAMINATION: Exam revealed tenderness localized to the superior pole of the patella and the vastus lateralis-retinacular interface without nodularity. No knee effusion was present, and all provocative maneuvers of the knee were negative. Give-way weakness of the right quadriceps was present as was skin hypersensitivity.


TEST AND RESULTS: Femur radiographs were negative but contrast MRI of the distal thigh revealed a T2 hyperintense lobulated mass deep to the vastus lateralis and quadriceps tendon, separate from the suprapatellar recess. CT guided biopsy showed benign fibrovascular tissue consistent with an arteriovenous malformation (AVM).

FINAL WORKING DIAGNOSIS: Slow flow arteriovenous malformation

TREATMENT AND OUTCOMES: The patient underwent percutaneous sclerotherapy with 2cc of absolute alcohol. He reported complete resolution of pain within 1-2 weeks and returned to all previous competitive activity.
Say It Ain’t Sew: A Unique Cause of Calf Pain in Marathoner
Matthew D. Sedgley, MD FAAFP CAQSM. MedStar Sports Medicine, Ellicott City, MD. (Sponsor: Nailah Coleman, MD, FACSM) (No relevant relationships reported)

HISTORY: 76-year-old male, with known Parkinson’s disease since 15 years ago, was training for a marathon in order to qualify for Boston Marathon. It is worse with fast running. Better with rest. There is no numbness.

PHYSICAL EXAMINATION:
- General: Fit appearing masters level runner
- WNN: NAD ENT. NCAT, normal teeth
- Skin: No rashes or ulcers
- Cardiac: Vasc: normal capillary refill, no cyanosis, palpable pulses distally at dorsalis pedis bilaterally
- Neuro: normal sensation, no tremors, symmetric knee and ankle reflex +2 bilaterally, negative slump sign
- Psych: nervous that she will not BQ in qualifying race, no depression
- MSK: Inspection: no atrophy, swelling or bruising
- Palpation: tender in calf muscle
- Plantar flexion, inversion and eversion and FHL and EHL bilaterally
- Special Testing: negative slump sign, negative homans sign, negative Thompson test.

DIFFERENTIAL DIAGNOSIS:
- Occult fracture
- Peroneal neuropathy
- Deep venous thrombosis
- Peripheral neuritis/entrapment

TEST AND RESULTS:
- Xray of left tibia and fibula 2 views: possible foreign object in calf muscle
- MSK ultrasound: on long and short axis a sewing needle is seen in the gastrocnemius on the left leg only, no defect
- ROM: ankle dorsiflexion -15 degrees bilaterally, negative slump sign
- Physicalexamination: no depression
- Neuro: normal sensation, no tremors, symmetric knee and ankle reflex +2 bilaterally, negative slump sign
- Psych: nervous that she will not BQ in qualifying race, no depression
- MSK: Inspection: no atrophy, swelling or bruising
- Palpation: tender in calf muscle
- Plantar flexion, inversion and eversion and FHL and EHL bilaterally
- Special Testing: negative slump sign, negative homans sign, negative Thompson test.

FINAL WORKING DIAGNOSIS: Foreign object in muscle

TREATMENT AND OUTCOMES:
- Ankle surgery consulted. Opted for watchful waiting instead of surgery. Patient qualified for Boston and chose after hearing benefits and risks to avoid surgery.

Leg Pain in Recreational Runner with Parkinson’s Disease - Running
Timothy M. Dekker, George G.A. Pujalte, FACSM. Mayo Clinic, Jacksonville, FL. (No relevant relationships reported)

HISTORY: A 76-year-old male, with known Parkinson’s disease since 15 years ago, presented due to left posterior thigh pain that started a week prior. He was running and felt a “tug,” sharp pain and weakness. At rest it was a pulling sensation, 5/10 in intensity. Running and prolonged sitting made it worse. He denies any back pain, numbness or tingling. He had been trying to walk/run about 2 miles a day, and strength training. He had a very similar pain on the right side a year ago and with a hamstring strain, given a methylprednisolone dose pack, and physical therapy focusing on his hamstrings. He was able to run pain-free until this injury. He was very distressed that he was unable to run as he believed exercise has been essential in managing his Parkinson’s.

PHYSICAL EXAMINATION:
- No leg swelling or ecchymosis. Normal hip and knee range of motion. Normal strength. Pain with resisted hamstrings testing. Right-favoring antalgic gait, but takes small steps. Tenderness to palpation of left proximal hamstring. Straight leg test caused mild pain in left hamstring.

DIFFERENTIAL DIAGNOSIS: Hamstring strain

TEST AND RESULTS:
- X-ray of left thigh: Mild pelvic enthesopathy at hamstrings’ tendinous origins along bilateral ischial tuberosities

HISTORY: A 13-year-old boy was running laps when he began convulsing. He was brought to the Emergency Department (ED) where vital signs, basic labs, CT brain, and EKG were normal. An EKG was read by the ED physician as normal, but the QTc was 491ms. The patient was discharged with neurology follow-up. Two months later, the patient was playing basketball when he developed convulsions and collapsed. Paramedics noted the patient to be pulseless. En route to the ED, he received 1 minute of CPR followed by 1 shock and 2 minutes of CPR. He then achieved return of spontaneous circulation.

PHYSICAL EXAMINATION: Examination of the patient on his 1st ED visit was normal. During his second ED visit, the patient’s Glasgow Coma Scale was 1-1-1. The patient was hypotensive with a blood pressure of 91/47. His pulse was 80 and he was saturating 100% on BVM. He had abrasions to his chin and neck. His pupils were equal and reactive to light bilaterally.

DIFFERENTIAL DIAGNOSIS:
1. Intracranial process such as traumatic brain injury, hemorrhage, tumor, infection.
2. Toxicologic etiology such as cocaine use, alcohol or benzodiazepine withdrawal, or overdose of buproprion or a tricyclic antidepressant.
3. Metabolic abnormality such as hypoglycemia, hyponatremia, or hypernatremia.
4. Cardiac process such as arrhythmia, ischemia, or total anomalous coronary artery.
5. Pulmonary embolism.

TEST AND RESULTS:
- Labs 1st visit: Normal
- 2nd visit: HCO3 18, Glucose 257, BUN 19, Cr 0.9, Na 137, K 3.7, CO2 16, AG 19, Ca 8.1, CK 209, BNP 110, Lactate 4.4, Mg 1.9, Trop 0.03, TSH 6, WBC 8.9, Hbg 13, plt 267, INR 1.3
- Urine drug screen 2nd visit: neg
- Chest xray 1st and 2nd visit: mild cardiomegaly.
- EKG 1st visit: LVH and QTc of 491ms, 2nd visit: LVH and dagger-like Q waves, QTc of 504ms.

Bedside Cardiac Ultrasound 2nd visit: Focal hypertrophy of the interventricular septum to 23 mm.

FINAL WORKING DIAGNOSIS:
Hypertrophic Cardiomyopathy
TREATMENT AND OUTCOMES:
The patient was intubated, resuscitated, and transported by helicopter to the nearest Pediatric Intensive Care Unit. Seizure-like activity is often thought to reflect a primary brain disorder; however, poor cardiac function and arrhythmias can decrease perfusion to the brain and cause convulsions. Seizure-like activity during exercise should increase suspicion of a cardiac etiology.

1720
May 31 3:35 PM - 3:55 PM
Primum Non Nocere - A Case Of Medication Overuse
Sahil Shah, Shaun Knox, Andrew Martin. Campbell University School of Osteopathic Medicine, Lillington, NC. (No relevant relationships reported)

HISTORY: 19 year old female college track athlete (100, 200 sprints) with past medical history significant for familial hypercholesterolemia acutely developed right posterior thigh pain during practice, 8 months prior to initial presentation to the clinic. Medications included oral contraceptive pills and simvastatin. She was seen at a different physician office and was diagnosed with a hamstring strain via MRI. Treatment course outlined at that time included rest, acupuncture. This was not completed and she presented to the sports medicine clinic for evaluation and continued treatment due to persistent pain. PHYSICAL EXAMINATION: Stable vital signs and general physical examination, including no rash in the affected area. Musculoskeletal exam revealed full AROM, strength 5/5 and pain at the myotendinous junction of the right biceps femoris. DIFFERENTIAL DIAGNOSIS: 1. Hamstring strain 2. Iliotibial band syndrome 3. Stress fracture 4. Meralgia paresthetica.

TEST AND RESULTS: Vitamin D level - 34.4 Lipid panel (on simvastatin): Total - 206, TG - 110, HDL - 42, VLDL - 22, LDL - 142 Lipid panel (off simvastatin): Total - 215, TG - 93, HDL - 46, VLDL - 19, LDL - 150

FINAL WORKING DIAGNOSIS: Right biceps femoris strain Familial Hypercholesterolemia.

TREATMENT AND OUTCOMES: 1. She was taken off her statin medication as this may have been contributing to muscular pain, and was not likely providing benefit for preventing cardiovascular disease at this point. 2. Percutaneous/transcutaneous electric nerve stimulation to the local area. 3. Range of motion exercises, eccentric strengthening of the affected area. Modified practice until able to perform event pain free, then return to full activity.

1721
May 31 3:55 PM - 4:15 PM
Preparticipation Physical Exam: More Than a Hernia Check.
Joshua Priddle DO1, Michael Goodlett MD2, Siraj Abdullah DO3, Joseph Edison DO2, 1VCOM-Auburn, Auburn, AL, 2Auburn University, Auburn, AL. (No relevant relationships reported)

HISTORY: A 17 year old male NCAA Div I football player presents for his intake physical exam with the complaint of right medial knee pain. He had a recent history of a right MCL sprain two weeks prior. He has a significant past medical history of a right posterior thigh pain during practice, 8 months prior to initial presentation to the clinic. Medications included oral contraceptive pills and simvastatin. She was seen at a different physician office and was diagnosed with a hamstring strain via MRI. Treatment course outlined at that time included rest, acupuncture. This was not completed and she presented to the sports medicine clinic for evaluation and continued treatment due to persistent pain. PHYSICAL EXAMINATION: Stable vital signs and general physical examination, including no rash in the affected area. Musculoskeletal exam revealed full AROM, strength 5/5 and pain at the myotendinous junction of the right biceps femoris. DIFFERENTIAL DIAGNOSIS: 1. Hamstring strain 2. Iliotibial band syndrome 3. Stress fracture 4. Meralgia paresthetica.

TEST AND RESULTS: Vitamin D level - 34.4 Lipid panel (on simvastatin): Total - 206, TG - 110, HDL - 42, VLDL - 22, LDL - 142 Lipid panel (off simvastatin): Total - 215, TG - 93, HDL - 46, VLDL - 19, LDL - 150

FINAL WORKING DIAGNOSIS: Right biceps femoris strain Familial Hypercholesterolemia.

TREATMENT AND OUTCOMES: 1. She was taken off her statin medication as this may have been contributing to muscular pain, and was not likely providing benefit for preventing cardiovascular disease at this point. 2. Percutaneous/transcutaneous electric nerve stimulation to the local area. 3. Range of motion exercises, eccentric strengthening of the affected area. Modified practice until able to perform event pain free, then return to full activity.

1722
May 31 4:15 PM - 4:35 PM
18yo Female Lacrosse Player with Abdominal Pain
Kyle H. Yost, Valerie Cotran, Paul Goleb. University of Maryland, Baltimore, MD. (No relevant relationships reported)

History:
An 18yo college lacrosse player was injured when she was struck in the abdomen with a lacrosse stick early in practice. She developed epigastric abdominal pain and reported her symptoms to her athletic trainer. Five months prior, she sustained a splenic laceration during lacrosse and was instructed to wear an abdominal pad during lacrosse activities. She was wearing an abdominal pad when she sustained this abdominal injury. She reported her symptoms a 4/10 and that it was different than her previous splenic injury. She was then sent to the emergency room of a community hospital. In the emergency room she had a CT scan performed, which showed physiologic fluid without evidence of abdominal or pelvic organ injury. She was then transferred to a level one trauma hospital for observation. Overnight her pain remained minimal and the next day she was going to be discharged. Before she was discharged her pain increased and it was determined she would have an exploratory laparotomy.

Physical Exam:

Differential Diagnosis:

Tests and Results:
CT 9/19/17: Pelvic peritoneal free fluid within the pelvis most likely physiologic, without specific evidence of abdominal or pelvic organ injury. Exploratory Laparotomy 9/20/17: Contusion to mid to distal body of the pancreas, no other intra-abdominal pathology identified.

Final working diagnosis:
1. Pancreatic contusion secondary to blunt abdominal trauma.

Treatments and Outcomes:
1. Admitted to the surgical ICU.
2. Post op day five her peri-pancreatic drains removed and nocturnal jejunal feeds were stopped.
3. Post op day six she was discharged from the hospital with GJ tube in place.
4. Eight weeks post op her GJ tube will be removed.
5. She will resume sports activities at 3 months post op with contact starting at 6 months post op.

1723
May 31 4:35 PM - 4:55 PM
General Medicine - Ultramarathon Runner
Kristin Schwarz, Laura Moretti, Kathryn Ackerman, FACSM. Boston Children’s Hospital, Boston, MA. (No relevant relationships reported)

History:
19-ya male ultramarathoner presents for performance advice. He runs 20 hr/wk, avg 120 mi/wk. 100-mi race avg pace is 8:30 min/mi. Follows vegan, gluten-free, raw food diet. Refuses to use vitamins/supplements. Does not feel he needs to gain weight. Minimal sexual interest, absence of morning erections. PMH: Low weight, 1 prior fracture. Fam Hx: Sister - celiac disease, Neg for osteoporosis or eating disorders. PHYSICAL EXAMINATION:
Temp: 36.6°C. Refuses Ht and Wt. BP Lying: 110/70, P 54; Standing 106/64, P 65. A&Ox3 and no acute distress; Eyes: PERRLA, +Conjunctival pallor; CV: RRR, No murmurs, rubs, gallops; Lungs: Clear; Thyroid: Normal; Skin: No rashes or lesions. DIFFERENTIAL DIAGNOSIS:

TESTS AND RESULTS:
EKG: sinus bradycardia, 48 bpm
DXA: BMI 17.6. Lumbar spine Z-score -2.3 (+6.6%), Fem neck Z-score -0.6 (+ 9.8%); total lip Z-score -0.2 (+10.5%); % Fat Z-score -1.0 (+Change from DXA 3 yr prior)
Labs: WBC 3200/ul (L), MCV 101.2 Fl (H), Ferritin 15 ng/ml (L), Iron 82 mcg/dl, TIBC 325 mcg/dl, B12 334 pg/ml (L), Folate wnl; Free testosterone 44 (L), Total testosterone 32 ng/dl (L), SHBG 44 nmol/L (wnl); 25-OH Vit D 20 ng/mL (L). TSH 2.14 mIU/L (wnl), Free T4 1.1 ng/dL (wnl), T3 2.2 pg/mL (L), TSH 2.14 mIU/L (wnl), Free T4 1.1 ng/dL (wnl), T3 2.2 pg/mL (L), TSH 2.14 mIU/L (wnl), Free T4 1.1 ng/dL (wnl), T3 2.2 pg/mL (L), TSH 2.14 mIU/L (wnl), Free T4 1.1 ng/dL (wnl), T3 2.2 pg/mL (L), TSH 2.14 mIU/L (wnl), Free T4 1.1 ng/dL (wnl), T3 2.2 pg/mL (L). IGF1 wnl, prolactin wnl; AST 23, ALT 7 (L), TTG IGA and Total IgA wnl; ESR and CRP wnl.

FINAL WORKING DIAGNOSIS:
-Relative Energy Deficiency in Sport (RED-S)
-Secondary to: Inadequate energy intake, eating disorder

TREATMENT AND OUTCOMES:
1. Nutrition Evaluation:
2. Dietary recall: 2700 to 3000 kcal/d (protein: 1.4 g/kg/d, carb: 8 g/kg/d, fat 0.5 g/kg/d).
3. 1000-1500 kcal deficit/d.
4. Goal: 4000 kcal/d. Diet insufficient in macronutrients. Initial goal: begin with small increase fat to 1 g/kg/d.

2. Refused anthropometrics for months - contracted that weights required for medical/nutrition appts.
3. Top finish in national ultramarathon. 2d later: Lying: BP 104/62, P 52; Standing 110/60, P 72 (+Orthostasis); EKG: sinus bradycardia. Recommended: higher level of care, but patient refused.
4. Sports Psych Referral: Felt he was “hitting a wall” in training. Went from pre-contemplative to contemplative stage regarding dietary changes.
5. Close follow-up.

D-56 Free Communication/Poster - Fitness Assessment
Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1740 Board #1 May 31 2:00 PM - 3:30 PM The Association of Asymmetry in Hopping Tests and Non-contact Injuries in Division I Female Student-athletes
Meghan Warren1, Monica Lininger1, Craig A. Smith2, Adam Copp3, Nicole J. Chimera1, Northern Arizona University, Flagstaff, AZ. 2Smith Performance Center, Tucson, AZ. 3Daemen College, Amherst, NY.

(No relevant relationships reported)

PURPOSE: Limb differences in hopping for distance tests (single, triple, and crossover) are commonly used for return to play readiness after anterior cruciate ligament (ACL) injury. Females athletes are at high risk of ACL injury and risk factor identification and early prevention is critical. No study has been conducted to assess the ability of these three tests to identify high-risk athletes. To determine the association between asymmetry in hopping tests and non-contact and overuse injuries in Division I female basketball, soccer, and volleyball student-athletes.

METHODS: 65 female student-athletes (SA; 19.1 ± 1 yrs, 171.3±8.7 cm, 68.4± 2.5 kg), recruited over 3 years, injury-free at the time of testing randomized for each SA, and included isometric hip abduction, external rotation, and extension using a handheld dynamometer, as well as hopping and jumping tests. The first non-contact injury that caused the SA to report to the athletic training room was abstracted from the medical record. Contact injuries were excluded. Strength was adjusted for body weight and categorized into tertiles. Logistic regression determined the odds of non-contact or overuse injury with each clinical test. History of previous injury was assessed for confounding.

RESULTS: 54 SA were injured during their sport season. No statistically significant association was found between injury and hip abduction (weakest vs. strongest odds ratio: 1.52 (95% confidence interval 0.31-7.50), middle tertile vs. strongest: 0.70 (0.18-3.82), external rotation (weakest vs. strongest odds ratio: 3.87 (95% confidence interval 0.67-22.30), middle tertile vs. strongest: 0.95 (0.24-3.71)), or extension (weakest vs. strongest: 1.15 (0.25-5.23), middle tertile vs. strongest OR = 0.80 (0.18 - 3.62)). CONCLUSIONS: None of the strength tests were associated with non-contact and overuse injury in this group of Division I female SA. Type II error cannot be ruled out for the findings.

1742 Board #3 May 31 2:00 PM - 3:30 PM Wearable Contour Sensors to Assess Neuromuscular Control During Repeated Unilateral Partial Squat Task
Shannon E. Linderman1, Donna Moxley Scarborough2, Eric M. Berksom1, Mary M. Eckert1, Nan-Wei Gong1, Massachusetts General Hospital, Boston, MA. 2MGH Institute of Health Professions, Charlestown, MA. 3Figur8 Inc, Boston, MA.

Reported Relationships: S.E. Linderman: Salary: Figur8, Inc.

PURPOSE: Improved quantification of muscle balance and symmetry, key facets of neuromuscular control, could aid sports medicine clinicians’ assessment of injury risk and readiness to return-to-sport. This proof-of-concept study evaluates a body contouring sensor network for assessment of neuromuscular control via intra-subject test-retest and intra-subject test-retest and intra-limb symmetry testing of peak quadrieps (Quads) and hamstring (HS) muscle contraction during a repeated unilateral partial squat (RUPS) task.

METHODS: Wireless contour stretch sensors were placed bilaterally across the Quads and HS muscle bulks of 5 healthy females (23 ± 4.3 years) who exercise regularly (4.6 ± 0.96 times/week). Subjects performed 3 trials of the RUPS activity. Total Quads and HS muscle bulk displacements were collected for 3 squat repetitions during the 3rd RUPS trial. Four subjects performed same day re-testing sessions. Statistical analyses included ICC 2-way mixed effects consistency model evaluation of intra-subject test-retest reliability (n=4) and paired t-test analysis of limb symmetry (n= 5). RESULTS: Both measurements of Quad and HS total muscle displacement displayed excellent correlation during test-retest reliability, ICCQuad = 0.91 (0.18-0.99) and ICCHS= 0.97 (0.58-0.99). Quad and HS muscle contraction displacement differed significantly between dominant and non-dominant limbs, p = 0.026 and p = 0.041, respectively (Table 1). A significantly greater Quad/HS total displacement ratio was observed for the dominant limb, p = 0.014. CONCLUSIONS: The wearable contour-sensor demonstrated consistent Quad and HS peak muscle displacement detection during the RUPS task. We observed differences in muscle ratios and peak muscle displacement between limbs among a small sample of healthy females. These findings demonstrate proof of concept for further investigation of this on-body contour sensor system for assessment of neuromuscular control.
Gläser (G; 2010) were used to assess CRF as previously described. Differences in peak power or fatigue during the Wingate Test were determined via Morton's model for ramp-incremental exercise. The assumption that power–time integral between the RCP and the instantaneous power values occur at equivalent kilojoule (kJ) values was assessed by one-way ANOVA. Similar to our previous data in a small cohort of otherwise healthy obese women, the current data show that the majority of obese women have normal CRF, independent of the prediction equation used.

### MEDICINE & SCIENCE IN SPORTS & EXERCISE®

**Table 1: Average peak muscle displacement of 3 partial squats during repeated unilateral partial squat (RUPS) activity.**

<table>
<thead>
<tr>
<th>Measure (n = 5)</th>
<th>Right limb Mean ± standard deviation (% sensor stretch)</th>
<th>Left limb Mean ± standard deviation (% sensor stretch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadriceps Peak displacement</td>
<td>3.047 ± 0.742</td>
<td>2.877 ± 0.764</td>
</tr>
<tr>
<td>Hamstrings Peak displacement</td>
<td>5.025 ± 0.754</td>
<td>6.195 ± 0.906</td>
</tr>
<tr>
<td>Quadriceps/Hamstrings Ratio</td>
<td>0.630 ± 0.218</td>
<td>0.487 ± 0.200</td>
</tr>
</tbody>
</table>

1744 Board #5 May 31 2:00 PM - 3:30 PM
**Cardiorespiratory Fitness of Otherwise Healthy Obese Women**
Vija Bernhardt1, Dharini M. Bhammar1, Rubria Marines-Price1, Tony G. Babb, FACSM1, 2Texas A&M University Commerce, Commerce, TX. 1University of Nevada-Las Vegas, Las Vegas, NV. 3Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital and UT Southwestern Medical Center, Dallas, TX. (Sponsor: Tony G Babb, FACSM)

(P) PURPOSE: Cardiorespiratory fitness (CRF) is used as a diagnostic and prognostic health indicator for all-cause and cardiovascular disease mortality (Lee et al, 2010). Thus, properly quantifying and interpreting CRF is important for accurate diagnoses. The commonly used method of evaluating VO2peak based on body weight (ml/kg/min) is not appropriate in obese individuals. VO2peak as percent of predicted is a better alternative when assessing CRF. Similar to our previous data in a small cohort of otherwise healthy obese women, the current data show that the majority of obese women have normal CRF, independent of the prediction equation used.

1745 Board #6 May 31 2:00 PM - 3:30 PM
**A Cluster Analysis and Validation of Health-related Fitness Tests in College Students**
You Fu1, Ryan D. Burns2, Timothy Brusseau2, Nora Constantanioni, 1University of Nevada, Reno, Reno, NV. 2University of Utah, Salt Lake City, UT.

(P) PURPOSE: Because health-related fitness consists of several domains, understanding clustering of scores from a testing battery can help practitioners derive exercise programs. The purpose of this study was to explore the clustering of health-related fitness test scores in college students and to validate the solution against criterion measures.

METHODS: Participants were college students (mean age = 19.2 ± 0.6 years, N = 523; 342 females, 181 males) recruited from a university in the southwestern U.S. The health-related fitness assessments consisted of BMI, estimated VO2peak from the Astrand-Ryhming cycle ergometer test, and standard push-ups. Criterion measures consisted of DXA-estimated percent body fat (%BF), measured VO2peak from a maximal treadmill test, and a 1-Repetition Maximum (1-RM) bench press score. A hierarchical cluster analysis was performed to derive groupings. One-way ANOVA tests were used to explore the differences among the derived cluster groups on each criterion measure.

RESULTS: Six cluster groups were formed representing various fitness “phenotypes” (Pseudo-F = 179.7). The cluster groups differed in SBF (F(5, 517) = 44.6, p < 0.001, eta-squared = 0.31), measured VO2peak (F(5, 517) = 49.7, p < 0.001, eta-squared = 0.33), and 1-RM bench press scores (F(5, 517) = 17.0, p < 0.001, eta-squared = 0.12), providing validation evidence.

CONCLUSIONS: Six cluster groups were formed from a health-related fitness test battery in college students that were validated against criterion measures of health-related fitness. The cluster groups can be used to inform current fitness status and for the derivation of exercise programs.
different from \( \bar{W} \) (15.7 ± 6.9 kJ). The degree to which the relationship between \( \bar{W} \) and \( RCP' \) approximated the line of identity was poor for \( \bar{W} \) (CCC = 0.09 and RMSE = 11.3 kJ), MR (CCC = 0.23 and RMSE = 7.5 kJ) and FR (CCC = 0.37 and RMSE = 6.5 kJ). 

**CONCLUSION:** Our data demonstrate that \( RCP' \) is lower when the ramp-incremental slope is increased. Furthermore, despite occurring at similar kJ values, we observed poor measurement agreement between \( \bar{W} \) and \( RCP' \), as evidenced by the low CCC and the large RMSE values, irrespective of the ramp-incremental protocol. Together, these findings indicate that \( RCP' \) obtained during ramp-incremental cycling is not equivalent to \( \bar{W} \).

1747 Board #8 May 31 2:00 PM - 3:30 PM 
**Effectiveness of Preseason Conditioning on \( V_{O2max} \) in College Athletes Assessed via Ift and Gxt**
Kallie LaValle, Jordan Nieuwma, Joseph D. Ostrem. Concordia University - St. Paul, St. Paul, MN. 

(No relevant relationships reported)

Developing a greater aerobic capacity is essential for successful performance in college athletics (Helgerud, Engeb, Wulff & Hoff, 2001). Specifically, the preseason training program can be utilized for aerobic capacity improvement to optimize performance throughout the competitive season (Castagna, et al. 2013). Moreover, accurately assessing aerobic capacity is important to quantify the effectiveness of an aerobic training program.

**PURPOSE:** The purpose of the study was to determine the aerobic capacity changes via Intermittent Fitness Testing (IFT) and Graded Exercise Testing (GXT) in Division II collegiate athletes following a preseason conditioning program.

**METHODS:** Fourteen college athletes (male = 7; age = 19±1.1 yrs) participated in the study. Subjects performed the 30-15 IFT (Buchheit, 2007), an interval running assessment with progressively increasing speed until maximal effort is reached, and a modified Balke GXT assessment on a treadmill to failure. Aerobic fitness was assessed before and after an 8-week preseason interval training program. Paired t-tests evaluated mean differences within IFT and GXT assessments for pre- and post-training variables. Independent t-tests compared the IFT and GXT assessments between genders. Correlations between IFT and GXT assessment were reported via Pearson’s correlation coefficients.

**RESULTS:** The measured \( V_{O2max} \) via GXT (45.1 ± 1.6 vs. 48.9 ml/kg/min, \( P<0.001 \)) and estimated 30-15 IFT \( V_{O2max} \) (46.7 ± 1.7 vs. 48.9 ml/kg/min, \( P<0.001 \)) both significantly increased over the 8-week preseason training period. Heart rate (HR) at 2 min post-GXT was significantly lower (150±20 vs. 141±17 bpm, \( P<0.019 \)) following preseason training. GXT measured \( V_{O2max} \) and 30-15 IFT estimate \( V_{O2max} \) displayed a strong correlation before and after preseason interval training (\( r=0.84, \ P<0.001 \) vs. \( r=0.77, \ P<0.001 \)). Weight was significantly lower in post testing (1.5±2kg, \( P=0.019 \)).

**CONCLUSIONS:** Preseason interval training produced positive aerobic capacity improvements and were similarly detected with IFT and GXT. Further studies could investigate the relationship between in-season athletic performance and preseason aerobic capacity changes.

1748 Board #9 May 31 2:00 PM - 3:30 PM 
**Comparison of Non-Maximal Tests for Exercise Prescription and Outcome Assessment**
Reem A. Alajmi, Carl Foster, FACSM, John P. Porcari, FACSM, Kim Radtke, Scott T. Dobberstein. University of Wisconsin-La Crosse, La Crosse, WI. 

(No relevant relationships reported)

**Introduction** Although maximal incremental exercise tests (GXT) are the gold standard for outcome assessment and exercise prescription, they are not widely available in either fitness or clinical exercise programs. **Purpose** This study compares the prediction of \( V_{O2max} \) in healthy, sedentary volunteers using a non-exercise prediction (Matthews, RPE extrapolation to 19 & 20) and the Rockport Walking Test (RWT) and of VT using the Test Talk and RPE @ 13, 14, 15. Methods Subjects performed treadmill GXT with gas exchange, submaximal treadmill with RPE and Talk Test, the RWT and Matthews Results All methods provided reasonable estimates of both \( V_{O2max} \) and VT, with correlations >0.80 and SEE = 1 MET \( V_{O2max} \) was best estimated with extrapolation to RPE=19. VT was intermediate between the TT Last Positive & Equivocal stages and between RPE 13 & 14. Conclusion Non-maximal evaluation can be used in place of maximal GXT with gas exchange to make reasonable estimates of both \( V_{O2max} \) and VT.

1749 Board #10 May 31 2:00 PM - 3:30 PM 
**Normative Benchmark Workout Scores For CrossFit® Athletes**
Gerald T. Mangine1, Brant Cebulla2, Yuri Feito, FACSM1, Kennesaw State University; Kennesaw, GA. 1University of California at Berkeley, Berkeley, CA. (Sponsor: Yuri Feito, FACSM)  

(No relevant relationships reported)

**PURPOSE:** To provide normative reference values for the five most common benchmark workouts for male (M) and female (F) CrossFit® athletes competing in the teen (T), individual (I), and masters (MS) divisions The CrossFit Games2. **METHODS:** Five-hundred uniform resource locators were scraped from a publicly-available online database and yielded 133,857 user profiles that contained self-reported anthropometric and performance data. Profiles were sorted by sex and age (i.e., T, I, or MS) and then screened for errors. Profiles were eliminated from the analysis if they: 1) contained data points that exceeded four standard deviations (i.e., < 0.001% of all values) from their respective mean; or 2) did not contain more than one completed benchmark workout (i.e., Fran, Grace, Helen, Filthy-Fifty, and Fight-Gone-Bad). Subsequently, a randomly-selected sample was used to calculate the mean, standard deviation, and normative percentiles (in decimals) for each workout in I (n = 500; 178.7 ± 7.4 cm; 86.1 ± 10.1 kg), M (n = 500; 160.4 ± 6.7 cm; 64.2 ± 7.3 kg), MS (n = 500; 178.8 ± 7.4 cm; 87.1 ± 10.6 kg), and MS (n = 500; 164.7 ± 6.7 cm; 64.3 ± 7.7 kg). Due to limited user profiles, the entire populations were assessed for T (n = 285; 175.8 ± 8.5 cm; 73.7 ± 11.6 kg) and T (n = 136; 163.7 ± 7.1 cm; 61.6 ± 9.1 kg).

**RESULTS:** Separate norms were calculated for each sex and age category for Fran (T: 314.6 ± 142.5 sec; T: 250.0 ± 109.4 sec; I: 300.2 ± 125.2 sec; I: 361.3 ± 129 sec; MS: 330.2 ± 138.4 sec; MS: 363.1 ± 145 sec), Grace (T: 212.8 ± 76.8 sec; T: 257.3 ± 97.9 sec; T: 178.8 ± 86.5 sec; T: 207.4 ± 80.5 sec; MS: 213.4 ± 95.4 sec; MS: 242.4 ± 114.8 sec), Helen (T: 98.1 ± 1.8 min; T: 12.0 ± 1.9 min; I: 9.5 ± 2.0 min; I: 10.9 ± 1.9 min; MS: 10.1 ± 2.0 min; MS: 11.3 ± 2.2 min), Filthy-Fifty (T: 24.3 ± 6.1 min; T: 29.2 ± 6.6 min; I: 24.9 ± 5.5 min; I: 26.8 ± 6.3 min; MS: 26.9 ± 6.7 min; MS: 27.4 ± 5.6 min), and Fight-Gone-Bad (T: 291 ± 50 reps; T: 269 ± 48 reps; T: 331 ± 60 reps; T: 284 ± 60 reps; MS: 314 ± 60 reps; MS: 283 ± 51).

**CONCLUSION:** This study presents norms for the five most common benchmark workouts for male and female athletes participating in The CrossFit Games® across the three major divisions. The norms can be used to assess competency in these sport-specific challenges within these populations.

1750 Board #11 May 31 2:00 PM - 3:30 PM 
**Assessment And Application Of The ‘bunkie Test’ In College Students**
Natalie Tamjidi, Jamie DeRevere1, Elizabeth O’Neill2, Kimberly Kostelis1. 'Central Connecticut State University, New Britain, CT. 'Springfield College, Springfield, MA. (Sponsor: Scan Walsh, FACSM)  

(No relevant relationships reported)
RESULTS: A repeated measures ANOVA revealed significant differences bilaterally among rest intervals for APL (p=.009; p=.001) whereas, no significant differences (p>.05) were observed for LL, LSL, and MSL and PSL had significant differences among rest intervals on one side (LSL left, p=.002; MSL right, p=.006; PSL right p=.005). Post hoc analysis with a Bonferroni adjustment revealed less variability among times between the 1min and 2min rest intervals between plank positions.

CONCLUSIONS: The results of the current study revealed that utilizing a shorter rest interval time frame could create greater variability in performance outcomes. Since no differences were found between using a 1 min or 2 min rest interval for both the final hold times and tension times, a rest interval of at least 1 min will allow for more dependable data.

1751 Board #12 May 31 2:00 PM - 3:30 PM Worker’s Cardiorespiratory Fitness Evaluation Using a 3-min Step Test with Daily Physical Activity Assessments
Tomoka Matsui, Rino So. National Institute of Occupational Safety and Health, Japan, Kawasaki, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

(No relevant relationships reported)

As measuring VO_{2max} in the workplace can be burdensome, the development of time-efficient, safe, and validated cardiorespiratory fitness (CRF) evaluation methods would be effective. Although step tests can be used to estimate VO_{2max}, their validity is not sufficient. Recently, precise physical activity (PA) information has been obtained from sophisticated wearable devices. PURPOSE: We developed a new CRF measurement procedure using a 3-min step test along with daily PA assessments. This study investigated the validity of the new method. METHODS: Our study subjects included 80 Japanese workers (45 men and 35 women, aged 30 to 59 years). We measured our subjects’ VO_{2max} by the Bruce protocol using treadmill exercise and an indirect calorimeter. The subjects completed two types of step test: the Chester step test (CST) for 26-min, and the NJoshi step test (JST). The latter was newly developed by our institute and consists of a 3-min (60, 80, 100 BPMs) stepping exercise followed by a 1-min rest. Daily PA levels were assessed by subjects wearing a 7-day accelerometer, and also a questionnaire which measured three types of workers’ PA levels: during working time, non-working time on weekdays, and non-working days. We performed multiple regression analyses using VO_{2max} as the dependent variable, and age, sex, BMI, heart rates from step tests, time (min) spent in given PA levels from the accelerometer, and scored points on the questionnaire, as the independent variables.

RESULTS: The correlation coefficients of the step tests and VO_{2max} were 0.65 (R^2 = 0.42) in the CST and 0.64 in the JST (0.41). In addition to age, sex, and BMI, the time spent in vigorous (>6.0 METs) PA and PA intensity points on the questionnaire were observed as significant independent variables (P<0.05). Multiple regression analyses showed that the adjusted R^2 increased to 0.73 when age, sex, BMI, heart rates during the JST, time spent in vigorous PA, and the questionnaire’s PA intensity points were included as independent variables. CONCLUSION: Our study suggests that this procedure can potentially be used to assess CRF at workers’ health check-ups when VO_{2max} measurements are not available. Supported by the Industrial Disease Clinical Research Grants from the Ministry of Health, Labour and Welfare, Government of Japan (150906-01).

1752 Board #13 May 31 2:00 PM - 3:30 PM Investigating the Effects of Obese On Fitness Among Community-dwelling Older Adults in Taiwan
Chueh-Ho Lin1, Liang-Hsuan Lu1, Wen-Hsu Sung2, Shang-Lin Chiang2, Po-Yung Chen3. 1Master Program in Long-Term Care, 2Taipei Medical University, Taipei, Taiwan. 3Tri-Service General Hospital, Taipei, Taiwan. 4National Yang-Ming University, Taipei, Taiwan.

(No relevant relationships reported)

Obesity is a critical health issue, increasing the risk for chronic diseases, including hypertension, diabetes mellitus, and coronary artery disease, in the elderly. However, the impact of obesity on physical fitness, which is important for functional performance of daily activities among the community-dwelling elderly, has not been evaluated.

PURPOSE: We investigated obesity-related changes in physical fitness among community-dwelling elderly individuals.

METHODS: Sixty-nine elderly individuals (67 women and 2 men; age, 73.26±6 years) were recruited and classified into the obese (BMI>27.0 kg/m^2, n=17) or non-obesity (BMI<27.0 kg/m^2, n=52) group. Weight, height, and waist girth were measured for all individuals. The following physical fitness tests were evaluated: back scratch, sit-and-reach, 30-s sit-to-stand, single leg balance, and the timed up-and-go (8 feet walk distance). Between-group differences were evaluated using independent sample t-tests, with a p-value <0.05 denoting statistical significance (SPSS statistical software, version 19.0).

RESULTS: The prevalence of obesity was 24.6% in our study group. Weight and waist girth were lower in the non-obese than in the obese group: 19% (t=4.30, p=0.001) and 13% (t=3.443, p=0.001), respectively. Performance on the back scratch test and single leg balance was better for the non-obese than for the obese group: back scratch (-22.9±15.3 cm versus -10.1±16.1 cm, respectively, p=0.005) and single leg balance (12.4±14.8 s versus 26.1±31.7 s, respectively, p=0.018). Performance for the non-obese and obese group was comparable on the sit-and-reach test (7.9±13.7 cm versus 7.0±8.0 cm, respectively, p=0.790), 30-s sit-to-stand (19.3±5.3 repetitions versus 18.1±3.5, respectively, p=0.412) and 2-min leg lift (131.9±36.9 repetitions versus 114.7±25.5, respectively, p=0.079).

CONCLUSIONS: We identified some effects of obesity among community-dwelling elderly individuals, such as single leg balance, which could lead to restriction in activities of daily living and an increased risk of falling.

Previous research suggests that obesity is associated with physical function limitations and poor balance, which may interfere with activities of daily living and lead to an increased risk of falls and injuries. Impaired balance has been attributed to low core strength in obese individuals. PURPOSE: To determine the relationships among body mass index (BMI), core strength, and balance in normal (BMI 18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2), and obese (≥30.0 kg/m^2) adults. METHODS: Seventeen adults (mean/SD: age, 39.4±9.8 y; BMI 28.5±5.3 kg/m^2), completed two assessments: a timed plank test, in which the time a subject could hold a static plank position was measured, and the Star Excursion Balance Test (SEBT), in which the distance in which a subject is measured while a subject stands is measured on one foot and reaches as far as possible at eight different angles with the opposite foot. RESULTS: There was a significant relationship between BMI and plank time (r=0.66, p=0.004), but not between plank time and SEBT performance (r=0.39, p=0.12) or BMI and SEBT (r=0.19, p=0.46). Mean plank time was significantly higher (p=0.001) in normal (85.3±6.5 s) compared to the overweight (56.8±10.8 s) and obese (51.1±11.2 s) subjects. The reach distance for all SEBT angles were lower in the obese subjects compared to the normal and overweight groups; although these differences were not statistically significant (all p>0.05). CONCLUSIONS: There is a significant relationship between BMI and core strength. Additionally, plank time is significantly lower in obese subjects indicating reduced core strength. There are also small, but non-significant, differences in balance among BMI groups. These findings suggest that obesity is associated with core strength and balance deficits that should be addressed in a fitness program.

1754 Board #15 May 31 2:00 PM - 3:30 PM Inerial Load Influences Power Measures during the Wingate Test
John Eric W. Smith1, David D. Pascoe, FACSM2, Benjamin M. Kriegs1, Matthew J. Allister1, Junfeng Ma3, Mississippi State University, Mississippi, MS. 1Auburn University, Auburn, AL. (Sponsor: David D. Pascoe, FACSM)

(No relevant relationships reported)

The Wingate Test is a commonly used assessment of anaerobic capacity and power during cycling. Wingate Protocol involves participants reaching maximal pedal cadence prior to resistance being added to the cycling flywheel. PURPOSE: The purpose of this study was to create a method to correct power measures to account for the influence of inertial load during a Wingate Test. METHODS: This study was performed using a Velotron ergometer and the Velotron Wingate Software. Ergometers were pedaled up to three different cadences (130, 150, and 170 revolutions per minute) at five different loads (9.75, 12.5, 6.25, 3.125, and 0 W). Pedaling force was measured immediately before resistance was added to the flywheel. Data were collected for a full 30-seconds as utilized in a standard Wingate Test. RESULTS: Peak power resulting from inertial load ranged from 482-1615 W. Average power resulting from inertial load over the first portion of the test varied between 282-735 W based on flywheel resistance and initial cadence while no work was performed. Statistical modeling allowed the development of a regression curve (r^2 = 0.986) accounting for second by second predictions of the influence of inertial load on power output readings. CONCLUSION: The Wingate Test can be a valuable tool in a participant’s work assessment. However, caution needs to be taken in the interpretation and application of power output as this study has demonstrated.
Muscular power is a skill-related component of physical fitness and is most often associated with athletic performance. A simple and effective way to measure lower body muscular power is the vertical jump test. PURPOSE: To compare 3 different vertical jump measurement devices and to determine the reliability of the 3 devices.

METHODS: A convenience sample of 30 college students (16 males and 14 females; mean age 20.7 ± 3.3 years), volunteered to participate in this study. The vertical jump heights were determined by the 3 devices (Jump™ mat, Vertec™, and the Vert™ device) simultaneously. The Just Jump™ mat was placed on the ground next to the Vertec™, and the subject wore the Vertec™ device, clipped to their waist, while jumping. The subjects completed a brief, dynamic warm-up prior to performing the counter movement vertical jumps. Each subject was allowed 2 maximal effort practice jumps prior to performing 5 maximum effort vertical jumps. After each jump, the 3 measurements were recorded. Each subject completed a 2× series of 5 jumps 2-3 days after the first testing session. The protocol for the 2nd day was exactly the same as the first day. An ANOVA was used to determine differences between vertical jump heights between the 3 measurement devices and a paired T-test was used to compare vertical jump measurements between the 2 testing days on each device. Significance was defined as p < .05 for all statistical calculations.

RESULTS: There was no significant difference in vertical jump heights measured between the 3 devices on either day (Day 1 - Just Jump™ mat: 21.6 ± 2.5 in.; Vertec™: 21.0 ± 2.5 in.; Vert™: 20.1 ± 4.9 in.; p = .227; Day 2 - Just Jump™ mat: 21.6 ± 6.0 in.; Vertec™: 21.1 ± 6.2 in.; Vert™: 20.2 ± 4.9 in.; p = .233). In addition, there were no significant differences between the vertical jumps between the 2 days for any of the devices (Just Jump™ mat: p = .616; Vertec™: p = .141; Vert™: p = .897).

CONCLUSION: The results of this study indicated that the Vert™ device recorded values approximately 1 inch lower than the Vertec™ and the Just Jump™ mat, however, the difference was not statistically significant. In addition, all 3 devices recorded similar measurements on both days of testing. Based on these results, any one of the 3 devices would be adequate to provide consistent and reliable vertical jump results in a field setting.

Electromagnetically braked cycle ergometers (CE) have been the standard modality for maximal anaerobic power (AP) testing in applied research settings; however, modern non-motorized treadmill (NMT) ergometers may prove a viable alternative for testing. PURPOSE: To compare performance markers derived from a 30-s maximal sprint on CE and NMT under optimized loads.

METHODS: Recreationally active men (n = 5; 24.8 ± 4.4 yrs) and women (n = 6; 21.3 ± 3.4 yrs) volunteered for the study. First visit consisted of a force-velocity-power test on the CE and NMT to determine optimal resistance for peak power production. Remaining two visits were performed in a randomized crossover order, consisting of a single 30-s maximal AP test on the CE or NMT. Peak power (PP), mean power (MP), minimal power (Pmin), and fatigue index (FI) were averaged over three revolutions on the CE and three strides on the NMT. Rating of perceived exertion (RPE), maximal heart rate (HRmax) and blood lactate concentration (BLa) were collected as a measure of intensity. All markers were analyzed using paired samples t-tests and Pearson product correlation coefficients.

RESULTS: PP, MP, and Pmin were higher (P < .001) on NMT (924.4 ± 297.7 W; 636.9 ± 309.5 W and 364.3 ± 123.20 W, respectively) than CE (501.9 ± 154.20 W, 309.5 ± 115.28 W and 178.11 ± 58.93 W, respectively). Significant correlation was found between PP (r = .936, p < .001), relative PP (r = .871, p < .001), MP (r = .859, p < .001), relative MP (r = .721, p = .012), Pmin (r = .824, p < .002) and relative Pmin (r = .779, p < .05). FI was not significantly different on the NMT (r = 0.99 ± 0.06%) compared to the CE (98.9 ± 6.67%), p = 0.172, although they were not significantly correlated, p > .05. HRmax was higher on the NMT than CE (184.1 ± 11.0 bpm and 177.1 ± 11.0 bpm, p = .001, respectively). BLa was significantly higher on the NMT (NMT = 11.6 ± 2.5 mmol/L; CE = 10.4 ± 2.4 mmol/L) and RPE (NMT = 17.6; CE = 17.1, p > .05), were not significantly different on the NMT. Maximal braking torque on the NMT was 20.8 ± 4.43% for males and 14.5 ± 1.9% for females. Optimal torque factor (On the CE was 0.76 ± 0.25 Nm/kg for males and 0.52 ± 0.08 Nm/kg for females.

CONCLUSION: There is a strong relationship between CE and NMT in assessing AP at optimized loads, however higher power output and maximal heart rates were observed on a NMT. Further research is necessary to clarify FI relationship.
The conventional push-up is a common method for assessing a person’s muscular endurance or as an exercise to improve muscle performance in the upper extremities or trunk. Many organizations encourage using the push-up as a test to assess muscular endurance (including the American College of Sports Medicine). A relatively new device called the Spyder 360™ is being promoted as a method to maximize muscle activation during a push-up due to its unstable platform on wheels. PURPOSE: To compare muscle activation in select muscle groups during a standard push-up activity with and without the Spyder 360™. METHODOLOGY: Twelve healthy male subjects volunteered for the study (age=26.67±5.74yrs; WT=85.58±9.40kg; HT=182.14±6.04cm; Percent Fat=13.78±5.40; BMI=25.87±3.28). Volunteers reported to the laboratory and were randomly assigned to test first using either stable push-up handles (PUH) or Spyder 360™ (PU360). EMG electrodes were placed over the following muscles to determine muscle activation: 1) clavicular fibers of the pectoralis major (PM); 2) middle triceps (TR); 3) middle latissimus dorsi (LD); 4) middle portion of the rectus abdominus (RA); and 5) anterior deltoid (AD). Subjects were asked to perform 5 push-ups each using the PUH and PU360. The maximal one push-up EMG data was used for comparison between the two interventions (PUH or PU360). RESULTS: Results indicate that the PU360 elicits significantly more muscle activation during a push-up activity in the pectoralis major (29%; p=0.001); triceps brachii (42%; p=0.0086); latissimus dorsi (26%; p=0.0157); and rectus abdominus (32%; p=0.0034). There was no significant difference in the anterior deltoid (8%; p=0.1653). CONCLUSION: These results demonstrate that the PU360 elicits more muscle activation in the PM, TR, LD and RA compared with PUH for the subjects in this study.

BACKGROUND: Professional guidance is integral to assist individuals adopting an active lifestyle to enhance physical fitness, yet there is clarity lacking regarding which aspects of exercise programming (aerobic and resistance training) should be targeted across the lifespan. PURPOSE: To provide a lifespan, descriptive analysis of aerobic and muscular fitness in individuals seeking guidance in initiating an exercise program through a University program. METHODS: Upon registering in a University sponsored, guided exercise program, participants (N=991) received a comprehensive health analysis, measuring variables largely influenced by aerobic endurance (including the American College of Sports Medicine). A relatively new fitness index (CCFI) to develop Chinese collegiate fitness index (CCFI). The advisory committee members used the Delphi method to rate the importance of the fitness factors of CCFI. Finally, three domain was included in the CCFI and named transportation, exercise facilities, and physical education policies and services. A total of 789colleges and universities were surveyed, 386 were recovered, and 245 were valid questionnaires. The missing data that schools with incomplete responses were filled with the mean by SPSS24.0. The domain score was calculated by the rank of each group. RESULTS: Finally, 245 colleges and universities came from 29 Provinces, Municipalities, Autonomous Regions and Hong Kong Special Administrative Region joining in the survey. Three groups were identified according to the difference of the attribution, the difference between public and private, as well as the different institutions and vocational institutions. Among the 245 colleges and universities, 48 were recognized as the subordinate universities, 152 were determined as the provincial universities, and 45 were defined as the public vocational or private colleges. The top three of universities are (1) Tsinghua University (74.7); (2) Beijig Normal University (72.1); (3) South China University of Technology (72.0). CONCLUSIONS: There are obvious regional differences in the fitness index of Chinese collegiate (p=0.000-0.05); The fitness index of the subordinate universities was significantly higher than other two group universities (p=0.000-0.05). ACKNOWLEDGEMENT: Supported by NPOPSS Grant 15CTY011, and Fundamental Research Funds for the Central Universities SWU1709240.

PURPOSE: Physical activity of college students was heavily influenced by individual interest, educational policies, social support, and the physical environment (including the built environment). The purpose of this study was to assess the status of Chinese collegiate fitness and to develop a promotion strategy from the supporting active lifestyle perspective. METHODS: Drawing on National Academy of Kinesiology released the National Collegiate Fitness Index Report 2015 (NCFI) to develop Chinese collegiate fitness index (CCFI). The advisory committee members used the Delphi method to rate the importance of the fitness factors of CCFI. Finally, three domain was included in the CCFI and named transportation, exercise facilities, and physical education policies and services. A total of 789colleges and universities were surveyed, 386 were recovered, and 245 were valid questionnaires. The missing data that schools with incomplete responses were filled with the mean by SPSS24.0. The domain score was calculated by the rank of each group. RESULTS: Finally, 245 colleges and universities came from 29 Provinces, Municipalities, Autonomous Regions and Hong Kong Special Administrative Region joining in the survey. Three groups were identified according to the difference of the attribution, the difference between public and private, as well as the different institutions and vocational institutions. Among the 245 colleges and universities, 48 were recognized as the subordinate universities, 152 were determined as the provincial universities, and 45 were defined as the public vocational or private colleges. The top three of universities are (1) Tsinghua University (74.7); (2) Beijig Normal University (72.1); (3) South China University of Technology (72.0). CONCLUSIONS: There are obvious regional differences in the fitness index of Chinese collegiate (p=0.000-0.05); The fitness index of the subordinate universities was significantly higher than other two group universities (p=0.000-0.05). ACKNOWLEDGEMENT: Supported by NPOPSS Grant 15CTY011, and Fundamental Research Funds for the Central Universities SWU1709240.
Knowledge regarding upper body muscular endurance and strength measures in college-age females is limited due to a relative lack of investigation. Since the implementation of Title IX, a large number of females regularly participate in strength and muscular endurance activities, and as such, more observational, descriptive fitness data on this population is needed. PURPOSE: While push-ups are traditionally a measure of muscular endurance, many females lack the upper body strength to perform a single standard push-up. This study seeks to determine the correlation between performance of push-ups from the standard position and a standard measure of upper extremity isometric strength, handgrip. METHODS: Healthy, non-pregnant females were recruited from the student population at CCSU. Subjects were excluded if they had uncontrolled asthma or any other medical condition that would prevent them from participating in strenuous physical activity. Following a short warm-up, subjects completed standard push-ups to exhaustion and completed a right-left maximum handgrip assessment using a dynamometer. RESULTS: Our 60 subjects had a mean age of 20.6 years (SD ± 2.5, range 18-27), and performed an average of 11.7 push-ups (SEM ± 1.30, range 0-47). Their average right and left handgrip was 35.1 kg (SEM ± 0.63) and 32.8 kg (SEM ± 0.62), respectively. Both Spearman rank and Kendall’s T lie correlations showed no significance relationship between push-up performance and handgrip strength for either hand (Left hand: r = 0.17, p = 0.27; Right Hand: r = -0.04, p = 0.78). CONCLUSIONS: Our results demonstrate that college-age females are capable of performing standard push-ups to exhaustion, but that upper extremity isometric strength is a poor predictor of push-up performance in this population.

### 1765 Board #26 May 31 2:00 PM - 3:30 PM Bone Strength Differences According to Peak Power Norm Table Categories

Rebeckah J. Reichert, Maria G. Alvarez, Andrew Denys, Kimberly D. Esperarter, Priscilla Franson, Arianna M. Mazzarini, Vanessa R. Yingling, FACSM. California State University, East Bay, Hayward, CA. (Sponsor: Vanessa R. Yingling, FACSM)

**Purpose:** To determine if a commonly used peak power (PP) norm table (Paterson & Peterson, 2004) discerns differences in bone strength between PP categories. Fractures become more prevalent with age due to bone strength losses. Bone strength is a predictive factor of fracture risk (Clark et al., 2006; Schuit et al., 2004) and previous research has shown muscle strength is significantly correlated to bone strength variables (Frost, 2003; Yingling, 2017). An accessible field measure of PP that detects differences in bone strength may be an important step in optimizing bone strength, thus preventing fracture later in life. **Methods:** 114 participants, 62 F and 52 M (age yrs 21.1±3.3) performed a maximal vertical jump test. PP was calculated from vertical jump height (Sayers, 1999) and categorized into the following groups: Well Above Average, Average, and Well Below Average. **Conclusion:** Current PP norm table categories show a significant difference between Well Above Average and Well Below Average for both genders. **Conclusion:** Current PP norm table categories show a significant difference between Well Above Average and Well Below Average. This indicates that those in the Well Below Average category for PP could benefit from exercise prescription targeted for bone strength optimization.
**BACKGROUND:** Exercise is commonly prescribed using various heart rate (HR) methods (e.g., %HRmax, %HRreserve, HRmax). Exercise can also be described using the Counting Talk Test (CTT). Studies analyzing the correlation between exercise HR and CTT are limited, as well as data supporting the validity of the CTT as a method of exercise prescription. **PURPOSE:** To investigate whether CTT results are associated with exercise HRs and can therefore be used as a valid method of exercise prescription.

**METHODS:** This study included 26 women with a mean age of 20.5 ± 6.4 years. Subjects performed exercise testing on a Stages ergometer once a week for three consecutive weeks. Data was collected at rest, during five stages of self-selected exercise intensities corresponding to RPE values of 8, 10, 12, 14 and 16 based on the Borg 6-20 scale, and during recovery. Data collection included measurements of Heart Rate, CTT Number, CTT Duration, average watts, and average RPM. Calculations were performed after testing to determine the subjects’ CTT using the equation (exercise CTT/resting CTT) x 100. Pearson Correlation Coefficients were calculated to analyze the relationship between Heart Rate and CTT Number, Heart Rate and CTT Duration, as well as between %HRmax and %CTT. **RESULTS:** A statistically significant inverse correlation was found between Heart Rate and CTT number (r = -0.4188, p < 0.05) as well as between HR and CTT Duration (r = -0.5675, p < 0.05). A statistically significant inverse relationship was also found between %HRmax and %CTT (r = -0.5211, p < 0.05). A statistically significant positive correlation was found between CTT number and CTT duration (r = 0.6866, p < 0.05). **CONCLUSION:** Heart Rate was inversely associated with both CTT number and CTT duration. There was also an inverse relationship between %HRmax and %CTT. This data supports the idea that CTT is a possible alternative method of exercise prescription. Using CTT as exercise intensity prescription may improve patient adherence, making the monitoring of exercise intensity more accessible to the general population. More research is needed to ensure proper exercise prescription using the CTT in practice.

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**EXERCISE IS COMMONLY PRESCRIBED USING VARIOUS HEART RATE (HR) METHODS (E.G., %HRRESERVE, %HRMAX). EXERCISE CAN ALSO BE DESCRIBED USING THE COUNTING TALK TEST (CTT). STUDIES ANALYZING THE CORRELATION BETWEEN EXERCISE HR AND CTT ARE LIMITED, AS WELL AS DATA SUPPORTING THE VALIDITY OF THE CTT AS A METHOD OF EXERCISE PRESCRIPTION.** **PURPOSE:** TO INVESTIGATE WHETHER CTT RESULTS ARE ASSOCIATED WITH EXERCISE HRs AND CAN THEREFORE BE USED AS A VALID METHOD OF EXERCISE PRESCRIPTION. **METHODS:** THIS STUDY INCLUDED 26 WOMEN WITH A MEAN AGE OF 20.5 ± 6.4 YEARS. SUBJECTS PERFORMED EXERCISE TESTING ON A STAGES ERGOMETER ONCE A WEEK FOR THREE CONSECUTIVE WEEKS. DATA WAS COLLECTED AT REST, DURING FIVE STAGES OF SELF-SELECTED EXERCISE INTENSITIES CORRESPONDING TO RPE VALUES OF 8, 10, 12, 14 AND 16 BASED ON THE BORG 6-20 SCALE, AND DURING RECOVERY. DATA COLLECTION INCLUDED MEASUREMENTS OF HEART RATE, CTT NUMBER, CTT DURATION, AVERAGE WATTS, AND AVERAGE RPM. CALCULATIONS WERE PERFORMED AFTER TESTING TO DETERMINE THE SUBJECTS’ CTT USING THE EQUATION (EXERCISE CTT/RESTING CTT) X 100. PEARSON CORRELATION COEFFICIENTS WERE CALCULATED TO ANALYZE THE RELATIONSHIP BETWEEN HEART RATE AND CTT NUMBER, HEART RATE AND CTT DURATION, AS WELL AS BETWEEN %HRMAX AND %CTT. **RESULTS:** A STATISTICALLY SIGNIFICANT INVERSE CORRELATION WAS FOUND BETWEEN HEART RATE AND CTT NUMBER (R = -0.4188, P < 0.05) AS WELL AS BETWEEN HR AND CTT DURATION (R = -0.5675, P < 0.05). A STATISTICALLY SIGNIFICANT INVERSE RELATIONSHIP WAS ALSO FOUND BETWEEN %HRMAX AND %CTT (R = -0.5211, P < 0.05). A STATISTICALLY SIGNIFICANT POSITIVE CORRELATION WAS FOUND BETWEEN CTT NUMBER AND CTT DURATION (R = 0.6866, P < 0.05). **CONCLUSION:** HEART RATE WAS INVERSELY ASSOCIATED WITH BOTH CTT NUMBER AND CTT DURATION. THERE WAS ALSO AN INVERSE RELATIONSHIP BETWEEN %HRMAX AND %CTT. THIS DATA SUPPORTS THE IDEA THAT CTT IS A POSSIBLE ALTERNATIVE METHOD OF EXERCISE PRESCRIPTION. USING CTT AS EXERCISE INTENSITY PRESCRIPTION MAY IMPROVE PATIENT ADHERENCE, MAKING THE MONITORING OF EXERCISE INTENSITY MORE ACCESSIBLE TO THE GENERAL POPULATION. MORE RESEARCH IS NEEDED TO ENSURE PROPER EXERCISE PRESCRIPTION USING THE CTT IN PRACTICE.
Validity of Hit & Turn Tennis Test in Estimating Aerobic Capacity with Amateur Players

Bo Li, Jianrong Zhong, Xinxin Wang, Xiaotian Li, Lu Jin, Yuchao Cao, Lv Miao, Yongming Li. 
Shanghai University of Sport, Shanghai, China.

Purpose: To evaluate the validity of H&TTT in estimating VO2peak.

Methods: Sixteen collegiate tennis players (age: 22.2 ± 1.7 yrs; height: 175 ± 5 cm; mass: 69.2 ± 6.1 kg; tennis training experience: 2.3 ± 0.8 yrs) volunteered to perform H&TTT on an indoor synthetic court. A portable spirometric system (K4b2, Cosmed, Italy) was utilized to measure the ventilatory activities to calculate VO2peak.

Results: The levels subjects achieved in H&TTT were 14.6 ± 3.4. The estimated VO2peak was 59.3 ± 6.7ml/min/kg using the regression equation. The calculated VO2peak using different smoothing methods and criterion ranged between 53.5 ± 5.1 and 57.7 ± 6.0 ml/min/kg. Significant correlation was found between estimated and calculated VO2peak (r = 0.3, p < 0.05). Significant differences were found for calculated VO2peak using different smoothing methods and criterion (p < 0.01).

Conclusion: Inconsistent with the literature, the validity of H&TTT in estimating VO2peak was not supported by this study. Caution should be paid when this test is utilized. In addition, a fixed method of data processing is recommended when calculating VO2 from direct measurements.
Unstable surface training has been popular in physical rehabilitation settings for decades. A more recent training technique in strength and conditioning is to create instability by using a suspended weight during resistance training exercises. Suspend weights could create a greater challenge for the core and potentially improve balance.

Intermittent instability by using a suspended weight during resistance training exercises. Suspend weights could create a greater challenge for the core and potentially improve balance.

To determine if a 6-week training program using suspended weights during squats will lead to improvements in balance. METHODS: As part of their 6-week off-season strength and conditioning program, collegiate baseball players were randomly assigned to one of two groups. A group that completed the squats in the traditional fashion and a group that completed the squats while weights were suspended below the barbell. The subjects were tested pre- and post-balance using a four-direction Star Excursion Balance Test (SEBT). The results for each subject were normalized to a percent of their individual leg length. Difference scores were made using ANOVA with repeated measures. RESULTS: Analyses revealed a significant interaction (p < .016). Independent t-tests revealed differences in decrement in maximal force between males and females for heavy (p < .04; males = -18.7%; females = -12.0%) and light-load (p < .005; males = -29.3%; females = -25.9%).

**CONCLUSION:** Fatigue responses in the lumbar extenders differ based on exercise load and sex of participant. Women showed either a more immediate recovery, or a smaller decrement in maximal force production compared to males, following fatiguing exercise at both heavy- and light-loads. This lends practical support to previous research reporting a greater number of slow twitch muscle fibres in the lumbar musculature of females compared to males.

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**IMPROVE BALANCE MORE THAN TRADITIONAL SQUATS?**

Bryan K. Christiansen, Samuel P. Thielen, Kyle J. Hackney, Jeremiah T. Moen, North Dakota State University, Fargo, ND. Sanford Health Performance Center, Fargo, ND. Mayville State University, Mayville, ND.

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**METHODS:** To determine if a 6-week training program using suspended weights during squats will lead to improvements in balance. **METHODS:** As part of their 6-week off-season strength and conditioning program, collegiate baseball players were randomly assigned to one of two groups. A group that completed the squats in the traditional fashion and a group that completed the squats while weights were suspended below the barbell. The subjects were tested pre- and post-balance using a four-direction Star Excursion Balance Test (SEBT). The results for each subject were normalized to a percent of their individual leg length. Difference scores were made using ANOVA with repeated measures. **RESULTS:** Analyses revealed a significant interaction (p < .016). Independent t-tests revealed differences in decrement in maximal force between males and females for heavy (p < .04; males = -18.7%; females = -12.0%) and light-load (p < .005; males = -29.3%; females = -25.9%).

**CONCLUSION:** Fatigue responses in the lumbar extenders differ based on exercise load and sex of participant. Women showed either a more immediate recovery, or a smaller decrement in maximal force production compared to males, following fatiguing exercise at both heavy- and light-loads. This lends practical support to previous research reporting a greater number of slow twitch muscle fibres in the lumbar musculature of females compared to males.
greater (p<0.05) for the BP compared to the OHP at loads ≤85% 1RM but similar at 95% 1RM (228±113 vs. 219±118 watts; p=0.405) and the 1RM (156±81 vs. 146±78 watts/kg; p=0.371). Neither BP nor OHP ACV were significantly (p>0.05) related to humerus length, training age, or training frequency. Only BP 1RM AVC was significantly related to relative strength (r=0.399; p=0.003). CONCLUSIONS: These data suggest velocity ranges used for prescribing training loads should not be used interchangeably for the BP and OHP; OHP velocity ranges should be greater than BP velocity ranges for the same relative loading. Velocity ranges for the BP may need to be reduced as a trainee's relative strength increases.

1782 Board #43 May 31 2:00 PM - 3:30 PM
Unilateral Strength Training Changes Direction Of Strength Asymmetry But Not Magnitude In Healthy Individuals
Joshua C. Carr, Xin Ye, Nathan Wages, Michael Bemben, FACSM. 1The University of Oklahoma, Norman, OK. 2University of Mississippi, University, MS. 3Ohio University, Athens, OH. (Sponsor: Dr. Michael G. Bemben, FACSM)

Unilateral strength training is now recognized as an effective exercise intervention that can attenuate strength asymmetries in clinical conditions (i.e., fracture, neurological damage). The magnitude and direction of muscle strength asymmetry following unilateral strength training may provide insight regarding the adaptability of the central nervous system and further guide rehabilitation programs. PURPOSE: To determine the influence of unilateral isometric strength training of the non-dominant elbow flexors across four weeks. The training protocol required the subjects to complete five sets of five, five-second isometric contractions at 80% of their MVC force. Strength asymmetry of the dominant and non-dominant limbs were determined at baseline and following the training intervention with the equation: (dominant arm−non-dominant arm)/stronger arm x 100. The resulting score reflects the magnitude of strength asymmetry and its direction (i.e., negative values favor the non-dominant limb). A paired samples t-test was used to determine significant inter group differences and compare the Between the BP and OHP at loads 35-100% 1RM. Pearson’s product moment correlations were used to determine relationships between variables. RESULTS: ACV were significantly (p<0.05) greater for the OHP compared to the BP at all submaximal loads (35-95% 1RM) as well as the IRM (0.2±0.09 vs. 0.18±0.07 m/s; p<0.01). PA values were significantly greater (p<0.05) for the BP compared to the OHP at loads ≥85% 1RM but similar at 95% 1RM (228±113 vs. 219±118 watts; p=0.405) and the 1RM (156±81 vs. 146±78 watts/kg; p=0.371). Neither BP nor OHP ACV were significantly (p>0.05) related to humerus length, training age, or training frequency. Only BP 1RM AVC was significantly related to relative strength (r=0.399; p=0.003). CONCLUSIONS: These data suggest velocity ranges used for prescribing training loads should not be used interchangeably for the BP and OHP; OHP velocity ranges should be greater than BP velocity ranges for the same relative loading. Velocity ranges for the BP may need to be reduced as a trainee’s relative strength increases.
before and after training. Nevertheless, the mean strength asymmetry shifted from the dominant limb at baseline to the trained, non-dominant limb following the training intervention. However, the individual responses were highly variable, as the magnitude of strength asymmetry decreased (40%), increased, (40%), or was relatively unchanged (20%). Collectively, these data show that unilateral non-dominant limb training reversed the direction of muscle strength asymmetry yet maintained its magnitude.

1783 Board #44 May 31 2:00 PM - 3:30 PM
An Examination of Performance and Cognitive Outcomes following Lower-Body Resistance Training in Males
Hayden Gerhart, Mitchell Moyer, Amy Fiorentini, Ruby Pressli, Mark Sloniger, FACSM, Pao Ying Hsiao, Madeline Bayles. Indiana University of Pennsylvania, Indiana, PA. (No relevant relationships reported)

PURPOSE: The purpose of the present study was to investigate physiological and cognitive changes following a 6-week lower-body resistance training protocol.

METHODS: Eight healthy men volunteered to participate in a 6-week resistance training protocol using the back squat (BS) and conventional deadlift (DL). Each participant went through a 1-week pre-testing period consisting of anthropometric measurements, vertical jump performance, 1-repetition maximum (1RM) testing of BS and DL, maximal aerobic capacity (VO2max), cognitive performance, and total mood disturbance (TMD). Participants were then randomly placed into one of two experimental groups. The two groups were 90s (90s) rest between sets (n = 5) and 3-minutes (3m) rest between sets (n = 3). Each group came into the lab for testing sessions twice per week, separated by at least forty-eight hours. In each session, the participants performed 3 sets of 5 repetitions using eighty-five percent of the previously determined 1RM for DL and BS. RESULTS: Analysis of variance (ANOVA) revealed a main effect of time for BS (p = 0.026), and main effect of group for vertical jump (p = 0.008). The 3m group increased BS performance (p = 0.020), while the 90s group improved vertical jump (p = 0.031). Group by time interactions were observed for two measures of cognitive performance: Interference score (p = 0.048) and Word-Color score (p = 0.050). Additionally, a group by time interaction was also observed for TMD (p = 0.004). Despite the trending increase of executive function in the 3m group, a worsened TMD score post-intervention was observed (p = 0.008).

CONCLUSION: Minimal rest improved power within the 90s group while the 3m group significantly improved lower body strength. Cognitive function only appeared to improve in the 3m group. Despite no increase in strength for the 90s group, it appears minimal rest is advantageous for athletes looking to enhance power performance, although further research is necessary.

1784 Board #45 May 31 2:00 PM - 3:30 PM
The “Unregulated” World Of Strength And Conditioning: Are CSCCa Coaches The Most Effective? Forrest Scott, Jordynne Ales, Andreas Stamatis. SUNY Plattsburgh, Plattsburgh, NY. (Sponsor: Peter W. Grandjean, FACSM) (No relevant relationships reported)

When designing training protocols, safety and effectiveness are the ultimate goals, with safety being a prerequisite of effectiveness (a protocol cannot be effective if not safe first). However, in January 2017, three Pacific-12 Conference football athletes were hospitalized with rhabdomyolysis. The affected players were supervised by a strength and conditioning coach certified by the Collegiate and Strength and Conditioning Coaches association (CSCCa), the only SCC certifying program and USTFCCCA is one of them. This revived the debate about the effectiveness of several SCC certifications. Among them, the Collegiate Strength and Conditioning Coaches association (CSCCa), the only SCC certifying organization that includes a two-part practical in their exam, claim they are the only ones devoted to meeting the unique needs of the collegiate SCC. We used 2016-17 NCAA men’s DI-III championship data to determine coaching effectiveness. PURPOSE: To investigate retrospectively the relationship between NCAA national championship data and CSCCa-certified SCCs. METHODS: Championship data was retrieved from NCAA archives. All SCCs, who won national championships in any sport within the past year/season, were recruited via email/phone in order to acquire information regarding certification and coaching prescription. We identified the number of CSCCa-certified coaches who worked in 2016-17 for NCAA programs that (a) did not win a championship and (b) won a championship. Using z-score for proportion (one-tailed hypothesis, significance level at 0.05), we tested for statistical significance. RESULTS: Last season/year, CSCCa-certified coaches worked for 2.7% of NCAA non-championship teams and for 15.5% of championship teams. The z-score is 5.9979. The p-value is 0.0001. The result is significant at p < 0.05. Conclusion: The CSC credential is essential for most NCAA teams. The regulation of the strength and conditioning

1785 Board #46 May 31 2:00 PM - 3:30 PM
The Effects Of An Acute Bout Of Resistance Training On College-aged Male 24hr Rmr
Connor Saker, Chad Witmer, Shala Davis, FACSM, Gavin Moir. East Stroudsburg University of Pennsylvania, East Stroudsburg, PA. (Sponsor: Shala Davis, FACSM) (No relevant relationships reported)

It has been demonstrated that increasing caloric expenditure through exercise participation is one mechanism by which to modify caloric balance in favor of weight loss. While chronic resistance training (RT) has been demonstrated to elevate resting metabolic rate (RMR) due to increased lean mass, there has been less research on the acute effects of a single bout of resistance training on RMR. PURPOSE: To determine the effects of an acute bout of resistance training on the 24 h RMR of college-aged males.

METHODS: Ten healthy men aged 18-24yr performed 8 exercises (2 sets, 10 repetitions, 2 min recovery, 70% IRM & SRM) following ACSM Guidelines for RT. Subjects reported for testing following a 12 h fast and engaged in 7, 30 min RMR measurements over the next 24 h. Subjects completed both an experimental (RT) and control (no exercise) day separated by 1 week. RESULTS: RMR (kcal) data was analyzed using a one way ANOVA with repeated measures on 2 factors (group and time). Statistical analysis revealed that there was no significant main effect for group (F = 2179.58: 44.82 kcal vs. 2143.16: 44.82 kcal; F = .330, p = .567) or group x time interaction (F = .592, p = .736, Table 1). There was a significant main effect for time (F = 5.126, p < .001, Table 2). CONCLUSION: We conclude that an acute bout of RT, following ACSM guidelines, did not significantly impact RMR in RT males 24 hrs post-exercise.

Table 1. Mean 24-hour RMR Values by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean RMR (kcal)</th>
<th>SD (kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>2199.89 ± 118.57</td>
<td>2058.98</td>
</tr>
<tr>
<td>Control</td>
<td>2180.48 ± 118.57</td>
<td>2010.28</td>
</tr>
</tbody>
</table>

Table 2. Mean RMR Values across Measurements

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean RMR (kcal)</th>
<th>SD (kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2199.89 ± 118.57</td>
<td>2058.98</td>
</tr>
<tr>
<td>3</td>
<td>2180.48 ± 118.57</td>
<td>2010.28</td>
</tr>
</tbody>
</table>

Note. Values are means ± standard error.

1786 Board #47 May 31 2:00 PM - 3:30 PM
Cluster Sets Attenuate Power Loss at Higher Intensities During the Back Squat Exercise
Will Jennings1, Jason D. Stone1, John D. Mata1, J. Craig Garrison2, Shihho Goto2, Margaret T. Jones, FACSM3, Andrew Jagim1, Adam King1, Jonathan M. Oliver1,2, Texas Christian University, Fort Worth, TX. 1Texas Health Sports Medicine, Fort Worth, TX. 2Texas Health Science Medicine, Fort Worth, TX. 3George Mason University, Fairfax, VA. 4Lindenwood University, St. Charles, MO. (Sponsor: Margaret Jones, FACSM) (No relevant relationships reported)

Cluster sets (CLU), a training method in which a brief rest is inserted between a group of repetitions, attenuates the load in power typically observed in traditional set (TRD) configurations during resistance training. Training studies report greater gains in strength and power when using CLU at lower intensities. However, few data exist on the kinetics and kinematics of CLU at higher intensities (~80%). PURPOSE: To compare the kinetics and kinematics during TRD and CLU at a high intensity.

METHODS: Eight resistance trained men (23 ± 3.3 y; 177 ± 7.9 cm; 82 ± 11 kg) had body composition and one-repetition maximum (IRM) back squat assessed. After at least 48 hours, in a randomized crossover, participants completed 4 sets 6 repetitions (TRD) with 180 seconds inter-set rest or 4 sets 2 clusters
of 3 (4 x [2 x 3]) (CLU) with 30 seconds intra-set rest and 150 seconds inter-set rest, both configurations at 80% 1RM separated by 72 hours. Data were collected using a bilateral force plate and motion capture system, and smoothed using a 4th order Butterworth filter (12 Hz cutoff). Data were analyzed by a repeated measures ANOVA (p = 0.05). RESULTS: A significant CONDITION x SET (p = 0.038) interaction was observed, with lower power outputs during TRD for SET 2 (p = 0.008), 3 (p = 0.019) and 4 (p = 0.002) compared to SET 1. Only SET 4 was significantly lower than SET 1 (p = 0.006) in the condition CONTR. CONCLUSION: The interaction (p < 0.001), mirroring the pattern observed in mean power. CONCLUSION: These data demonstrate that the greater power observed during resistance exercise at lower intensities is also observed at higher intensities, and is attributed to higher velocities. Long-term training studies at higher intensities are warranted to determine the adaptations resulting from consistent CLU training.

1789 Board #50 May 31 2:00 PM - 3:30 PM
One Set to Failure per week Increases Strength More Effectively than Traditional Resistance Training
P. Gage Murphy, Danny Dominguez, Murat Karabulut. University of Texas at Rio Grande Valley, Brownsville, TX.
(No relevant relationships reported)

PURPOSE: To determine the efficacy of the current recommendations for increasing strength compared to other, less time consuming programs in untrained sedentary and recreationally active females. METHODS: Forty-six female subjects (age = 22.7±4.1 yrs) were randomly assigned to one of four groups that determined the resistance training program they would follow for 6 weeks. All resistance training programs utilized the same two exercises on the same equipment: leg extension and leg curl. The four training groups included: a traditional group (HIGH), two blood flow restriction (BFR) groups (BFR-1 and BFR-2), and a minimalist group (MIN). HIGH group followed ACSM guidelines for increasing strength, which comprised a training program of 10 repetitions 3x/wk at 50% of 1RM. BFR-1 program consisted of 4 sets of 30, 15, 15 reps 1x/wk at 20% of 1RM. BFR-2 program consisted of 4 sets of 30, 15, 15, 15 reps 2x/wk at 20% of 1RM. MIN program consisted of 1 set to failure 1x/wk at 75% of 1RM. Weight was added each week if each subject completed the previous weeks program with proper form. Prior to and following 6 week training period subjects were tested for 1RM strength on leg extension and leg curl exercises. All subjects were at least 8 hours fasted as well as hydrated (determined using clinical urine refractometer) for pre- and post-testing. RESULTS: One-way ANOVA found no between-group differences in any of the outcome measures of interest at baseline. Repeated measures ANOVA found a significant time main effect for 1RM (p < 0.01) with all groups improving in strength for leg extension and leg curl. There was also a significant condition difference (p < 0.01) for the MIN group in the 1RM for the leg extension, representing that increases in leg extension 1RM by MIN group was significantly greater than all other conditions. CONCLUSION: All training programs were effective at increasing 1RM strength for the leg extension and leg curl. Strength increases by the MIN group for the leg extension were significantly greater than all other groups. These results indicate that a less frequent, more time efficient program is more effective than the current recommendations for increasing strength and it may be an alternative training approach for those who want to minimize the time spent for training but still maximize benefits.

THURSDAY, MAY 31, 2018

Abstracts were prepared by the authors and printed as submitted.
Regarding resistance training objectives, muscle hypertrophy and strength are primary goals. The movement velocity appears to be important to improve muscle mass and strength. Eccentric exercises have been attributed to greater gains in muscle cross-sectional area, mainly because of a greater time under tension, inducing more stress to muscle fibers and greater adaptation. Therefore, manipulation of the eccentric phase tempo may have different implications to results in resistance training.

PURPOSE: Evaluate the effects of two different velocities of eccentric phase in isokinetic contractions on muscle hypertrophy and strength of the quadriceps femoris in healthy adults.

METHODS: Ten healthy adults underwent in a training program consisting of knee extensions unilaterally, where each leg was allocated in a different pattern of movement. These consisted of two groups isokinetic contractions of one second in concentric phase, 0 seconds in a transition phase and 2 seconds in eccentric phase (G2S); Isotonic contractions of 1 second in concentric phase, 0 seconds in a transition phase and 4 seconds in eccentric phase (G4S). Each protocol consisted of 5 series of exercise until volitional failure, with 70% of 1 maximal repetition and 3 minutes of rest between series, 2 times a week.

RESULTS: We observed muscle hypertrophy response over time for all muscles (Rectus Femoris (RF), P < 0.00; Vastus Lateralis (VL), P = 0.00) and vastus medialis (VM), P = 0.00; the difference between treatments was observed only for VM (P = 0.022). The effect size was: RF, 0.78 and 0.82; VL, 1.05 and 0.8; VM, 0.59 and 1.08; for G2S and G4S, respectively. Both groups improved strength over time (P < 0.00), with the effect size for G2S of 0.63 and G4S 0.53, with Hegde’s g approach; however, there was no difference (P > 0.05) between treatments. Time Under Tension (TUT) was different between groups (G2S = 1300.6±336 and G4S = 2535.6±654).

CONCLUSIONS: Our results suggest that the different eccentric phase tempo is not able to produce differences in strength and muscle hypertrophy for knee extenders, except for the Vastus Medialis, although the time under tension was greater in G4S.

Research is needed to clarify if an explanation or technique descriptions may have an impact on biomechanics of individuals, especially in major strength exercises and daily movements such as squat (SQ), sit-up stand (SS), overhead dumbbell press (DBP), and overhead barbell press (OHP). PURPOSE: To determine if peak velocity and peak acceleration of SQ, SS, DBP, and OHP are influenced by written descriptions and explanations.

METHODS: Twenty-one subjects (14 males, 7 females) attended two visits with 48-72h separation. At each visit they performed four different exercises (SQ, SS, DBP, OHP) in the same order and with the same resistance during which movement was recorded with the Iron Path Pro Application Version 2.2. Additionally, the app recorded velocity, acceleration, bar distance, and force. At the second visit subjects were randomized to either receive a description on correct SQ and OHP technique or not. Height, body mass, humerus and femur length were measured and resistance training experience and frequency were reported via survey. Two-way mixed ANOVA with repeated measures was used to determine differences between the first and second visit (time) and explanation and non-explanation (condition).

RESULTS: The subjects had the following descriptive statistics: age of 21.4±1.6 yrs, body mass of 79.38±23.71 kg, height of 1.77±0.10 m, femur length 0.45±0.05 m, humerus length 0.35±0.05 m, lifting experience of 4.68±3.45 yrs, and lifting session 2.6±1.63 days per week. No significant (P>0.05) condition, time, or condition x time effects were found for either peak velocity or peak acceleration for the SS, SQ, DBP, and OHP.

CONCLUSION: These data show that neither repeated trials (time) or condition had a significant impact on peak velocity and peak acceleration in SS, SQ, DBP, or OHP in this sample of young, resistance trained subjects.
lactate (p<0.001) and pulse rate (p=0.040). The variables that predicted significant increase in pH were mean arterial blood pressure (p<0.001), temperature (p<0.010), and pregnancy status (p<0.026). Sex (p=0.316), age (p=0.714), obesity (p=0.195), and blood alcohol content (p=0.624) were not statistically significant. Injury severity score was a trending predictor (p=0.057). CONCLUSIONS: The strong association between lactate and pH may indicate a need to re-examine components of the lactate/ pH framework. The associations between blood pressure, pulse, and pH implicate the kidney; further work needs to be done in outlining renal function and its role in modulation of pH and cardiovascular function.

1796 Board #57 May 31 3:30 PM - 5:00 PM
Combined Effects of Hypohydration, Muscle Damage, and Exertional Hyperthermia on Biomarkers of Acute Kidney Injury
Cory L. Butts, Aaron R. Caldwell, Samantha A. Mohler, Matthew S. Ganio, FACSM, Nicholas P. Greene, Stavros A. Kavouras, FACSM, Brendon P. McDermott, FACSM. University of Arkansas, Fayetteville, AR. (Sponsor: Dr. Brendon P. McDermott, FACSM)

Dehydration, exertional hyperthermia, and muscle damage commonly occur in athletes, military, and occupational settings, yet, their combined effects on biomarkers of acute kidney injury are not well understood. PURPOSE: Investigate the combination of dehydration, muscle damage, and exercise in the heat on biomarkers of renal stress. METHODS: Six male participants (age 24±5 y, body mass 74±9.6 kg, body fat 14.3±4.4%) completed two trials, one euhydrated (EU; fluid replacement ≤2% body mass loss) and one hypohydrated (HY; fluid replacement ≤5% body mass loss) prior to a 120 min cycle ergometer exercise, separated by 228 days. Trials consisted of muscle damaging unilateral eccentric knee flexion, 60 minutes of treadmill running (~60% VO2max) in the heat (33 °C, 54% RH), and 30 minutes of passive recovery. Participants were provided a rehydration protocol in both trials and returned 24 hours later for a follow-up visit. RESULTS: Urine osmolality when HY was greater pre (HY 1045±102, EU 612±142 mOs/mkg; P<0.01) and post (HY 1003±71, EU 503±203 mOs/mkg; P<0.01), but not 24 hour post (HY 543±310, EU 545±404 mOs/mkg; P = 0.98). Serum osmolality was also different pre-trial (HY 301±5, EU 290±5 mOs/mkg; P = 0.02), but was similar 24-h post (HY 295±4, EU 293±3 mOs/mkg; P = 0.25). Isometric strength was reduced regardless of condition immediately after eccentric exercise (grand mean Δ = -33.6±27.9 N.m; P = 0.03). Rectal temperature increased to a greater degree when HY (21.10±0.60 °C) compared to EU (16.5±0.44 °C; P = 0.01). Plasma neutrophil gelatinase-associated lipocalin (NGAL) increased independent of condition (grand means: pre- 59.9±7.3, post-exercise 77.6±12.0 ng/mL; P<0.01), but was not different between trials (P = 0.84). However, percent changes from baseline in NGAL were greater, regardless of time of week, water intake, or hydration level (P = 0.017%) compared to EU (P < 0.01). CONCLUSION: Exercise in the heat with muscle damage increased renal stress when HY and resulted in greater changes in NGAL, a biomarker of acute kidney injury. These preliminary findings suggest that improper fluid consumption prior to and during exercise may augment renal stress, yet the long-term consequences of these detriments require further investigation.

*Supported by funding from Central States ACSM Student Grant Award

1797 Board #58 May 31 3:30 PM - 5:00 PM
Home-based Exercise Improves Heart Contractility Determined by 2D Speckle Tracking Strain in Renal Transplant Recipients
Laura Stefani1, Riggs Kilka, FACSM, Gianni Pedrizzetti2, Chiara Ingletti1, Benedetta Tosi1, Stefano Pedri2, Giorgio Galanti1. 1University of Florence, Firenze, Italy; 2University of Trieste, Trieste, Italy. 2ESAOTE, Firenze, Italy. (Sponsor: Riggs J. Kilka, FACSM)

(No relevant relationships reported)

PURPOSE: Renal transplant recipients (RTR) are at high risk for adverse cardiovascular events due to potential cardiotoxic effects of multiple drug therapies and often sedentary behavior. Moderate intensity exercise has been shown to decrease the risk of these potential events. The purpose of this study was to evaluate the changes in myocardial function using global longitudinal strain (GLS), mean strain (Lo) and ejection fraction (EF) determined from 2D speckle tracking strain (STS) before and after participation in a home-based aerobic and strength training program in RTR and to determine if there was a sex difference in the response.

METHODS: A group of 30 RTR’s (12 females and 18 males, aged 47.9 ± 12.3 y, BMI: 24.4 ± 3.9, average age at transplant 38.6 ± 13.1 y) participated in an exercise program for 12 months. Individualized exercise programs were created based on the results of a cycle ergometer test, hand grip dynamometry, bioelectrical impedance and skinfold thickness. Repetition measure ANOVA with Tukey post-hoc analysis were used to detect differences across time and sex differences.

RESULTS: GLS and Lo increased significantly from T1 to T2 and remained high at T2 (GLS: -17.9 ± 3.3 vs -20.4 ± 3.2 and -20.5 ± 3.8 and Lo: -18.3 ± 3.8 vs -20.4 ± 3.3 and -20.4 ± 3.0) with no changes in EF over time (EF % 60.4 ± 5.3 vs 61.8 ± 6.9 and 64.3 ± 6.2). Men were significantly older at time of transplant (33.8 ± 12.6 vs 45.7 ± 11.4, P < 0.05) with lower cardiac function at T1 (-17.1 ± 3.7 vs -19.2 ± 2.2), P < 0.05) than women and accounted for a majority of the improvement in cardiac function in this sample. CONCLUSIONS: A moderately intense exercise program was well tolerated by RTR’s and significantly improved heart function in men during the initial 6 months of the program. More research is needed to confirm that these initial findings can be generalized to a larger population.

1798 Board #59 May 31 3:30 PM - 5:00 PM
Aerobic Exercise Improves Subclinical Cardiopulmonary Abnormalities in Chronic Kidney Disease
Danielle L. Kirkman, Bryce J. Muth, Joseph M. Stock, David G. Edwards. University of Delaware, Newark, DE.

No relevant relationships reported

PURPOSE: Subclinical cardiopulmonary abnormalities have been reported in patients with mild-moderate CKD that may predispose these individuals to overt cardiovascular disease (CVD). This randomized controlled trial investigated whether 12 weeks of moderate to vigorous intensity aerobic exercise could improve cardiopulmonary measures in Stage 3-5 non-dialysis CKD patients.

METHODS: Stage 3-5 CKD patients (eGFR, 40-60 ml/min/1.73m2) with CVD history were randomized to an Exercise Training (EXT) or Control (CON) arm. EXT consisted of 3x45 minutes of supervised exercise per week at 60-85% HRmax for 12 weeks. CON received routine care. Cardiopulmonary exercise testing (CPX) was carried out at baseline and after 12 weeks. CPX was performed on a cycle ergometer with workload increased by 15W every minute until volitional fatigue. Breath by breath inspired respiratory gas analysis was carried out with an automated gas analyzer and averaged over 10 second intervals.

RESULTS: Ext significantly improved exercise capacity as shown by an increase in VO2peak compared to CON (EXT: 17.89±1.21 vs. CON: 19.98±1.59; CON: 18.29±1.73. Abstracts were prepared by the authors and printed as submitted. 

THURSDAY, MAY 31, 2018

Vol. 49 No. 5 Supplement
Official Journal of the American College of Sports Medicine S349

No relevant relationships reported

Purpose Early-stage chronic kidney disease (CKD) is prevalent in pre-diabetes. A healthy lifestyle is promoted in those at high risk of developing type 2 diabetes (T2DM) yet any relationships between physical activity and nutritional intake on kidney function in these individuals is unknown. This study aimed to quantify the independent associations that may exist between changes in physical activity, dietary fats and fibre, and estimated kidney function in individuals with pre-diabetic stage-2 CKD. Methods The study analysed data from a subset of adults at high risk of T2DM recruited to a lifestyle education programme (Yates et al. Diabet Med. 34:698-707, 2017). At baseline and 24 months, 126 (84 male) pre-diabetic CKD stage 2 (mean(SD) baseline estimated glomerular filtration rate (eGFR) 76.80(3.35) ml/min/1.73 m2, age 66(6) years, BMI 31.6(5.1) kg/m2) provided dietary data via the Dietary Instrument for Nutrition Education food frequency questionnaire and physical activity and steps by 7-day accelerometer. Linear regression examined the independent associations of baseline and change at 24 month in eGFR and average number of steps, moderate to vigorous physical activity (MVPA), total fat and unsaturated fat, and dietary fibre and carbohydrate intake and average number of steps at baseline (r=0.140, p=0.059). However, after adjustment for known confounders (including age, sex, BMI, smoking status, ethnicity), these associations disappeared. There were no associations between change in eGFR and average number of steps at baseline (r=0.140, p=0.059). However, after adjustment for known confounders (including age, sex, BMI, smoking status, ethnicity), these associations disappeared. There were no associations between eGFR and dietary fats (total and unsaturated), and fibre. CONCLUSIONS: Higher MVPA and average number of steps were associated with (but not predictive of) higher eGFR in a group of adults with pre-diabetic stage-2 CKD. Therefore, a healthy active lifestyle should be encouraged in pre-diabetes to prevent decline in kidney function.
vs. 17.36±1.60 kg/m²; p<0.01). Cardiopulmonary reserve improved following EXT as indicated by an increased oxygen uptake efficiency slope (EXT: 1.76±0.13 vs. 1.93±0.12; CON: 1.76±0.14 vs. 1.68±0.15). Relative O₂ pulse improved following EXT, suggestive of left ventricular function (EXT: 0.12±0.01 vs. 0.14±0.01; CON: 0.14±0.01 vs. 0.14±0.01 ml/beat/kg; p=0.03). Ventilation perfusion mismatching (V̇̇/V̇̇CO2) was still evident following EXT (EXT: 32.2±v 33.0±9; CON: 32.2±34.1±AU; p=0.1). EXT had no effect on the ventilatory cost of oxygen uptake (V̇̇/V̇̇O2; EXT: 40.2± vs. 42.2±; CON: 37.2± vs. 41.2±AU; p>0.05). EXT had no effect on autonomic function assessed by maximal heart rate (EXT: 149±8 vs. 143±8; CON: 113±5 vs. 129±5 bpm; p>0.4) and 1 minute heart rate recovery (EXT: 15±1 vs. 16±2; CON: 14±1 vs. 13±1 %; p>0.2).

CONCLUSION: Aerobic exercise improved exercise capacity, cardiopulmonary reserve and oxygen delivery in CKD patients. Despite these improvements, CPX measures were not fully restored to those observed in matched sedentary healthy individuals. Additional interventions coupled with exercise may be required to enhance cardiopulmonary adaptations to exercise training in CKD.

D-59 Free Communication/Poster - Imaging and Assessment Methodology
Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1799 Board #60 May 31 3:30 PM - 5:00 PM
Using an Accelerometer to Predict Mechanical Load of Physical Activities in Adults
Shelby L. Francis, Kathleen F. Janz, FACSM, Jacob E. Simmerring. University of Iowa, Iowa City, IA. (Sponsor: Kathleen F. Janz, FACSM).

(Please report all relevant relationships.)

PURPOSE: The accepted method for quantifying impact forces on the lower skeleton involves force plates to quantify ground reaction forces (GRF) in a lab. This method is not feasible in free-living situations. Developments in accelerometer (accel) technology may provide the ability to evaluate the effects of mechanical loading on bone. Technology is preferred over a compendium approach since the GRF of activities such as jumping, jogging depend on the actual execution of the movement.

The purpose of this project was to validate an accel for the prediction of mechanical load by comparing its output to GRF. METHODS: Participants (n=20 males, 20 females; 18 to 39 yr) completed 10 repetitions of 9 activities (stand, walk, jog, run, 15 cm jump, step down from curb, drop down from curb, forward hop, side hop) on a force plate with an accel on their right hip. The activities were categorized as standing, ambulation, running, jumping, and using and paired with 59 accel variables to predict mechanical load. Models were fit using the randomForest package in R using 10-fold cross-validation. Model performance was assessed using coefficient of determination (R²) and median absolute error. RESULTS: The percentage of variance explained by the models ranged from 0.32 to 0.78 with median absolute errors ranging from 0.20 to 0.49. The best model (Model 2) contained the known activity categories and accel variables, but is not realistic for free-living situations where activity categories will not be known. The best free-living model was Model 5, which used derived activity categories and accel variables.

RESULTS:

<table>
<thead>
<tr>
<th>Model</th>
<th>R²</th>
<th>Median Absolute Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known Activity Categories</td>
<td>0.44</td>
<td>0.43</td>
</tr>
<tr>
<td>12. Accel Variables</td>
<td>0.65</td>
<td>0.27</td>
</tr>
<tr>
<td>Known Activity Categories + Accel Variables</td>
<td>0.78</td>
<td>0.20</td>
</tr>
<tr>
<td>4. Derived Activity Categories</td>
<td>0.32</td>
<td>0.49</td>
</tr>
<tr>
<td>5. Derived Activity Categories + Accel Variables</td>
<td>0.66</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Known Activity Categories = standing, ambulation, jumping.

Accel Variables = 59 possible accel variables related to measures of central tendency, variability of accel signal, and change in direction.

CONCLUSION: Models containing the accel variables performed better than those containing only activity categories. The accel data can be used to predict categories and GRF. Accels provide valuable objective information when evaluating mechanical loading on bone and should be used when examining bone-strengthening physical activity in free-living situations.

1800 Board #61 May 31 3:30 PM - 5:00 PM
To Investigation Of The Alignment Abnormality In Pelvic Girdles In One Leg Standing X-ray Examination
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(No relevant relationships reported)

Urinary incontinence is often considered a disorder by pelvic floor dysfunction in post-partum women. Thus we think a lack of care during the puerperal period also influences instability of the pelvic girdle as well as pelvic floor dysfunction. A lumbar X-ray examination was performed as diagnostic imaging for low back pain, and alignment abnormality in the pelvic girdle was often found. At our clinic, diagnostic imaging with a simple load as one leg standing was performed in addition to the above cases to emphasize abnormality in pelvic girdle. PURPOSE: To investigate alignment abnormality of pelvic girdles, in particular symphysiopathy, in one leg standing X-ray of the pelvic girdle in post-partum women, and to examine the relationship with alignment abnormality in pelvic girdles and the cross-sectional areas (CSA) of the psoas major.

METHODS: Participants were 30 parous women (61±5.14yr, 154.6±6.7cm) who consulted us with low back pain at our clinic. Lumbar X-ray, one leg standing X-ray, and a lumbar MRI were conducted. The difference in the height between right and left super pubis (the malalignment in pelvis) was measured from a one leg standing X-ray. The CSA of the psoas major was measured from a lumbar MRI at L4-L5, and the difference between right and left CSA was calculated. Analysis of the relationship between the malalignment in pelvic and the CSA of the psoas major was performed using Spearman’s rank correlation coefficient.

RESULTS: The malalignment in pelvic measured from a one leg standing was 1.64±1.39 mm (mean ± SD). These malalignment in pelvic varied between right leg standing and left leg standing. The amount of variation between right leg standing and left leg was 1.41±0.894. The CSA of the psoas major was 711.5±146.6 mm². The difference in CSA between right and left was 13.0±7.31 %. The relationship between the malalignment in pelvic and the CSA of psoas major was not statistically significant (r = 0.213; p>0.05), but the relationship became significant by increasing number of experiments (power analysis; n = 77).

CONCLUSIONS: The alignment abnormality in pelvic girdles could be estimated by a one leg standing X-ray examination. These results suggest that lack of care during the puerperal period influences alignment abnormality in pelvic girdle, and may lead to a future orthopedic disease.

1801 Board #62 May 31 3:30 PM - 5:00 PM
A Comparison of pQCT Versus B-ultrasound for Lower Leg Muscle Size Assessment in Young Adults
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(No relevant relationships reported)

The current gold standards for assessing muscle cross-sectional area (mCSA) are magnetic resonance imaging and computed tomography, both expensive and largely unavailable methods. PURPOSE: The purpose of the investigation was to examine the precision of ultrasound (US) in measuring muscle thickness (MTH) and peripheral quantitative computed tomography (pQCT) for measuring mCSA in the dominant (DOM) and non-dominant (ND) gastrocnemius (GST) muscle group of college-aged males and females (n=4).

METHODS: pQCT (XCT 3000, Stratec) and B-mode ultrasound (UF-750XT) imaging were performed on both lower legs at the tibia 66% of the muscle thickness was assessed in the lateral head by measuring the distance from fat tissue to the fibula. Two-way repeated measures ANOVAs (leg x time) were performed to detect differences in muscle size between legs across time within each imaging technique. As expected, there were no significant leg or time effects for either device (Table 1), thus, the data were collapsed by leg for correlation analysis. The relationship between mCSA and muscle thickness was determined by Pearson’s r. Intra-class correlation coefficients (ICC), coefficient of variation % (CV%), and least significant change (LSC) were calculated to determine precision. RESULTS: The ICC’s for ND mCSA and ND MTH were 0.999 and 0.967, respectively. The ICC for DOM mCSA was 0.993 and 0.894 for MTH. CV% for ND mCSA was 1.08% and 3.1% for MTH, and for DOM was 1.59% for mCSA and 7.83% for MTH. LSCs at 95% confidence for ND mCSA and ND MTH were 20.5 cm² and 0.25 cm, respectively. LSCs for DOM mCSA was 37.7 cm² and 0.65 cm for MTH. There was a moderate correlation between mCSA and MTH (r=0.7, p<0.01). CONCLUSION: Precision values were comparable between imaging techniques, thus, US may be a viable alternative to measuring muscle size in the gastrocnemius muscle.
Studies of rats have demonstrated that skeletal muscle plays a central role in whole-body nitrate (NO)/nitrite (NO₂)/nitric oxide (NO) metabolism. The small size of human muscle biopsy samples, however, presents an analytical challenge in this context. Indeed, a recent study by Nyakajura et al. (J Appl Physiol 2017; 123:637-644) reported that NO₂ was below the limit of detection (LOD) using the “gold standard” chemiluminescent method even when assaying 40 mg of tissue. PURPOSE: To develop a method to precisely and accurately quantify the NO₃⁻ and NO₂⁻ content of biopsy-sized muscle samples. METHODS: NO₃⁻ and NO₂⁻ were extracted from rat soleus muscle samples using methanol combined with mechanical homogenization + ultrasound, bead beating, pulverization or 0.5% Triton X100. After centrifugation to remove precipitated proteins, NO₃⁻ and NO₂⁻ were measured using a dedicated high performance liquid chromatography analyzer with a LOD of <0.5 pmol. RESULTS: Mechanical homogenization + ultrasound resulted in the lowest NO₃⁻ content (62±16 pmol/mg), with high variability (CV >50%) across samples from the same muscle. NO₂⁻ content (1.00±0.18 pmol/mg) was also elevated, suggestive of NO₂⁻ reduction during tissue processing. Bead beating or pulverization yielded higher NO₂⁻ and lower NO₃⁻ levels, but reproducibility was still poor. Pulverization + 0.5% Triton X100 provided the highest NO₂⁻ (97±15 pmol/mg) and lowest NO₃⁻ (0.59±0.16 pmol/mg) contents, with the least variability (CV ~15%). These values are consistent with literature data from larger rat muscle samples analyzed using the chemiluminescent approach. CONCLUSIONS: We have developed a method capable of measuring NO₃⁻ and NO₂⁻ in muscle samples as small as 10 mg. The theoretical limit is even lower, i.e., 1 mg for both NO₃⁻ and NO₂⁻ and 5 ng for NO₂⁻ alone. This method should prove highly useful in investigating the role of skeletal muscle NO₃⁻/NO₂⁻ metabolism in both healthy and diseased subject populations, in response to exercise and dietary interventions, etc.

Achilles tendinopathy is a common overuse condition in runners, and if degenerative can be a precursor to rupture even in absence of symptoms. Ultrasoundography and spatial frequency analysis are capable of detecting impaired collagenous organization and tensile strength in Achilles tendons, often not plainly visible. These tools, along with basic clinical tests and athletic history, may help characterize the traits and risk factors for sub-clinical Achilles tendinopathy. PURPOSE: To characterize athletic history, waist-to-hip ratio, BMI, ultrasonography findings, heel raise endurance, and composite dorsiflexion associated with symptomatic and asymptomatic Achilles tendons in runners. METHODS: 48 self-identified runners (16 F, 32 G, 26.8 ± 4.9 years) with 9 ± 7.6 years of running experience were examined. Heel raise endurance and knee-to-wall composite dorsiflexion were assessed. Height, weight, and waist and hip circumferences were taken, and participants filled out a VISA-A and activity questionnaire. Achilles ultrasound images were analyzed for peak spatial frequency radius (PSFR), P6 width (an indirect measure of collagen bundle size), and Q6 (ratio of PSFR to P6) with MATLAB code developed for prior tendon research. Data were sorted by PSFR into 4 ascending groups (1.50-1.69, 1.70-1.89, 1.90-2.09, 2.10-2.29), and 1-way ANOVA with post-hoc analyses was used to detect and compare between-group differences. RESULTS: One-way ANOVA revealed statistically significant differences for knee-to-wall (p = 0.043) and BMI (p = 0.038). Post-hoc analyses showed that knee-to-wall was higher at PSFR of 1.50-1.69 when compared to PSFR of 1.90-2.09 (p = 0.032). Decreased BMI was found at PSFR of 1.50-1.69 versus 1.70-1.89 (p = 0.001). CONCLUSIONS: In tendons with decreased PSFR (impaired collagenous organization), increased ipsilateral composite dorsiflexion was found. Lower PSFR has been linked to degraded mechanical properties of tendons. Although Achilles tendon stiffness is not the sole factor affecting ankle ROM, findings from this study depict the relationship between the two variables. Where PSFR was at or below the low end of previously-established healthy ranges (1.8-2.4), lower BMI was found with lower PSFR.

Ultrasoundography has become a popular tool to simultaneously examine muscle size and quality due to their important role in muscle function. These variables demonstrate excellent reliability in the lower extremity but have yet to be assessed in upper extremity. PURPOSE: To determine the test-retest reliability of US-derived cross-sectional area (CSA) and echo intensity (EI) in the infraspinatus, supraspinatus, and flexor carpi ulnaris. METHODS: Twenty two shoulders and forearms were scanned with a brightness mode US one week apart (n=11, age: 19.9 ± 0.94 years, height: 180 ± 6.7cm, mass: 78.37±12.17kg). Shoulder muscles were panoramically assessed at 1/3 the distance from the root of the spine of the scapula and the acromial angle. The flexor carpi ulnaris was assessed 4 cm distal to the medial epicondyle. Images were reduced in ImageJ to assess CSA and EI in each muscle. Relative and absolute consistency were assessed with intraclass correlation coefficients (ICC) and standard error of measurement (SEM), respectively. Minimal detectable change (MDC) scores were determined to identify a difference or change that can be considered real.

RESULTS: Infraspinatus CSA (ICC²=0.960) and EI (ICC²=0.850) demonstrated the highest relative consistency among the three muscles (supraspinatus CSA: ICC²=0.717, EI: ICC²=0.762; flexor carpi ulnaris CSA: ICC²=0.954, EI: ICC²=0.676). Infraspinatus CSA and EI (CSA: SEM=3.28%, MDC=9.09%, EI: SEM=9.40%, MDC=26.05%) also demonstrated the lowest semi and MDC, expressed as a percentage of the mean values (supraspinatus CSA: SEM=15.83%, MDC=43.89%, EI=SEM=12.99%, MDC=36.01%, flexor carpi ulnaris CSA: SEM=13.56%, MDC=37.61%, EI=SEM=9.90%, MDC=27.45%). CONCLUSIONS: Of the upper extremity muscles examined, the infraspinatus muscle had the highest relative consistency, and the lowest absolute consistency and MDC scores for CSA and EI. Furthermore, as the primary stabilizer of the glenohumeral joint, future studies may consider examining infraspinatus CSA and EI to assess upper extremity muscle morphology following an intervention, treatment, and/or condition.

Muscle strain injuries are typically diagnosed based on physical exam and patient history, although muscle strain injuries can be detected by T₂-weighted magnetic resonance imaging (MRI) and Diffusion Tenser Image (DTI). Proton MR spectroscopy (H MRS) enables the study of metabolic changes in vivo, such as fat content stored inside fibers as droplets (intra-myocellular lipids, IMCL) or in adipocytes between myofibers (extra-myocellular lipids, EMLC). Diffusion kurtosis imaging (DKI) is a novel technique that allows in vivo characterization of diffusion of water in muscle. PURPOSE: To determine the effects of injury on IMCL and EMLC in vivo, and if variables calculated from DKI would serve as an earlier and more sensitive marker of damage after muscle strain injury in rats. METHODS: The tibialis anterior muscles (TAs) of anesthetized Sprague-Dawley rats (N=3, 100 ± 5 g) were injured by 50% lengthening contractions. DTI and DKI were acquired over the same region as axial T2 images. A Point-RESolved Spectroscopy pulse sequence was used for MRS data acquisition from TA muscle. LCMModel package (Provencher 2001, Version 6.3) was used for quantification of the MRS data. T2 imaging was compared to functional.

Abstracts were prepared by the authors and printed as submitted.
changes, and BODIPY 495/503 staining of TA cross-sections sections was used to identify lipid deposits. RESULTS: Injury was confirmed by a significant loss of isometric torque (70 +/- 2% confidence) and a significant lactate accumulation (>= 68 mM) with corresponding reductions of EMCL and total creatine (Cr) at 4 hours post injury. The complicated metabolic patterns were expected during muscle regeneration, remodelling, and maturation. BODIPY staining confirmed the changes quantified by the 1H MRS findings. For DTI, mean diffusion (MD) and fractional anisotropy (FA) values varied little and returned to normal by the time of functional recovery (day 21). Mean kurtosis (MK), however, was significantly different at all time points and remained high, even after recovery. CONCLUSIONS: These data suggest that DKI may be a useful indicator of overall muscle health. Furthermore, EMCL and IMCL levels, determined from 1H MRS, can be used as biomarkers of metabolic alterations following muscle injury and subsequent recovery.

1806

Board #67
May 31 3:30 PM - 5:00 PM
Near-Infrared Spectroscopy Derived Total Heme vs. Assay Derived Total Heme
Kaylin D. Didier, Shane M. Hammer, Kelsey J. Phelps, John M. Gonzalez, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.

Objective: The primary aim of this study was to compare frequency-domain multi-distance (FDMD) Near-Infrared Spectroscopy (NIRS) derived total heme concentration (emoglobin + myoglobin) to the total heme concentration measured by an assay after the heme had been extracted from the skin. METHODS: Five swine were transported to the Kansas State University Meats Laboratory for harvest under federal inspection. Carcass measurements were taken on the same day as harvest. Immediately post draining of the carcass the NIRS probe was placed along the belly of the deltoides (DT), triceps brachii lateral head (TLH), tensor fasciae latae (TFL), longissimus dorsi (LD), biceps femoris (BF), and semitendinosus (ST) muscles and a measurement was taken for 1 min. The position of the probe was marked to accurately assess the same region of exposed muscle after processing. After the carcass was processed the muscles were exposed (removal of the skin and adipose tissue layer). The NIRS probe was placed on the exposed muscle and data was collected for 1 min. The muscles were then excised for chemical analysis. RESULTS: The NIRS total heme signal with the skin intact was significantly less than the assay derived total heme (p<0.05). The NIRS total heme signal during the direct muscle condition was not significantly different from the assay derived total heme for BF, DT, TFL, and TL (p>0.05), but was significantly less than the assay derived total heme for the LL muscle group (p<0.012). The NIRS total heme signal directly on the muscle was significantly correlated with the assay derived total heme concentration (r=0.56, p<0.0001). The NIRS total heme signal was significantly less for the intact skin compared to direct muscle conditions for BF, DT, TFL, and TL (p<0.05), but was significantly less than the assay derived total heme concentration for BD, ST, TFL, and TL (p<0.005). CONCLUSIONS: The similar total heme derived between the assay and the FDMD NIRS indicates that the NIRS provides an accurate quantification of the total heme in the muscles, including myoglobin. However, when skin and adipose tissue are intact the signal is attenuated and should be taken into consideration.

1807

Board #68
May 31 3:30 PM - 5:00 PM
Comparison between Dual X-ray Absorptiometry and Magnetic Resonance Imaging for Visceral Fat Assessment in Athletes
Hiroyuki MURATA,1 Tomoyoshi YAGI,1 Taishi MIDORIKAWA,2 Suguru TORII,1 Eri TAKAI,1 Motoko TAGUCHI,1 Waseda University, Tokorozawa, Japan; 2Obirin University, Machida, Japan.

PURPOSE: The primary aim of this study was to compare frequency-domain multi-distance (FDMD) Near-Infrared Spectroscopy (NIRS) derived total heme concentration (emoglobin + myoglobin) to the total heme concentration measured by an assay after the heme had been extracted from the skin. METHODS: Five swine were transported to the Kansas State University Meats Laboratory for harvest under federal inspection. Carcass measurements were taken on the same day as harvest. Immediately post draining of the carcass the NIRS probe was placed along the belly of the deltoides (DT), triceps brachii lateral head (TLH), tensor fasciae latae (TFL), longissimus dorsi (LD), biceps femoris (BF), and semitendinosus (ST) muscles and a measurement was taken for 1 min. The position of the probe was marked to accurately assess the same region of exposed muscle after processing. After the carcass was processed the muscles were exposed (removal of the skin and adipose tissue layer). The NIRS probe was placed on the exposed muscle and data was collected for 1 min. The muscles were then excised for chemical analysis. RESULTS: The NIRS total heme signal with the skin intact was significantly less than the assay derived total heme (p<0.05). The NIRS total heme signal during the direct muscle condition was not significantly different from the assay derived total heme for BF, DT, TFL, and TL (p>0.05), but was significantly less than the assay derived total heme for the LL muscle group (p<0.012). The NIRS total heme signal directly on the muscle was significantly correlated with the assay derived total heme concentration (r=0.56, p<0.0001). The NIRS total heme signal was significantly less for the intact skin compared to direct muscle conditions for BF, DT, TFL, and TL (p<0.05), but was significantly less than the assay derived total heme concentration for BD, ST, TFL, and TL (p<0.005). CONCLUSIONS: The similar total heme derived between the assay and the FDMD NIRS (during direct muscle measurements) indicates that the NIRS provides an accurate quantification of the total heme in the muscles, including myoglobin. However, when skin and adipose tissue are intact the signal is attenuated and should be taken into consideration.

1808

Board #69
May 31 3:30 PM - 5:00 PM
Utilizing Ultrasound Imaging to Evaluate Acute Doppler Flow Adapations of the Medial Elbow
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PURPOSE: The use of musculoskeletal ultrasound imaging (MSKI) has been rapidly gaining use the (chemo)diagnosis and (therapeutic) clinical setting. An emerging feature of MSKI is power Doppler imaging quantification (PDQ) that can be used to quantify circulation in MSK tissue and provide a measure of tissue perfusion and/or inflammation. METHODS: Ten Division I collegiate baseball pitchers (mean age 20.4 ± 1.4 yrs and mean body fat percentage 18.6 ± 3.9%). With no history of significant upper extremity injuries participated. MSKI imaging was obtained with a GE LOGIQe ultrasound unit for each athlete prior to and immediately following (~15 minutes) the pitching performance during his first game of the season. Post-imaging PDQ ratios were calculated to assess the maximum level of tissue perfusion of the UCL in the throwing arm. RESULTS: Differences in maximum UCL PDQ ratios pre and post the first pitching outing of the season were analyzed through paired sample t-tests. There was no significant difference (t(9) = 1.37, p>0.5) between the PDQ ratios before (mean max ratio .082 ± 0.04) and after pitching (mean max ratio: .22 ± 0.29). Assessment of the following control variables: pitch count (F(1, 8) = 0.73, p>0.42) and innings pitched (F(1, 8) = 0.37, p>0.56) indicated no significant effect on the PDQ ratios. CONCLUSIONS: No statistically significant difference in perfusion of the UCL, as expressed by PDQ ratios was found after a single pitching outing. However, a numerical increase in the mean PDQ ratio post pitching was seen. Upon further exploration of the data, it was noted that there was significant variability in ratio changes among the subjects, which may be improved upon by increasing the sample size and number of pitching outings. Further research is needed to evaluate the clinical significance of immediate perfusion changes during throwing.

1809

Board #70
May 31 3:30 PM - 5:00 PM
The Use of Dual Energy X-Ray Absorptiometry For the Identification of Knee Osteoarthritis
Katie R. Hirsch1, Malia NM Blue1, Kara C. Anderson1, Eric T. Trelxler1, Hope C. Davis1, Britteny A. Luc-Harkey2, Brian Pietrosimone, FACSM, Abbie Smith-Ryan, FACSM1, University of North Carolina at Chapel Hill, Chapel Hill, NC; 1Brigham and Women’s Hospital, Boston, MA. (Sponsor: Abbie Smith-Ryan and Brian Pietrosimone, FACSM)

PURPOSE: Knee osteoarthritis (KOA) severity is currently determined by the presence and magnitude of tibiofemoral osteophytes and joint space width (JSW) narrowing upon weight-bearing radiography. Newer dual-energy x-ray absorptiometry (DEXA) models have a specialized knee scan feature that could serve as a low-radiation, cost effective alternative to radiographic diagnosis. METHODS: To evaluate the relationship of DEXA-derived JSW with patient-reported pain and physical function and evaluate the reliability of a semi-automatic knee analysis software for measuring JSW from DEXA-derived images. RESULTS: Eleven Division I collegiate baseball pitchers (mean age 20.4 ± 1.4 yrs and mean body fat percentage 18.6 ± 3.9%). Regression analysis showed the linear relationship between DEXA and MRI-V AT volume (r=0.90). The fit line for the relationship between MRI and DEXA-V AT volume was calculated as follows: DEXA-V AT volume = MRI-V AT volume + 97 (cm³). Blund-Alman analysis showed DEXA-V AT volume overestimation by 94.5±3 cm³ compared with MRI-V AT volume, with no systematic error (p>0.203). Less subcutaneous abdominal fat in athletes than in nonathletes may cause overestimation of DEXA-V AT volume. CONCLUSIONS: DEXA-V AT volume was overestimated compared with MRI-V AT volume, with strong correlations for a wide range of values. A new equation may be needed to assess DXA-V AT in athletes.
PURPOSE: Muscle and fat areas in thigh CT scans are important outcomes in aging and exercise research. NIH Image J and SlicioMatic software programs are often used to quantify these areas but three methodological issues commonly exist between references: the tissue density range used to define muscle and fat varies between studies, areas of intermediate density are omitted, and the handling of areas of matching density (i.e. skin and bone marrow) is unreported. Thus, the purpose of this analysis was to validate methods for using these programs while assessing the effects of these three issues on the results. METHODS: CT scans of the mid-thigh were analyzed for two cohorts based on gender (57F, 65-86 yrs v. 44M, 64-91 yrs) and the effects of resistance exercise training (12 wks, 26M, 62-77 yrs) and detraining (26 wks, subset 16M, 62-75 yrs). The total thigh was segmented into seven regions based on Hounsfield Units range: fat of normal (NDF) and high-density (HD); muscle of low (LDM), normal (NDM), high (HDM), and very high density (VHDM); and bone.

RESULTS (mean, SD, cm²): In the first cohort, male thigh total area was (207 ± 27 v 223 ± 42, P=0.02) and contained less NDF (54 ± 19 v 118 ± 38, P<0.0001) but more muscle of all densities (e.g. NDM 108 ± 19 v 69 ± 14, P=0.0001) than female thigh. These results were from Image J and the effect of skin was not considered. However, the results were strongly correlated (R²=0.99) with those from SlicioMatic even if skin was included as subcutaneous fat. In the second cohort, resistance training (pre v post) increased thigh size (220 ± 32 v 229 ± 30, P<0.0001) and muscle content of all densities (e.g. NDM 107 ± 20 v 111 ± 22, P=0.02) except VHDM. Detraining (trained v detrained) decreased thigh size (230 ± 34 v 222 ± 39, P<0.0007) and content of NDM (112 ± 24 v 106 ± 21, P=0.001) and HDM (2.5 ± 1.8 v 1.8 ± 1.6). These results were from SlicioMatic and were not affected by skin fat and bone marrow.

CONCLUSIONS: Image J and SlicioMatic generate similar results for measurement of muscle and fat of all densities in the thigh. SlicioMatic is the more capable program but Image J is sufficient if areas with density similar to muscle and fat are constant and do not affect the results. Funding: VA R&D Merit RX001203 (RAD) and NIH NIA R01 AG046920 (CAP and MMB).
Balance system requires multiple bodily systems working in tandem. Sample entropy (SE), indicator of attentional involvement in balance, measures time series complexity, high values indicating high complexity. In older adults (OA), balance is documented as deteriorating as aging progresses. As such we hypothesized attentional investment on balance is higher among OA, leading to lower SE. **Purpose:** Investigate 1) effects of group and breathing conditions on attentional involvement (AI) in both balance group effect on respiratory complexity (RC) and AI in balance between OA and YA. **Methods:** Participants were recruited and placed into 2 groups, OA (n=6) and YA (n=6). Participants were asked to stand on force plate for 2 minutes (Accusway, AMTI, Watertown, MA) with feet apart at 15° one foot apart at heels. Balance tests conducted under 3 breathing conditions, neutral breathing (NB), chest breathing (CB), abdominal breathing (AB). Raw data of CoP were filtered by 4th order low-pass Butterworth filter with cutoff-frequency 10Hz in R software (R software, The R Foundation, Austria). SE of CoP was calculated in mediolateral-direction (SEx), anteroposterior-direction (SEy), chest RC (SEx), abdominal RC (SEy) in R. Factorial ANOVA MANOVA used to test the effects of group and breathing conditions (dependent variables) on SEx, SEy, SEp (dependent variables). ANOVA and post-hoc tests used when needed. **Results:** MANOVA showed significant difference in group and breathing condition (Wilks’ lambda = 0.000). Older adults exhibited higher mean (p<0.05) in SE (OA:0.149±0.052; YA:0.158±0.040) and SE (OA:0.271±0.106; YA:0.142±0.062). A significant interaction was observed between groups and breathing conditions (Wilks’ lambda = 0.000). ANOVA showed significant interactions in SEp and SEy (p<0.000). Post-hoc tests showed YA AB (0.013±0.064) was significantly higher than all conditions and OA AB (0.006±0.002) was significantly higher than YA CB (0.010±0.003) with respect to SEp (p<0.05). YA NB (0.011±0.005) and YA CB were significantly higher than OA NB (0.006±0.001), OA AB (0.006±0.001), OA AB, and YA AB with respect to SEy. **Conclusion:** Breathing condition significantly affected attention on balance with significant group effect between RC and AI, OA and YA. YA group exhibited highest combined complexity for both SEp and SEy.

**1814 Board #75 May 31 3:30 PM - 5:00 PM**

**Mobility And Balance Performance Is Associated With Health-related Quality Of Life In Community-dwelling Older Adults**

Lauren Graham1, Allison M. O’Halloran2, Trishia T. Yada2, Jane E. Freund1, Chitra Lakshmi K. Balasubramanian1, Srikanth Vallabhajosula1, *Elon University, Elon, NC, 1University of North Florida, Jacksonville, FL (Sponsor: Stephen Bailey, FACSM) (No relevant relationships reported)

Safe and successful mobility maybe essential to maintain quality of life in independently living community-dwelling older adults. These are high functioning individuals who may encounter precarious situations during their community ambulation increased risk for falling and loss of mobility. Loss of mobility in these individuals may have a dramatic impact on their quality of life. Though there are many ways to measure balance and fall-risk in older adults, the Community Balance and Mobility (CB&M) assessment is shown to alleviate the ceiling effects and suggested to be a preferred assessment for balance and mobility in independently living community-dwelling older adults. It is important from a clinical perspective to determine if performance on such a challenging assessment like CB&M is related to having a higher quality of life. **Purpose:** To assess how quality of life is related to mobility and balance performance in community-dwelling older adults. **Methods:** An ongoing study of 20 older adults (mean age: 74.1±14.64 years; 10 females) who were living independently in the community participated. Health-related quality of life was measured with 36-item Short Form Health Survey (SF-36). SF-36 is a patient-reported survey measuring health status with subscales consisting of physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health. Mobility and balance was measured with CB&M, a performance measure consisting of 13 challenging tasks evaluating mobility and balance performance. Correlation analysis was performed between SF-36 and CB&M scores. **Results:** The physical function subscale (r = 0.572; p = 0.008) and general health subscale (r = 0.520; p = 0.019) showed significant moderate positive correlations with mobility and balance performance, as assessed by the CB&M. **Conclusions:** Community-dwelling older adults with a higher CB&M score attained higher scores on the SF-36 subscales, suggesting that, greater mobility and balance ability is associated with a higher quality of life in independently-living community-dwelling older adults. If dynamic balance can be improved or maintained in older adults, they are more likely to sustain a better health-related quality of life.

**1815 Board #76 May 31 3:30 PM - 5:00 PM**

**Relationship between Cognition and Exercise Capability in Community-dwelling Older Adults**

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Several studies found that both cognition and exercise capability (EC) were risk factors related to older adults’ falls. However, there is limited information about the performance of cognition and EC in old adults. **Purpose:** To investigate the relationship between components of cognition and EC in older adults. **Method:** Sixty-six old adults (aged 65-80 yr, 31 males and 35 females) volunteered performing a battery of four physical test (Hand force, 30-s chair-stand test, Eyes closed standing and The timed “Up & Go”) evaluating EC. Four psychological tasks (Stroop task, N-back task, More Oddshifting task and working memory) were used to assess EF, and 2-Choice Reaction Time (CRT) to processing speed, dual task walking to attention. Person correlation coefficient (r) was used to determine the relationship between cognition and EC. **Result:** Some low-to-moderate correlations were found between cognition and EC, which are summarized in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Stroop task</th>
<th>N-back task</th>
<th>More oddshifting task</th>
<th>Working memory</th>
<th>CRT</th>
<th>Dual task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand force</td>
<td>0.11</td>
<td>0.10</td>
<td>0.09</td>
<td>0.11</td>
<td>-0.16</td>
<td>-0.41</td>
</tr>
<tr>
<td>30-s chair-stand test</td>
<td>0.20</td>
<td>0.22</td>
<td>0.18</td>
<td>0.18</td>
<td>-0.26</td>
<td>0.25</td>
</tr>
<tr>
<td>Eyes closed standing</td>
<td>0.32</td>
<td>0.19</td>
<td>0.29</td>
<td>0.12</td>
<td>-0.15</td>
<td>0.40</td>
</tr>
<tr>
<td>The timed “Up &amp; Go”</td>
<td>-0.27</td>
<td>-0.21</td>
<td>-0.31</td>
<td>-0.25</td>
<td>0.39</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Note: *p<0.05, **p<0.01.
Conclusion: The cognition does have to moderate-to-low relationship with some EC, which means that we may promote one through training another one.

**1816 Board #77 May 31 3:30 PM - 5:00 PM**

**Greater Stance Time Variability is Associated with Lower Step Activity in Older Adults**

Trishia T. Yada1, Lauren E. Graham1, Allison M. O’Halloran1, Jane E. Freund1, Chitra Lakshmi K. Balasubramanian1, Srikanth Vallabhajosula1, *Elon University, Elon, NC, 1University of North Florida, Jacksonville, FL (Sponsor: Stephen Bailey, FACSM) (No relevant relationships reported)

Previous research has shown that older adults with greater gait variability are at a higher risk for falling. Falls increase fear of falling and may subsequently result in mobility disability manifested by decreased physical activity. Physical activity is commonly gauged from continuous step activity monitoring. While decreased step activity has been associated with impaired gait, the associations between gait variability and step activity are not understood. **Purpose:** To examine the relationship between gait variability and step activity in older adults. **Methods:** Spatiotemporal gait parameters were recorded for 19 healthy older adults (mean age 74.5 ± 6.3 years; 9 males/ 10 females) walking at a normal walking speed across a GAITRite walkway for 5 trials. Step activity (0% of steps) was collected using a research-grade step activity monitor for 7 consecutive days. Average number of steps for the 7 days was used. Coefficient of variation (defined as % of SD over mean) of gait speed, stride length, step width, swing time, stance time and double support time were calculated. Pearson’s and Spearman’s correlation coefficients were based on normality to determine the relationship between gait variability and step activity. **Results:** Stance time variability showed significant moderate inverse correlation with step activity (r = -0.482, p = 0.036). Swing time variability showed moderate inverse correlation with step activity with a trend towards significance (r = -0.451, p = 0.052). Variability of gait speed (r = -0.349, p = 0.143), stride length (r =...
Each year, more than 2.5 million geriatric patients are admitted to emergency departments for fall-related injuries. Identifying variables that predict fall risk may help manage this problem. Physical activity and body composition are potential predictors. The average elderly fall risk patient walks ~2,200 steps per day and is commonly advised to minimize physical activity owing to elevated risk of injury. Limiting exposure can be effective in the short term but the chronic anthropometric consequences may exacerbate risk in the future. PURPOSE: To evaluate the effect of body mass index (BMI) on balance in geriatric patients who are at risk of falling. METHODS: We enrolled 24 patients (12 men, 12 women) with a diagnosed vestibular disorder who were ≥65 years of age. Patients were excluded if they had a history of injury precluding participation or currently participated in an exercise program. We collected demographic, anthropometric, and balance data at baseline. Balance was assessed using a CSMI HUMAC System Balance Board. After baseline testing, subjects were randomized to either a fatigue intervention (modified Bruce treadmill protocol) or a mild walking intervention (2 mph, 0% incline, 4 minutes). Following exercise, patients repeated the balance assessment. Linear regression tested the effects of age, sex, body mass index, and group assignment on the change in balance score. RESULTS: The regression model explained 78% of the variance in the change in balance score (p<0.001). Holding all other predictors constant, performing the fatigue protocol associated with a greater loss of balance (3.9 percentage points; p<0.044); for each 1-point increase in BMI, patients experienced an additional loss of 0.7 percentage points. When evaluating obesity as a binary variable, being classified as obese associated with a loss in balance of 5.0 percentage points (p<0.011). CONCLUSIONS: The relationship between fall risk and level of activity is complex. In our sample, obesity associated with a greater deterioration of balance following physical activity. When patients who are at risk of falling are advised to avoid physical activity, that advice may result in chronic compromise of balance, elevating the risk of future falls. Conversely, exercise performed in a safe, controlled environment may have therapeutic potential.
INTRODUCTION: Static and dynamic balance declines with age. A training program including aerobic (AT), resistance (RT) or balance training (BT) may improve dynamic and static balance in older adults. PURPOSE: To determine the influence of a 12-week self-managed exercise program combining AT, RT, and BT on static and dynamic balance measures in unpaired older adults. METHODS: 17 participants attended three educational seminars on AT, RT, and BT prior to beginning exercise, consulting with their physician, and selecting exercises including AT, RT, or BT. Based on activities chosen, participants were organized into three groups: G1 (AT only): n=8, age:73.0±2.8yrs, BMI: 26.1±3.5kg/m²; G2 (AT+RT): n=5, age:68.2±3.1yrs, BMI: 25.5±6.0kg/m²; and G3 (AT+RT+BT): n=4, age:70.0±1.4yrs, BMI: 27.8±6.8kg/m². Exercises were based on National Institute of Aging guidelines. Assessments were conducted prior to the start (PRE) and completion (POST) of the program. An ANOVA was used to analyze dynamic (Timed Up and Go, TUG, Four Square Step Test, 4S) and static (Sway area: 95% confidence ellipse during 30s of standing balance with eyes open, SA) measures of balance between groups. T-tests were used to analyze within-group differences and Cohen’s d was used to analyze effect size within groups. RESULTS: No differences were found between groups in the TUG, 4S, or SA following the program at POST. T-tests showed improved TUG scores (all participants p=0.0019, G1: p=0.0049, G2: p=0.413, G3: p=0.0242) and 4S times (all participants p=0.0365, G1: p=0.0224, G2: p=0.522, G3: p=0.0172) from PRE to POST. Cohen’s d values for the TUG (all participants=0.832, G1=1.971, G2=2.145, G3=1.75) and the 4S (all participants=0.383, G1=5.177, G2=2.037, G3=5.05) suggest a large effect for the TUG for all participants, G1, and G3. A small effect was found for all participants for the 4S and a medium effect was found for G1 and G3. CONCLUSION: The exercise mode did not influence dynamic or static balance between groups of older adults after a 12-week self-managed exercise program. However, measures of dynamic balance improved in the TUG and 4S for all participants as well as some individual groups. Additional investigation is necessary to identify community-based exercises that appropriately challenge and improve static balance in older adults.

Individuals with weak hip musculature may have compensatory hip and knee motion during common strengthening exercises, such as the back squat (BS), that elevate frontal plane joint loading. PURPOSE: The purpose of this study was to compare frontal plane squat mechanics between strong and weak individuals during the BS. METHODS: Twenty-eight individuals (17 males and 11 females, 23.42±3.34 yrs., 1.72±0.09 m, 73.20±11.41 kg) who consistently performed the BS were recruited for this study, and were categorized into strong (n=14, 23.00±0.08yrs, 1.69±0.09m, 71.97±11.80kg) and weak (n=14, 23.86±5.86yrs, 1.76±0.08m, 74.43±11.23kg) groups using a median split of BS 1-repetition-maximum (1RM) normalized to body mass. This study required two visits, with the first being 1RM testing and the second consisting of a 3-dimensional assessment of squatting mechanics. During the second visit, participants performed 2 sets of 3 repetitions of the BS at 70% and 85% 1RM in a random order. The average of the second repetitions of each set was used for analysis. Dependent variables included the peak knee abduction angle and external moment, and peak hip adduction angle and external moment. 2 (group) x 2 (load) mixed model ANOVA was used to compare peak external knee abduction moments and angles, and peak external hip adduction moments and angles at 70% and 85% 1RM. RESULTS: Group x load interactions were not significant for peak knee abduction angles (F(1,26)=0.105, p=0.311) and moments (F(1,26)=0.61, p=0.44), or for peak hip adduction angles (F(1,26)=0.037, p=0.611) and moments (F(1,26)=0.11, p=0.79). There were also no main effects of load or group on any dependent variable. CONCLUSIONS: Results suggest that strong and weak individuals have similar frontal plane hip and knee mechanics during the BS at 70% and 85% 1RM. However, these loads were relatively similar, and loads greater than 85% 1RM are frequently used in exercise programs. Differences may also become evident during repetitions closer to failure. Future research should examine if compensatory frontal plane actions are found with greater resistance. Furthermore, all participants were trained regardless of group, and training status may influence the magnitude of frontal plane hip and knee motion during the BS.

Front squats are a commonly used squat variation as they place less load on the lumbar spine. However, when done incorrectly, front squats may have inefficient posterior-chain activation and reduced trunk stability, thus negating any potential benefits. Various techniques have been proposed to mitigate such consequences but, to date, few have been quantified. PURPOSE: This study examined the effects of an intervention designed to increase posterior chain engagement on kinematics and muscle activity during the front squat. METHODS: 7 physically active adults (4 male, 3 female; ages 25 +/- 4 years) performed front squats under two conditions: baseline and after instruction in a specific front squat technique emphasizing foot alignment and using EMG biofeedback to help engage the glutes. All squats were performed at 70% of a tested 1 rep max. Whole-body kinematics were recorded with a 12-camera motion capture system while ground reaction forces were measured using two force plates. Peak hip extensor moments, pelvic tilt, and forward torso lean were calculated on each repetition. Activity of the erector spinae (ES) and glutaeus maximus (GM) muscles was analyzed by calculating average root mean square (RMS) amplitude across the squat. Differences from pre to post intervention were evaluated using paired t-tests and effect sizes. RESULTS: Peak pelvic tilt, forward trunk lean, and hip extensor moments were all not statistically different after the intervention and all showed small effect sizes (Table 1). While mean ES activity decreased after the intervention the effect size was small (Table 1). In contrast, while mean GM activity was not significantly different post-intervention, there was a moderate effect size (Table 1). CONCLUSION: The intervention technique changed activation of some posterior muscle groups, but not kinematics or kinetics. Whether this was due to the training program itself or participants requiring more training time requires further investigation.

<table>
<thead>
<tr>
<th>Table 1. Means (± standard deviations) for pre and post intervention.</th>
<th>Pre</th>
<th>Post</th>
<th>p</th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak pelvic tilt (°)</td>
<td>30.4±10.5</td>
<td>27.5±14.2</td>
<td>0.541</td>
<td>0.124</td>
</tr>
<tr>
<td>Forward trunk lean (°)</td>
<td>38.9±5.6</td>
<td>37.9±6.9</td>
<td>0.521</td>
<td>0.127</td>
</tr>
<tr>
<td>Peak hip extensor moment (Nm)</td>
<td>98.9±65.9</td>
<td>85.8±83.3</td>
<td>0.313</td>
<td>0.027</td>
</tr>
<tr>
<td>Mean erector spinae RMS (mV)</td>
<td>6.0±3.2</td>
<td>5.7±3.0</td>
<td>0.034</td>
<td>0.148</td>
</tr>
<tr>
<td>Mean gluteus maximus RMS (mV)</td>
<td>1.1±0.7</td>
<td>1.2±0.6</td>
<td>0.496</td>
<td>0.472</td>
</tr>
</tbody>
</table>

The squat is an exercise commonly used to improve lower-extremity (LE) strength and performance. Repeated frontal plane movement in the LE could have detrimental effects by contributing to certain joint pathologies. Therefore, investigating squat...
technique on LE kinetics is warranted. PURPOSE: To investigate load-dependent RME of the knee extensor muscles during the BS and FS.

METHODS: Seven collegiate athletes (4 male, 3 female) participate in this study. Each athlete completed motion analysis and isometric muscle strength testing. During motion analysis testing each athlete performed, in counterbalanced order, both the BS and FS at loads of 40, 60, and 80% of their FS one-repetition maximum (1-RM). Kinematic and kinetic data were captured from markers placed on anatomical landmarks (Plug-in Gait marker set) and from two force plates underneath the athletes’ feet. These data were used to calculate the net joint moments (NJM) during each exercise and at each load. During the isometric strength testing sessions each athlete performed maximal voluntary isometric contractions (MVIC) at 30, 60, and 90 degrees of knee flexion. A moment-angle curve was fitted to the MVIC data and used to calculate the theoretical peak NJM during the squats, which was then compared against the actual NJM during the execution of the BS and FS to calculate the RME. A 2x3 ANOVA ([Exercise: Front, Back] x [Load: 40, 60, 80]) was used to determine the effects of exercise and load on RME.

RESULTS: The interaction (p = 0.025) and load main effect were significant (p = 0.004). Post-hoc testing, however, indicated that only the exercise-pooled RME differed across loads (40% RME: 51.6 ±0.05, 60% RME: 61.3 ±0.06, 80% RME: 69.3 ±0.06). Specifically, the RME differed significantly between 40% and 60% (p = 0.049), 40% and 80% (p = 0.015), and 60% and 80% (p = 0.008).

CONCLUSIONS: RME did not differ between BS and FS at any load, but increased linearly from 40% through to 80% of FS 1-RM. These results suggest that at the same absolute load both exercises impose similar demands upon the knee extensor muscle groups, and that greater loads increase that demand.

The ability to assess, prescribe, and modify exercises based on biomechanical characteristics of the movement is an essential skill that personal trainers, strength and conditioning coaches, physical therapists or other fitness/exercise practitioners must possess. Currently no tool exists that assesses this overall perceptual-cognitive skill.

PURPOSE: To gain item level feedback and begin to evaluate an efficient instrument to accurately and reliably assess strength training technique expertise.

METHODS: Fifteen exercise science students (Mean age: 22.6 ± 2.4 SD; 27% with B.S.) and 15 experienced academics in the strength training field (Mean age: 42.2 ± 10.7; 67% with PhD) completed a 26-item test with various questions eliciting knowledge of strength training technique skill. Additional questions relative to perceived importance, confidence, and education preparations of various skill applications (e.g., modifying exercises, optimizing muscle activation, selecting exercises, and identifying poor technique) were also characterized. Item level metrics such as discrimination and difficulty were calculated. RESULTS: Overall, academics performed better than students with a medium to large effect size (d = 0.78, p = 0.041). Four items displayed poor discrimination (item-total correlation <0.1) and two items were relatively easy (overall percent answered correctly <85%). Qualitative item level feedback was helpful to further modify/refine wording of questions. Almost all individuals (93%) indicated they wanted to learn more about techniques to assess strength training exercises.

CONCLUSIONS: Initial evidence indicates this tool demonstrates sufficient difficulty and discriminability to characterize strength training technique expertise. In addition, individuals perceive this evaluative skill of strength training technical performance as very important for practical application and desire further training/education to improve this skill (even in high level academic individuals). Larger sample - factor analytic, reliability, and predictive/discriminant validity evidence should be gathered to further assess and refine this assessment tool.
1828 Board #89 May 31 3:30 PM - 5:00 PM Dynamic Resistance Training Promotes Better Neuromuscular Benefits And Reduces Oxidative Stress In Healthy Wistar Rats

Michel Souza¹, Rodrigo Neves², Thiago Rosa³, Alexander Oliveira⁴, Gustavo Gomes⁵, Rafael Costa⁶, Bernardo Brixii⁶, Luiz Souza⁶, Rafael Olheri, Lysleine Deus³, Milton Moraes³, ¹Universidade Católica de Brasilia, São Paulo, Brazil. ²Universidade Católica de Brasilia, Brasilia, Brazil.

NO relevant relationships reported

PURPOSE: Resistance training (RT) is used as a non-pharmacological tool in the prevention and treatment of various diseases. However, few studies have evaluated the different neuromuscular adaptations promoted by dynamic (DRT) and isometric (IRT), and their impact on redox status. This study aimed to compare the different adaptations on muscle strength and oxidative stress in healthy Wistar male rats.

METHODS: Fifteen male Wistar rats at 12 weeks of age were randomized into 3 groups: control group (CTL; n = 5), DRT (n = 5) and IRT (n = 5). All animals were adapted for 2 weeks on the vertical ladder. After the animals were submitted to dynamic strength muscle (DSM) test performed every 15 days and maximum isometric resistance (MIR) (pre and post-testing) tests. Both DRT and IRT were performed 5 times a week on non-consecutive days for 12 weeks, with a duration of ~22 min per session, consisting of 1 set of 8 uninterrupted clamps for 1 min, with a 30% overload of DSM. The animals of the IRT group remained in isometry for 1 minute.

The level of significance was set at P<0.05.

RESULTS: The DRT group presented a greater gain of the DSM (390±68 and 868±66 g, pre and post-training, P<0.05) compared to the groups CTL (339±65 and 427±39 g, pre and post-training, P<0.05) and IRT (369±31 and 393±41 g, pre and post-training, P<0.05). The DRT (6:9±3.4 and 24:7±5.3 min, pre and post-training, P<0.05) and IRT (9:6±4.6 and 39:3±9.5 min, pre and post-training, P<0.05) had similar time of contraction. These redox status indicators did not change between CTL; TBARS (15±5 and 17±7 µM, pre and post-training, P>0.05) (TAC). These decreases are similar to the reductions in voluntary activation that we observed previously at submaximal torques following 3 and 6 weeks of high-, but not low-load training. Therefore, we suggest that MMG amplitude is sensitive to training-induced changes in motor unit activation during high- versus low-load training.

CONCLUSIONS: There were no significant interactions for time × torque × group (p = 0.08; η²p = 0.06) or torque × group (p = 0.14; η²p = 0.06), but there were for time × group (p = 0.02; η²p = 0.15) and time × torque (p < 0.001; η²p = 0.12). We further evaluated the time × group interaction by collapsing across torque and using ANCOVA with baseline MMG amplitude as the covariate to examine between group differences at week 3 and 6, and one-way ANOVAs to examine the change in MMG amplitude across time within groups. The adjusted mean for MMG amplitude during the submaximal isometric step muscle actions was lower in the 80% than 30% 1RM group at week 3 (mean ± SE; 67.8 ± 4.5% vs. 83.2 ± 4.7% and p< 0.05). In the 80% group, MMG amplitude decreased from baseline to week 3 (77.7 ± 4.3% to 66.8 ± 4.5%; p< 0.01), and from baseline to week 6 (77.7 ± 4.3% to 65.2 ± 3.8%; p< 0.05), but did not change from week 3 to 6 (p = 0.93). There were no changes in MMG amplitude for the 30% 1RM group (p = 0.69; η²p = 0.03). CONCLUSION: We observed a decrease in MMG amplitude during submaximal isometric contractions performed at the same absolute torques following 3 and 6 weeks of 80% 1RM, but not 30% 1RM resistance training. These decreases are similar to the reductions in voluntary activation that we observed previously at submaximal torques following 3 and 6 weeks of high-, but not low-load training. Therefore, we suggest that MMG amplitude is sensitive to training-induced changes in motor unit activation during high- versus low-load training.

1830 Board #91 May 31 3:30 PM - 5:00 PM Prediction of Ground Reaction Forces of Flexible Barbells using their Bar End Displacement

Meemhed Mallick, Sunyeop Lee, Randolph E. Hutchinson, Anthony Caterisano, FACSM. Furman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)

NO relevant relationships reported

PURPOSE: The Flexible Barbell (FB) has been used in various strength and conditioning programs at levels from high school athletics to professional programs such as the National Football League. Yet, fundamental characteristics of the various models of the barbell are unknown. The purpose of this study was to investigate if flexible bar end displacement could predict peak ground reaction forces (GRFs) to aid in training applications.

METHODS: Six models of flexible barbells at nine different loading conditions were lifted by a machine set atop a force platform with barbell motion recorded by an eight-camera 3-D motion capture system. Typical exercises such as the bench press and squat were simulated lifting the barbell a total displacement of 30.5 cm up and 30.5 cm down per repetition at a range of lifting velocities from 0.15 m/s to 1.55 m/s. Linear regression models were run to predict measured GRFs from FB bar end displacements.

RESULTS: Significant linear regression models predicted peak GRFs for all models of the FB and the post-tested loading conditions based upon maximal bar end displacements (Table 1).

CONCLUSIONS: Although these results will require follow-up confirmation studies with human subjects, coaches in training programs can use bar end displacement to predict peak external loading from lifting the FB. These predictions are useful over a large range of physiologically relevant lifting velocities typically seen in athletic training programs.

Prediction of peak ground reaction force based on bar end displacement linear regression model at ea

<table>
<thead>
<tr>
<th>Bar Type</th>
<th>Loading (kg)</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Light</td>
<td>6.56</td>
<td>0.938</td>
</tr>
<tr>
<td>Gold SS</td>
<td>10</td>
<td>0.922</td>
</tr>
<tr>
<td>Light</td>
<td>15</td>
<td>0.899</td>
</tr>
<tr>
<td>Light Plus</td>
<td>28.6</td>
<td>0.988</td>
</tr>
<tr>
<td>Level 1</td>
<td>28.6</td>
<td>0.915</td>
</tr>
<tr>
<td>Level 2</td>
<td>46.7</td>
<td>0.976</td>
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<tr>
<td>Level 3</td>
<td>28.6</td>
<td>0.944</td>
</tr>
<tr>
<td>Level 4</td>
<td>46.7</td>
<td>0.942</td>
</tr>
</tbody>
</table>

*denotes statistical significance (p<0.005)

1831 Board #92 May 31 3:30 PM - 5:00 PM Comparison of Peak Ground Reaction Forces at Natural Frequencies of a Flexible Barbell

Randolph E. Hutchinson, Sunyeop Lee, Anthony Caterisano, FACSM. Furman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)

NO relevant relationships reported

PURPOSE: The Flexible Barbell (FB) has been used in various strength and conditioning programs at levels from high school athletics to professional programs such as the National Football League. Yet, fundamental characteristics of the various models of the barbell are unknown. The purpose of this study was to compare peak ground reaction force (GRF) response at natural frequencies (NF) of various models of the FB at typical loading conditions.

METHODS: Six models of FBs and a steel Olympic barbell (SB) at nine different loading conditions were lifted by a machine set atop a force platform with barbell motion recorded by an eight-camera 3-D motion capture system. Typical exercises such as the bench press and squat were simulated lifting the barbell a total displacement of 30.5 cm up and 30.5 cm down per repetition at a range of lifting velocities from 0.15 m/s to 1.55 m/s. Two NFs were identified at the lifting velocity in which both the previous and following lifting velocities showed a decrease in bar end displacement. Independent-samples t-tests were used to compare the FB to a similarly loaded and lifted SB at the FB’s NFs. Effect sizes were calculated using Cohen’s d.
RESULTS: All models and loading conditions of the FB had significantly higher peak GFRs than the SB at all Nfs (Table 1).

CONCLUSIONS: Although these results will require follow-up confirmation studies with human subjects, coaches in training programs can use bar end displacement to predict peak external loading from lifting the FB. These predictions are useful among a large range of physiologically relevant lifting velocities typically seen in athletic training programs.

<table>
<thead>
<tr>
<th>FB Type (Loading)</th>
<th>Fundamental Frequency</th>
<th>Lifting Velocity (m/s)</th>
<th>Peak GFR (N)</th>
<th>Peak GFR (N) of Equivalently loaded Steel Bar</th>
<th>Effect Size, d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Light (6.56 kg)</td>
<td>1st</td>
<td>0.62</td>
<td>190±2*</td>
<td>167±2</td>
<td>11.5</td>
</tr>
<tr>
<td>Light (6.56 kg)</td>
<td>2nd</td>
<td>1.01</td>
<td>527±6*</td>
<td>337±5</td>
<td>34.4</td>
</tr>
<tr>
<td>Golf SS (10.0 kg)</td>
<td>1st</td>
<td>0.54</td>
<td>262±2*</td>
<td>191±4</td>
<td>22.5</td>
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<tr>
<td>Golf SS (10.0 kg)</td>
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<td>0.91</td>
<td>418±3*</td>
<td>355±6</td>
<td>13.3</td>
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<td>1754±18*</td>
<td>1006±32</td>
<td>28.8</td>
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*Significance at p<0.05

Comparison of ground reaction forces at first two fundamental frequencies of flexible barbell (FB)

Resistance Exercise (RE), due to its short high intensity nature, primarily uses glycolysis; producing more CO₂ than utilizing O₂. The relationship between Mechanical Work, O₂, CO₂, and acute muscular fatigue during RE is not well understood. PURPOSE: To investigate the relationship between volume of O₂ (VO₂), volume of CO₂ (VCO₂), and total mechanical work (TMW) in response to multiple sets of high intensity (90% 1-RM) 1-Leg Extension (LE) RE completed to failure. METHODS: 25 males, Age=20.3±1.1 yrs, BMI=24.2±2.1, BodyFat% = 13.7±6.1, volunteered: Day 1 included body composition (air-plethysmography) and 1-RM assessment of dominant 1-leg LE; Day 2: (≥96 hours later) subjects’ completed multiple sets of 90%/1-RM LE. Each set was completed to failure; 15-20 seconds later another set to failure was completed. This sequence (set) was a set was composed of < 1 repetition; subjects’ then completed 10 minutes of sitting rest (Post-RE R). Metabolic measures were recorded on a breath-by-breath basis. VO₂ and VCO₂ were calculated as the sum totals, in ml/min, for the total RE time period (all reps & sets) & Post-RE R. TMW was measured with an ultrasound sensor (distance & time of weight stack movement) and custom-built software. Correlations, Linear Regression, and Min-Max Accuracy were used to assess the relationship between TMW, VO₂, and VCO₂. RESULTS: Averages and standard deviations for comparison variables of interest: TMW=13041±12127.9mL/min, VO₂=13210.9±2858.5ml/ min, VCO₂=15407.4±4136.1mL/min, and failure-set=≤1.2. Significant correlations were found between TMW and VO₂ (r=0.28) & TMW and VCO₂ (r=0.31). Regression analysis showed TMW had little explanatory power for VO₂ (p=0.12, AdjR²= 0.04), and VCO₂ (p=0.31, AdjR²= 0.01). Min-Max Accuracy measures, comparing in-sample predictions (TMW data plugged into Linear Regression Models) to observed values, were 84.5% for VO₂, and 79.1% for VCO₂. CONCLUSIONS: Weak Correlations and low AdjR² values suggest very little relationship between TMW and metabolic measures during and following RE. Min-Max Accuracy measures suggest TMW does not predict VO₂ & VCO₂ well. These results are not unexpected as the work of RE is primarily governed by anaerobic processes and O₂ is not the primary energy source for this type of intensity of activity.

Whether participating in Olympic Weightlifting prompts balance adaptations to reduce age-related decrements is unknown. Previous research has examined the relationship between anthropometric factors and balance performance in the general population. It is likely that adults participating in Olympic Weightlifting possess different anthropometric characteristics. Thus, prior to comparing balance abilities of Olympic Weightlifters to other groups, the relationship between various anthropometric factors and balance needs to be established. PURPOSE: To determine if age and sex related balance differences exist in Masters Olympic Weightlifters and to examine the relationship between balance performance and anthropometrics, body composition, and strength. METHODS: 26 men (35-67yrs) and 22 women (35-61yrs) competitors from the Masters Olympic Weightlifting Championship volunteered to undergo 30 balance testing trials on firm (FT) and foam (FO) surfaces with eyes open (EO) and eyes closed (EC) while average medial-lateral center of pressure velocity was recorded. Body weight, height and body mass index were measured while lean mass (LM), and percent body fat were determined using dual energy X-ray absorptiometry. Strength was defined as the meet clean and jerk to body mass ratio. RESULTS: There were no significant (p>0.05) relationships between age and balance performance (r= -0.086 to .265). Except for LM and FT EO and EC performance in the women, there were no significant (p>0.05) relationships between anthropometrics (r: -0.277 to -0.67), body composition (r: -0.28 to 0.271) and failure-set (r: -0.34 to 0.16) and balance performance. No sex differences (p>0.05) were identified. Complex post hoc comparison of a significant surface by vision interaction (p<0.001) demonstrated the EO-EC difference for the FO surface as significantly greater than the FT (p<0.001, d=3.4). CONCLUSIONS: In contrast to the general population, except for LM and FT EO and EC performance for the women, balance performance in Masters Olympic Weightlifters was not related to anthropometrics or body composition. The lack of age-related differences suggests the need for further study comparing this group to age-matched individuals participating in other modes of physical activity.
Squatting to different depths or with different loads changes the demands on the neuromuscular system, thus potentially altering training effects. Previous studies have used EMG to assess joint contributions with various depths or loads. Another method for assessing this is to examine how each joint contributes to the total support moment (M) during the squat. PURPOSE: Examine how hip, knee, and ankle contributions to M vary with increasing squat loads and depths. METHODS: 19 females (age: 25.1 ± 5.8 years; squatting experience: 3.8 ± 2.6 years) participated in this study. Participants performed squats at three different depths (AP, P, and P) and three different load levels (0%, 50%, and 85%) of their 1 rep max. Kinematics were recorded using a 12-camera motion capture system while ground reaction forces were measured with two force plates. Joint moments at the ankle, knee, and hip were summed to calculate M. Differences between depths and loads in peak M and the percent each joint contributed to peak M were evaluated using a 3x3 repeated measures ANOVA. RESULTS: Peak M increased as load increased (0%: 2.2 ± 0.3 Nm/kg, 50%: 3.1 ± 0.2 Nm/kg, 85%: 3.8 ± 0.1 Nm/kg, p<0.001), but not as depth increased (p=0.149). There was a significant depth*load interaction for hip contributions to M (p<0.013), with hip contributions increasing with heavier loads for AP and P depths, but not FP (Figure 1A). There was also a depth*load interaction for knee contributions to M (p=0.046). However, the opposite pattern was displayed. As load increased, knee contributions to M decreased for the AP and P depths, but not FP (Figure 1B). Ankle contributions to M did not change with depth (p=0.483) or load (p=0.581). CONCLUSION: Total demand on lower extremity joints increases with increasing load but not depth in the back squat. At AP and P depths, increasing load involves the hip musculature more and the knee musculature less. At deep depths changing load does not impact how much each joint contributes to M.

Table 1

<table>
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<th>Measurement</th>
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*sig. dif. (bias/fix error) P<0.05; **nonsig. correlation P>0.05

Conclusions: This wireless inertial sensor was effective for quantifying the countermovement and propulsive phases of a CMJ, but was not effective for quantifying landing force. The sensor was not effective for quantifying CMJAT parameters.

Methods: 9 men (age 35±14 yr, height 178±6 cm, mass 84±9 kg) performed 3 vertical countermovement jumps with arms akimbo (CMJ) and with arm thrust (CMJAT) while standing on force plates (BTS 6000D, BTS Bioengineering, Brooklyn, NY) and wearing a wireless inertial sensor (BTS G-Sensor 2, Brooklyn, NY) placed on the lumbar spine. CMJ and CMJAT biomechanical metrics were compared between FP and IS using paired t-tests, with reliability assessed using Pearson correlation coefficients. The following metrics were assessed: flight height, jump height (flight height - difference between standing height and takeoff height), low force (unweighting during initiation of countermovement), countermovement distance dropped, force at low point (end of countermovement), rate of force development, eccentric power, peak propulsive force, peak and takeoff velocity, maximum power, and peak landing force. Results: For CMJ there was good agreement between FP and IS for most parameters (Table 1); all metrics were significantly correlated between the FP and IS, but the IS significantly underestimated flight height, low force and force at low point. For CMJAT there was poor agreement for most jump parameters.

3D motion capture (3D) systems are the gold standard for assessing displacement during movements such as a drop vertical jump (DVJ) and a countermovement jump (CMJ). However, it is not feasible to use 3D in the field during game or practice situations. PURPOSE: To examine validity of vertical jump height measured by inertial measurement units (IMU). METHODS: Eleven male (15.4±0.9yrs, 178.0±6.5cm, 80.5±13.0kgk) high school football players participated. A small IMU placed in an elastic belt was worn around the waist of each subject during 3 CMJ and DVJ trials. Maximum vertical jump height was recorded as the vertical displacement of the pelvis using standard 3D techniques. A 2X2 repeated measures ANOVA (p<0.05) was used to determine differences in vertical displacement between measurement methods and movement type. 95% limits of agreement (LOA) and Bland Altman plots were utilized to determine the level of agreement between IMU and 3D during each task. RESULTS: A significant interaction between measurement and movement was found in vertical displacement (p<0.05). During the CMJ, the displacement measurement was not different (3D: 46.9±5.4cm, IMU: 45.9±4.3cm; p=0.36). However, during the DVJ, the IMU measurement was statistically underestimated (45.0±3.7cm p=0.001) compared to 3D (48.7±5.7cm). Bland Altman plots and 95% confidence intervals were utilized to determine the level of agreement between IMU and 3D during each task. CONCLUSIONS: This wireless inertial sensor is advancing with potential utility for on-field and in-game use. However, the algorithms which calculate vertical jump height may need to be adapted for varying types of complex movements.
Running power is one of the primary measures of running intensity, however, variations in grade and surface limit quantifying intensity solely based on pace. With the advent of wearable running power meters, runners can assess the external work stimulus inclusive of pace, grade, and surface. **Purpose:** To assess reliability, a running power meter was evaluated based on two trials of submaximal running on three different surfaces.

**METHODS:** Eight collegiate cross country runners (male n=4, age=21.25±0.50 yrs, weight=63.45±9.73 kg, height=178.5±10.82 cm; female n=4, age=20.14 yrs, weight=56.45±4.95 kg, height=169.5±7.97 cm) participated in two trials of submaximal running at 85% of lactate threshold (LT) on each of three different surfaces: treadmill, grass, and track. All subjects completed a VO2max and LT running test. For this investigation, sub-maximal running speed/pace was determined from the maximal effort / LT test. During subsequent submaximal running trials, ventilatory and metabolic measures and heart rate (HR) were collected with a portable breath by breath analyzer (COSMED K4B2) and HR monitor (Polar). For the track and grass submaximal running, the runners were paced by a cyclist maintaining a constant speed using a speedometer. Intra-class correlations were run between trials 1 and 2 on all surfaces including treadmill, track, and grass.

**RESULTS:** VO2, HR, and running power were all reliable between trials 1 and 2 on the three different surfaces: treadmill, grass, and track. Peak moments were greater in the DP-R (Left: DP = 0.60 ± 0.11 Nm/kg, DP-R: 0.76 ± 0.13 Nm/kg). Two Force plates (AMTI) were used to isolate the Ground Reaction Forces (GRF) during submaximal running trials. Ventilatory and metabolic measures and heart rate (HR) were collected with a portable breath by breath analyzer (COSMED K4B2) and HR monitor (Polar). For the track and grass submaximal running, the runners were paced by a cyclist maintaining a constant speed using a speedometer. ANOVAs were run between trials on all surfaces including treadmill, track, and grass.

**RESULTS:** The running power for the treadmill surface was significantly lower than both the grass and track (Mean±SE: RPtreadmill = 237±12.7 W*, RPgrass = 244±13.4 W, RPtrack = 242±13.0 W). There were no significant differences between grass and track surfaces (*p<0.05).

**CONCLUSIONS:** This investigation found that running power (Stryd) is less when running on a treadmill compared to running on grass and a track which may indicate a different training stimulus when training on a treadmill versus other surfaces.
Plyometric exercise in water is used by a variety of people. Recently, a water proof system to measure muscle activity has become available but the procedures for analyzing muscle activity during water plyometrics are not established. PURPOSE: The aim of this study was to describe the procedures for collecting and analyzing muscle activity data during plyometrics in the water and on land. METHODS: A single subject (male, 29 yr, 170 cm, 81.8 kg) completed all conditions. The subject completed two plyometric exercises (countermovement jump (CMJ), drop jump (DJ)) during the two environmental conditions (on land, water). Electromyography (EMG) signals were recorded using a water proof EMG system (Cometina Miniwave Infinity, 2000 Hz). Each sensor measured EMG as well as accelerations along 3 orthogonal axes. EMG was recorded from four muscles (rectus femoris (RF), biceps femoris (BF), gastrocnemius (GA) and tibialis anterior (TA)) during CMJ and DJ while on land and in water. The subject then performed three trials of CMJ then three trials of DJ (from 30.5 cm platform) on land. The subject stood still for at least 1 sec between each trial. After completion on land the subject performed the same conditions in the same order in the water. Depth of water was set to about navel high. EMG data were processed by removing zero offset and full wave rectifying with percent difference (%diff) calculated between on land and in water for each movement. The start and end of each movement was identified using acceleration in the z direction (a). Start of movement was first a 5% greater than baseline. Corresponding with burst of EMG and end of movement (standing still after landing from jump) was a 5% less than baseline after landing. EMG data were then averaged between start and end times. %Diff data were averaged across trials. RESULTS: The CMJ movement duration was similar on land (2.1±0.08 s) and in water (2.4±0.20 s) but different during DJ on land (1.9±0.13 s) vs. in water (3.0±0.86 s). During CMJ, %diff for RF (-0.6%) and TA (6.5%) was similar but BF (10.9%) and GA (70.9%) were more active during water. During DJ, BF (55.9%), GA (70.9%), and TA (34.4%) were more active but RF (-9.5%) less active during water vs. on land. CONCLUSION: Using sensors that incorporated EMG and accelerometers allowed for analysis of muscle activity during plyometrics.

Despite an increasing emphasis on underwater dolphin kicking in competitive swimming, little objective evidence exists to explain its preference over flutter kicking. PURPOSE: To examine kinematic characteristics of flutter and dolphin kicking performed in prone and supine body position. METHODS: The subjects performed 10 trials each of underwater dolphin and flutter swimming (1.77±0.07 m, 72.4±7.6 kg, 19.8±1.0 yrs) experienced with dolphin and flutter kicking in the water. Dolphin kicking included a horizontal entry and exit through the stroke path, with 45° knee flexion. Dolphin kicking was performed according to the American Swimmers’ Association ( onward). The dolphin kicking height was targeted at 1.0 m. Each participant performed 10 trials of dolphin kicking and flutter kicking. RESULTS: Dolphin kicking velocity (1.22±0.18 m/s) was faster (p<0.001, η²=0.88) than flutter kicking velocity (0.99±0.12 m/s). Dolphin kicking amplitude (0.58±0.10 m) was larger (p<0.001, η²=0.93) than flutter kicking amplitude (0.48±0.06 m). Dolphin kicking frequency (1.85±0.34 Hz) was lower (p=0.002, η²=0.68) than flutter kicking frequency (2.33±0.33 Hz). Dolphin kicking (0.88±0.12) was more efficient as indicated by a lower Strouhal number (p<0.001, η²=0.71) than flutter kicking (1.11±0.21). Body position had no effect on any measure of kicking performance (p>0.05). CONCLUSION: For these participants, dolphin kicking was a faster, more efficient means of underwater kicking. However, body position had little effect on the ability of these participants to perform the respective kicking style.

Lower-extremity stiffness is suggested to contribute to lower-extremity injury risk. Specifically, lower-extremity stiffness is believed to lead to excessive joint motion and contribute to soft tissue injuries. Alternately, higher stiffness is thought to enhance overall joint stability, reduce ligament loading, and potentially increase bone loading. Though beneficial in the short-term, long-term bone loading (and the reduced ability to attenuate lower extremity forces may also increase injury risk. Thus, it may be important to elucidate the relationship between stiffness and bone mineral density (BMD). PURPOSE: To identify differences in BMD between athletes with relatively higher and lower levels of vertical stiffness (Kv). METHODS: BMD of the whole body (BMDwb), dominant limb (BMDdl), and second and fifth metatarsals (BMDmet2 and BMDmet5, respectively) of the dominant leg, was assessed in 41 male American football players (age: 16.1±1.4 yrs, height: 176.5±6.8 cm, mass: 80.6±18.3 kg) via dual-energy x-ray absorptiometry. Additionally, vertical stiffness (Kv) of the dominant leg was assessed via a repetitive single-leg vertical hopping task at a set hopping frequency of 2.2 Hz. Participants were divided into tertiles based on their body mass normalized Kv values. Differences in BMD-related variables between the low- and high-stiffness groups were evaluated using independent t-tests. RESULTS: Athletes in the high-stiffness group displayed significantly greater Kvs compared to the low-stiffness group (0.28±0.01 vs. 0.20±0.02 km/m², p<0.001); however, there were no between-group differences identified in terms of age, height, or mass (p>0.05). Athletes in the high-stiffness group were found to possess significantly greater BMDwb compared to the low-stiffness group (0.44±0.11 vs. 0.34±0.11 g/cm², p=0.029). Similar between-group differences in BMDmet2, BMDmet5, and BMDmet5, were not observed (p>0.05). CONCLUSIONS: Athletes with relatively high Kv also had greater BMDstart indicating that relatively higher stiffness may impose stress on the bone that results in favorable adaptation (increased BMD). Continued work investigating the relationship between Kv and BMD, and training load may elucidate the risk of bony injury in these athletes is warranted.
RESULTS

Three-dimensional (3D) motion analysis has been regarded as the gold standard for measuring landing mechanics. However, motion analysis is limited in clinical settings due to the time and expertise requirements. The amount of knee flexion during a single leg landing task is commonly assessed and has been found to be related to a number of injuries. However, to date there have been few studies investigating the relationship between a simple two dimensional (2D) measure to 3D measurements. Establishing this relationship would be important to provide better tools for clinicians to use.

Purpose: To determine if there is a relationship between 2 and 3 dimensional knee flexion angle during a single leg hurdle task.

Methods: 2D Healthy Subjects (11 M, Age 22.4 ± 3.14, BMI 22.96 ± 3.06). Subjects performed instrumented single leg jumps over a series of 30.5 cm hurdles. The landing over the final hurdle was recorded with both a video camera and motion capture equipment. 2D knee flexion angles were measured using National Institute of Health image J program at the point of initial contact and peak knee flexion. An angle was determined by bisecting the knee along the mid shaft of the femur and tibia for the 2D motion. Peak knee flexion was determined in both the 2D video and 3D motion capture data with the association between the two assessed with a Pearson product moment correlation coefficient.

Results: Mean values for knee flexion in 3D were 24.8 ± 9.0° at initial contact and 59.8 ± 9.2° at peak knee flexion. Mean values for the 2D data were 28.0 ± 11.6° at initial contact and 46.0 ± 8.9° at peak knee flexion. There was a significant correlation at initial contact (r = 0.717, p = 0.01) as well as for peak knee flexion angle (r = 0.617, p = 0.06) between the 2D method and 3D motion capture.

Conclusion: At both initial contact and peak knee flexion, there was a strong relationship between the 2D and 3D angle values. Both measurements trended similarly but were different in magnitude. This suggests a simple 2D technique may be applicable in the clinical setting providing similar precision but different accuracy to the 3D motion capture data.

Measure of reactive strength attempt to model the neuromuscular regulation of muscle tissue stress and strain. The specificity of neuromuscular training is important for maximizing the effectiveness of neuromuscular regulation of stress and strain within muscle and tendon tissue. Additionally, failure to regulate stress and strain within the muscle may lead to stresses placed on supporting structures of the body, including ligaments and bones. It is important to understand how sport participation effects neuromuscular reactivity and to develop strategies that maximize neuromuscular reactivity through specific training.

Purpose: The purpose of this study was to evaluate the effects and interactions of sport participation on the Coefficient of Reactivity (CoR), Reactive Strength Index (RSI), and Reactive Strength Kinetic (RSK).

Methods: Fifty-nine young adults from the general community and 21 NCAA Division I basketball players performed five repetitive countermovement jumps (RCM) and a single depth jump from heights of 0.51 m, 0.66 m, and 0.81 m. The CoR, RSI, and the RSK were computed using tri-axial force platform data and two-dimensional videography. A Multivariate General Linear Model Analysis of Variance (GLM ANOVA) was performed on RCM data and another on depth jump data. Condition, sport participation, sex, and age were included as factors in each model.

Results: The CoR, RSI, and RSK were 30%, 23%, and 28% greater in males performing deep jumps versus females (p < 0.05). The RSI and RSK were 23%, and 21% greater in males performing RCM jumping versus females (p < 0.05). Main effects for sport participation were observed for the CoR, RSI, and RSK in depth jumping and for the RSI (p < 0.05) but not for the CoR.

Conclusion: All three measures of reactive strength were sensitive to sex. Sex by sport interactions on the RSI and RSK suggest that involvement in NCAA Division I basketball may lead to a divergence in lower extremity neuromuscular reactivity between male and female athletes (male/female). This result makes sense from the perspective that female athletes tend to sustain higher incidence of lower extremity injuries when participating in sport.
The Landing Error Scoring System (LESS) and Single Leg Squat (SLS) are two clinical assessments that can be used to identify faulty lower extremity biomechanics for screening injury risk in athletic populations. To date, few studies have examined the effect of prior injury on these tests or the relationship between LESS and SLS scores. PURPOSE: Determine if prior history of lower extremity injury affected LESS and SLS scores and examine the association between LESS and SLS performance.

METHODS: Thirty-eight collegiate female athletes (n=26 field hockey, n=12 basketball; 19.4 ±1.4y; 167.5 ± 9.4cm; 67.2 ±11.3kg) underwent LESS and SLS testing. Participants completed 3 jump landing tasks followed by 3 consecutive SLSs on each leg. A Microsoft Kinect sensor using Athletic Movement Assessment software (PhysiMax®) was used to automatically score the LESS and SLS. The LESS consisted of 22 items while the SLS was comprised of 14 items; both were adjusted to omit the overall impression item. The highest scores possible for the LESS and SLS were 22 and 10, respectively. The lowest score of the 2 SLSs for the SLS was used for analyses. An injury history survey was completed to identify prior history of inverting independent tests were used to compare mean LESS and SLS scores between participants with and without a history of injury. A Pearson correlation coefficient was used to examine the association between LESS and SLS total scores while chi-square statistics were used evaluate relationships between scores for medial knee displacement (MKD R/L side errors) across tests. RESULTS: No differences were found between participants with and without a history of injury in LESS (5.3±1.9 vs. 6.0±1.7; p=0.375) or SLS (4.6±0.9 vs. 4.3±1.3; p=0.403) total scores. No correlation was found between LESS and SLS total scores (r=0.127; p=0.453). Although not statistically significant, players displaying an error for MKD during a right-legged SLS were 3 times more likely to also display this error (right MKD) on the LESS (p<0.01; OR=3.3, 95%CI=1.2-8.9). COCLUSION: Prior injury history did not affect LESS or SLS scores. More research is necessary to determine potential associations between scores on similar items across tests and their clinical implications for injury risk screening and corrective exercise programming.

**RESULTS**:

Linear regressions detected the strongest association in the RSK v. RSI (R²=0.599, p<0.001) and RSKa v. RSI (R²=0.635, p<0.001) comparisons. Additionally, a linear regression detected that drop height had a measured impact velocity revealed marginal statistical association (R²=0.346, p<0.01).

**CONCLUSION**:

The proportion of explained variance in the comparisons of RSK vs. RSKa and RSI vs. RSKa suggest that the RSI, RSK, and RSKa all attempt to model the construct of reactive strength. The CoR, RSI, and RSKa all assume that drop height in depth jumping stimuli is a significant independent variable in the RCM jump test. The current study did not measure drop height accurately due to the use of variable drop heights. However, results suggest that using theoretical assumptions to compute reactive strength scores is invalid. The RSKa is kinetic-based and kinematic-adjusted to eliminate theoretical assumptions known to introduce measurement error in the RSI, CoR, and RSKa.

Increased participation in high school girls’ lacrosse has coincided with higher rates of game related head and facial injury. In response, rules allowing for the use of headgear following American Society for Testing and Materials (ASTM) performance standards has been adopted. However, due to the novelty of this equipment it remains unknown how lacrosse headgear responds to all impacts after testing. PURPOSE: To compare the resultant peak linear acceleration (RPLA) between used and pristine girls’ lacrosse headgear during blunt impacts. METHODS: 10 pristine and 10 used Cascade LX Women’s Lacrosse Headgear were tested. Pristine headgear were tested in their original condition and were not worn or exposed to external elements or impacts prior to testing. Used headgear were worn for an entire competitive season (15 games, 51 practices). A Cadex Monorail Impactor impacted all headgear fitted to a EN 960 size J headform according to ASTM standards (F1446-15b, F2220-15, and F3137-15) in the front, side, rear and front boss, crown and one random location. The resultant tri-axial acceleration of the EN 960 J headform was measured with Cadex Software. A factorial ANOVA was employed to compare RPLA among headgear conditions (pristine and used) and impact locations. RESULT: A significant main effect for position was observed (p<0.001). With the exception of random location with side location, all pairwise comparisons denoted statistically significant differences among them for RPLA (front = 50.6 ± 3.5, side = 37.1 ± 1.8, rear = 23.4 ± 2.1, rear boss = 56.5 ± 4.3, front boss = 63.1 ± 4.9, crown = 58.7 ± 3.5, random = 38.5 ± 5.2 RPLA). There was no significant difference between headgear conditions for RPLA. CONCLUSIONS: All headgear regardless of condition, met the ASTM performance standard. No differences existed in RPLA between pristine and used headgear. No differences existed among the pristine and used headgear. This indicates that the headgear is capable of being used beyond a single season. Our findings are comparable to those that investigate the RPLA of verified head impacts to high school girls’ lacrosse games. Further field research is necessary to evaluate if headgear improves the safety of girls’ lacrosse, including changes in behavior subsequent to the additional safety standard.

**CONCLUSIONS**

Compressive clothing is commonly worn by athletes and anecdotally believed to elicit beneficial responses both physiologically and biomechanically during a performance. PURPOSE To determine if compression socks influence muscle activity of the lower extremities while running. A secondary purpose was to assess whether compression socks had an effect on heart rate (HR) and rating of perceived exertion (RPE) during running. METHODS Recreational runners (n=5; 1.65 ± 0.07m; 67.48 ± 8.9kg; 21.8 ± 3.25yr) completed three running conditions: wearing graduated compression socks (CS), regular socks (RS), and placebo socks (PS). Each run was 10 minutes at a self-selected pace with speed controlled between conditions. CS were knee-high socks that had graduated compression moving proximally up the lower leg. Sock size used was based on shoe size as per manufacture instructions. RS were determined by the type of sock each subject was wearing on the day of testing. PS were regular soccer socks in which we fitted all subjects with LXL to minimize any compression and instructed each subject they were a different brand of compression socks. Subjects were blind to conditions. HR was recorded during the last 30s of all trials telemetrically (Polar, Lake Success, NY). Muscle activity of the lower extremity was measured through electromyography (EMG) (Delsys, Natick, MA). RPE was recorded at 3 minute intervals. EMG data was processed by removing any zero offset, rectifying, and averaging over 30 seconds of minutes 4, 7, and 10 of each trial. Dependent variables (EMG, HR, RPE) were each compared between conditions using repeated measure
The straight leg raise test and its variations are ubiquitous in clinical sports medicine practice to assess hamstring flexibility. According to a placebo-controlled study, testing techniques such as the straight leg raise test may not provide an accurate measurement of hamstring flexibility due to the many confounding variables including lumbar spine motion, lumbar spine positioning and femoro-acetabular motion. PURPOSE. The current study contrasted the difference in the measurement of supine, passive straight leg raise with and without a blocked lumbar spine; block in strict extension to replicate a neutral lumbar spine and normal contra-directional pelvic/lumbar motion and a non constrained lumbar spine during a passive straight leg raise via goniometric measurements of hamstring flexibility. METHODS. Utilizing 25 collegiate male and female cross country runners, goniometric measurements of the passive straight leg raise with and without a blocked lumbar spine were taken on both the left and right leg. RESULTS. A correlation between the average straight leg raise with and without at blocked lumbar spine was found to have a moderate to high correlation (r= 0.693, p value < 0.001). A dependent t-test revealed that there was a significant difference between straight leg raise measurements with and without a blocked lumbar spine; M (SLR) =66.3, M (Blocked SLR) = 39.54, SD= 9.44, t (24) =-14.71, p<0.001. CONCLUSION. Maintaining neutral lumbar spine position, replicating normal contra-directional pelvic/lumbar motion during a passive straight leg raise significantly decreased goniometric measurements of hamstring flexibility. The results of this study indicate that consideration must be given to lumbar spine position and normal, functional, contra-directional lumbo-pelvic rhythm during the measurement of hamstring flexibility. Changes in testing procedures need to be made in the clinical setting to ensure that athletes are being correctly identified as demonstrating normal hamstring flexibility before being cleared to return to activity after hamstring injury.

High-intensity interval training (HIIT) is an exercise mode designed to repeatedly stress the body with intense stimulus. Intense running can increase impact forces and alter muscle activation intensity. As skeletal muscles have an important role in shock attenuation, the depletion of muscle phosphorylcreatine (PCr) stores and the diminished energy sources could lead to exhaustion and impairments in the protective functions of muscle during running. We hypothesize creatine supplementation could avoid peripheral fatigue during intense exercise and reduce impairments on shock attenuation. PURPOSE: This study investigated the effects of creatine supplementation on biomechanical parameters related to shock attenuation during a session of HIIT. METHODS: A single-blind, placebo-controlled, crossover design was tested to assign 8 elite soccer players (males; 16.3±0.5 years; 70.7±4.16 kg; 1.78±0.06 m) during HIIT sessions under two conditions: after placebo supplementation (PL) and after creatine supplementation (CR). HIIT test sessions consisted of an intermittent test (5 bouts of running) with constant load applied until exhaustion was reached. The vertical component of Ground Reaction Force (VGRF) and Electromyography (EMG) data were recorded by Gaitway and Lynx-EMG Systems, respectively. Heart rate (HR), Rated Perceived Exertion (RPE) and lactate concentration were also obtained. RESULTS: Creatine supplementation did not affect HR, RPE and lactate concentration. Decreased values (p=0.05) of magnitude of first peak (FY1) of VGRF and impulse of first 50 ms (imp50) were observed for CR (about 16.2–24.2% and 34.3% of decrease, respectively), whereas higher values (p=0.05) of time to reach first peak (FY1) were detected for CR as compared to PL (28.9% of increase). Significant modifications (p=0.05) in muscle activation were also observed. Changes occurred in intermediary bouts, mainly in bout 2. CONCLUSION: Creatine supplementation has potential to influence biomechanical parameters related to impact control during a single session of HIIT based on running. Results indicate possible improvements in shock attenuation under creatine supplementation.

The snatch is a high-speed lift that is performed by many weightlifters ranging from recreational to Olympic athletes across a wide spectrum of ages. Despite the regular use of the snatch by athletes, limited research exists on the components of the movement that produce the greatest success. Research on competitive weightlifters is even more limited, particularly those individuals competing at the Masters level. PURPOSE: To determine the extent to which several second pull components relate to snatch performance, and the relationship between age, sex, and success in a high-level Masters competition. METHODS: 42 competitors, 23 women (35 to 64yrs) and 19 men (36 to 76yrs), from the 2017 National Masters Championship completed four snatch lifts (official meet recorded 1RM). Simultaneously, three-dimensional barbell kinematics were collected and used to compute several characteristics describing the second pull, including peak (relative to body weight) and time (relative to full snatch time) to peak vertical force and power, and second pull time. Additionally, the barbell distance to displacement trajectory ratio across the entire snatch was computed as an indicator of mechanical efficiency. Backward multiple regression analysis was conducted to determine the factors that could predict each lifter’s championship meet performance, defined as their final snatch to body mass ratio. RESULTS: The final set of variables which were significant predictors were; peak power (R=0.47, p<0.05) and time to peak vertical force (R=0.49, p<0.05), peak vertical second pull force (R=0.23, p=0.05), sex (R=0.42, p<0.05), and age (R=0.41, p<0.05). CONCLUSION: When comparing sex and age, men and younger competitors lifted more weight relative to their body mass while performing the snatch. Even when shorter second pull times were accounted for in the model, peak vertical force remained the most potent predictor for meet performance. Therefore, for optimal competitive success, Masters weightlifters should consider training that maximizes their capacity to exert high-speed force against the bar in the second pull. Such training might focus on vertical explosion utilizing shrug and triple-extension techniques while minimizing curvature in their second pull trajectory.
Saccadic eye movements are produced from several frontal and parietal cortical regions of the brain that also aid in the execution of cognitive functions. However, no known research has examined the relationship between a sport-like antiscissarc task and standard neurocognitive exams. Purpose: To evaluate the relationship between the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) cognitive domains and a sport-like antiscissarc task (SLT) of Division I athletes on symptom free-day of post-sport like concussion. Methods: 10 concussed individuals (8 males; 2 females; age: 20 ± 2 years) were assessed on the ImPACT test and the SLT on a symptom free day post-sport related concussion. A monoocular eye tracker (240Hz, Argus Science) synchronized with the Vicon Motion Capture System (Vicon Motion Ltd., Version 1.85, Oxford, England) was employed to track raw ocular coordinates and further analyzed to obtain resultant distance (RD), mean horizontal velocity (MHV), and prosaccade errors (PE) during the athlete’s participation in the SLT. ImPACT variables included verbal and visual memory composite, visual motor speed, reaction time composite (RT), and impulse control. All eye variables were run through a custom MATLAB code (MATLAB 2017, Mathworks, Inc., Natick, MA). Spearman rho correlations were used to assess the relationship between ImPACT variables and ocular metrics. Results: Significant negative moderate relationships (∼=−0.70, p = 0.02) between MHV (5.78 ± 1.28 pixels/second) and reaction time composite score (0.57 ± 0.07) were observed. Similarly, there was a significant negative moderate relationship (∼=−0.65, p = 0.03) between RD (2.73 ± 0.03 pixels) and Impulse control composite score (6.4 ± 3.7). No other significant relationships were noted. Conclusion: These significant relationships suggest that as eye velocities increase, RT decreases which is possibly due to a decrease in accuracy on overall cognitive efficiency. As impulse control decreases, the eye movement resultant distances are minimal. This may be due to more cognitive errors that lead to an inability to properly control antiscissarc eye movements. Due to the relationships exhibited between the ImPACT and SLT, it can be suggested that antiscissarc eye movements contain a neurocognitive component.

INTRODUCTION Recent studies reported reduced muscle activity in competitive alpine skiers using directional compressive force. It is not known whether the effects of DC are limited to competitive skiers, or if similar changes would be observed in recreational skiers. The purpose of this study was to examine changes in hip and leg muscle EMG patterns in recreational alpine skiers when skiing with and without a lower body DC garment. METHODS 11 intermediate and expert skiers volunteered for this study. Subjects skied 2 days, 2 weeks apart, with DC and non-compressive (TNC) base layer in a randomized order. EMG (Medelec Synergy, Coventry, United Kingdom) rectus femoris (RF), and adductor longus (ADL) were recorded using surface EMG during measurement runs. Two measurement runs with standardized turns were taken on each visit. Subjects free skied for 1.75 hrs between measurement runs. This sequence of ski runs was replicated on the second testing day. Standardized turns were normalized to 100% turn duration and averaged together for each trial in each condition. A 2x2 ANOVA with repeated measures was used to compare turn time, edge angle, RMS, and MF within trials. Paired t-tests were used to compare percent change (%) RMS, MF and self-paced skiing between trials. RESULTS Subjects skied more runs (8.0 ± 1.5 vs. 5.6 ± 1.8; p<0.05) and vertical (196 ± 489 m vs. 1382 ± 304 m; p<0.05) during free skiing with DC than TNC. No differences were observed between trials for turn duration or edge angle. Although no statistical differences in %Δ RMS or MF were found, there was a trend towards smaller magnitude %Δ MF with DC (Table 1).

CONCLUSIONS Although there were no differences in muscle activity between trials in either condition, subjects improved their self-paced skiing performance in the DC condition. There was also a trend towards smaller %Δ MF in the DC condition. Further research should investigate the biomechanical influence of DC on skiing performance.
rectus abdominis, erector spinae longissimus, and biceps brachii long head using a wireless EMG system (Trigno, Delsys, USA). Breath-by-breath pulmonary gas exchange data were measured continuously throughout (Vytus, Carefusion, USA).

RESULTS: There were no differences between the two ergometers in energy cost or neuromuscular activation (peak EMG amplitude) of 5 muscles. However, mean handle force and impulse during the drive phase were greater on the Skillrow than Concept II (P<0.002), also with a tendency for higher peak force (P=0.087). Skillrow involved a lower peak handle velocity (0.006) and longer drive phase (P=0.003) than Concept II.

CONCLUSIONS: The two ergometers were similar in terms of energy cost and neuromuscular activation. In term of biomechanical parameters rowing with the Skillrow required a higher average force and impulse, a lower peak velocity and a longer drive phase.

1862 Board #123 May 31 3:30 PM - 5:00 PM Differences in Ground Reaction Forces When Collegiate Quarterbacks Throw Using Different Drop Patterns
Cailyn Schroeder, Samantha Bessert, John Seifert, James Becker. Montana State University, Bozeman, MT. (No relevant relationships reported)

While there is limited research examining the kinematics of the quarterback passing throw, to date there have not been any studies reporting on ground reaction forces (GRF) during this type of throwing motion. Additionally, there have been no studies reporting how foot positions or drop patterns used by quarterbacks might change GRF parameters. This information would useful to both coaches and sports medicine professionals as it provides both performance and injury related insights. PURPOSE: Compare GRF parameters between three commonly used quarterback drop patterns: a one step (1S), a three step (3S), and a three plus one step (3P1) when performed with the rearfoot angled 90° relative to the throwing direction and 45° relative to the throwing direction. METHODS: Three NCAA Division I quarterbacks participated in this study. Participants performed three throws using each type of drop and each foot position. Two force plates were used to record GRF data at 1000 Hz. Trials were considered valid if both the front (FF) and rear (RF) feet landed on their respective force plates, with the RF foot in the appropriate orientation. For both the RF and FF, peak horizontal and vertical forces, and horizontal and vertical impulses were calculated. Differences between foot positions and drop patterns were evaluated using a 2x3 repeated measures ANOVA. RESULTS: There were no differences in any force metrics for the FF. For the RF, peak horizontal GRFs showed a main effect of drop (F<sub>2,43</sub>=43.9, p=.002), with peak forces being lower in the 3P1 (210.7 ± 13.5 N) than the 3S (476.7 ± 50.5 N) or 1S (387.8 ± 2.6 N) conditions. Peak vertical forces in the RF also showed a main effect of drop (F<sub>2,43</sub>=20.3, p=.008), with peak forces being lower in the 3P1 (1201.7 ± 39.8 N) than the 3S (1539.9 ± 105.8 N). Lastly, there was a main effect of drop for RF horizontal impulse (F<sub>2,43</sub>=5.57, p=.001), with impulses being lower in the 3P1 (58.2 ± 9.12 Ns) than the 3S (150.7 ± 4.5 Ns) or 1S (150.8 ± 5.1 Ns) conditions. CONCLUSION: A 3P1 drop pattern makes use of horizontal momentum, thus requiring the athlete to generate less force and smaller impulses with the RF during the throw. As such, coaches should emphasize pushing with the RF when using a 1S or 3S drop pattern. Changing foot positions does not appear to influence force parameters.

1863 Board #124 May 31 3:30 PM - 5:00 PM Hip Joint Torques During the Golf Swing of Young and Senior Healthy Females
Judy Foxworth, Chris Wendt, Audrey L. Millar, FACSM. Winston-Salem State University, Winston-Salem, NC. (Sponsor: Audrey Lynn Millar, FACSM) (No relevant relationships reported)

Hip joint torques during the golf swing of young and senior healthy females. Female participation in golf has increased throughout the past few decades and now comprises approximately 20% of all golf participants. However, little is known regarding the biomechanics of the golf swing for women, and even less is known about hip torques. PURPOSE: To describe and compare the hip torques associated with the golf swing of healthy young and senior female golfers. METHODS: 21 right-handed, female golfers, aged from 18-70 years old volunteered. Age groups were divided into young (18 – 39) and senior (40 – 70). Subjects completed 10 swings with a standardized drive. A high speed motion capture system and force plates were used to collect kinematic and kinetic data. 3-D hip torques for trail and lead legs were calculated using inverse dynamic analyses. 2-way mixed model ANOVAs (group by leg) were calculated, with club head velocity as a covariate. RESULTS: There were no differences between the groups for BMI (24.6 ± 3.5), handicap (22 ± 7), or club head velocity (30.1 ± 4.2 m/s). The trail hip extension torque was the largest torque produced by both groups. A main effect for leg was found for hip internal rotator torque (p<0.024) with the largest torques produced by the trail leg. There was an interaction between the legs by groups for hip abductor torque (p=0.43); the young group had larger torques for the lead leg, while the senior group had no difference between legs. Club head velocity was significantly (p<0.05) correlated with hip internal rotator torques of both the lead and trail leg (~r=7 and 56, respectively), however, when separated by group, these correlations were only significant for the young group (~r=8, p<.001).

1864 Board #125 May 31 3:30 PM - 5:00 PM Effects of Metronome Training on Timing of the Golf Putt and Neural Connectivity in Professional Golf Players
Jin Hyun Kim¹, Jong Kyue Han², Doug Hyun Han¹. "Kent state University, Kent, OH. 'Chung ang Univ, Seoul, Korea, Republic of. 'Chung ang Univ, seoul, Korea, Republic of. (Sponsor: J. Derek Kingsley FACSM, FACSM) (No relevant relationships reported)

During putting in golf, the direction of movement and force of the club head should be conserved among each swing. In order to maintain consistency in swing timing, the cerebellum provides temporal information, motor timing, control of rhythm, and timing of movements. We utilized a brain training neurotechnology that combines the concept of a musical metronome with a computer-based program that facilitates the improvement of an individual's rhythm and timing. PURPOSE: To determine if metronome training(MT) activates neural networks involved in the putt swing and decreases variation in the swing speed. METHODS: Twenty professional female golfers (KLPGA) were randomly assigned to either MT training group (n=10, 35-40 min per session, twice a week for 6 weeks) or a control group (n=10). The putting performance and brain activity were analyzed using kinematic software and resting state functional MRI. Consistency was measured as the standard deviation of the mean swing speed (SSD) during three sections of the swing: backswing/AD-BS, backswing-impact (BS-IMP), impact-finish (IMP-FIS). RESULTS: The MT group improved consistency in the time between the back swing and ball impact in a 2 meter putt compared to the control group (pre: 0.97±0.04 vs 0.70±0.02, post: 0.65±0.03 vs 0.46±0.05, F=5.27, p=0.03). In addition, the MT group showed greater consistency (measured as a lower SSD) in the duration of the full swing of the 5 meter putt compared to the control group (pre: 21.09±1.61 vs 16.07±1.01, post: 14.09±1.06 vs 11.06±0.59, F=5.99, p=0.02) and in swing time in the SAD-BS section of the 5 m putt compared to the control group (pre: 0.72±0.04 vs 0.55±0.02, post: 0.41±0.03 vs 0.54±0.02, F=9.24, p<0.01). After the training period, the MT group showed increased functional connectivity from the superior cerebellar vermis to the right medial frontal gyus, left superior temporal gyrus, right middle occipital gyrus, right middle temporal gyrus, right cingulate gyrus, and right supramarginal gyrus (uncorrected p<0.001, voxels=40). CONCLUSION: MT training in professional female golf players may improve the consistency and reduce variability in putt timing. In addition, MT training may increase brain connectivity from the cerebellum to the frontal cortex which plays an important role in the timing process. Support: Korea reative Content Agency (R2014040055).
Lower back pain (LBP) in golf has been associated with repeated swing performance and high-speed swing load rotations. While different swing techniques exist, no studies have examined the “traditional” or modern swing with the lower body swing. The lower body swing, a novel technique, is believed to reduce the risk of LBP, as it does not require extensive lateral axis tilt of the upper body as rotations are achieved through increased motion at the knees and hips. PURPOSE: To analyze the modern and lower body swing with respect to the risk of developing LBP. METHODS: Nine athletes performed the modern swing (Age 48 ± 13.6 yrs, Height 176.8 ± 4.4 cm, Mass 82.1 ± 5.3 kg) and seven lower body swing (Age 33 ± 12.1 yrs, Height 182.9 ± 6.1 cm, Mass 92.5 ± 14.8 kg), all free from LBP. Whole-body kinematics were recorded using a motion analysis system and a continuous t-test (point by point) was performed to identify differences in examined parameters associated with LBP (high crank factor and thorax to pelvis abdution velocity and acceleration, flexion velocity, thorax rotational velocity and acceleration). Cohens’s d was calculated to determine the magnitude of effects. RESULTS: Significant differences with strong effects (p < 0.05; d > 0.80) were observed for: thorax to pelvis abduction acceleration (lower=558 ± 332°/s; modern=1024 ± 464°/s); thorax flexion velocity (lower=35 ± 21°/s; modern=131 ± 42°/s); thorax rotation velocity (lower=242 ± 33°/s; modern=375 ± 8°/s); and thorax rotation acceleration (lower=2432 ± 535°/s; modern=3861 ± 712°/s). CONCLUSION: The lower body swing displayed favorable kinematics in comparison to modern swing in relation to LBP risk in healthy golfers. Future work should include larger sample sizes and prospective or intervention-based approaches to explore injury prevention efficacy of this novel swing technique.

1866  Board #127 May 31 3:30 PM - 5:00 PM Trunk Flexibility, Balance, Muscle Endurance, And ContraLateral Lean In Collegiate Baseball Pitchers Kaitlin M. Ford, Karen Myrick, Juan Garbalosa, Rich Feinn. Quinnipiac University, Hamden, CT. (No relevant relationships reported)

Excessive contraLateral trunk lean at maximal shoulder external rotation has been linked with increased pitching velocity and increased joint forces. Pitchers with a less efficient transmission of the generated force from the lower limbs to the upper extremities consistent with less forward trunk flexion, less upper torso rotation, and greater upper torso contraLateral flexion at maximal shoulder external rotation demonstrated excessive contraLateral lean. PURPOSE: To examine the relationship between trunk muscle fatigue, trunk flexibility, and balance in relation to maximum contraLateral lean at maximal shoulder external rotation in collegiate baseball pitchers during fastball pitches. METHODS: Anthropometric measurements, isometric holds in trunk flexion, extension, lateral planks, flexibility, and STAR Excursion Balance Test assessments were performed on 10 Division I Collegiate baseball pitchers ages 18-21 (mean 19.6, SD=1.04) with an average of 7.36 in-game pitches at the time of testing. Multiple linear regression tested the effect of SPS force plate measured Load, Explode, and Drive data; and VJ height was recorded as the best of 3 performances. Fastball velocity was quantified as the mean mph of the fastest 3 in-game pitches at the time of testing. Multiple linear regression tested the effect of VJ and SPS data on pitch speed, controlling for appropriate confounders. RESULTS: Players were evenly distributed throughout year in school. Average VJ was 19.8 ± 2.5 inches, fastball velocity was 87.4 ± 4.0 mph, SPS Load was 54.2 ± 8.6, Explode was 51.5 ± 8.4, and Drive was 54.2 ± 8.8. Multiple linear regression, holding the players’ height and grade constant, found each additional inch of VJ predicted a 0.5 mph increase in pitch velocity (p < 0.001); 95% CI: 0.21-0.70. The collection of predictors explained 56% of the variance in speed (p < 0.001). In this model, each additional unit of Load predicted a 0.2 mph decrease in speed (p=0.001) while each additional unit of Explode predicted a 0.2 mph increase (p<0.001). The most powerful predictor was year in school: for each additional year, fastball velocity increased by 2.1 mph (p=0.001). SPS Drive was not a significant predictor (p=0.491). CONCLUSION: In the age of sophisticated analytics equipment, the VJ remains a compelling predictor of fastball velocity, but it predicts in tandem with the SPS technology. The information gathered from a comprehensive athletic evaluation can help coaches evaluate the athleticism of their athletes and inform decisions regarding individualized conditioning programs.

D-64 Free Communication/Poster - Disabilities Thursday, May 31, 2018, 1:00 PM - 6:00 PM Room: CC-Hall B

1868  Board #129 May 31 2:00 PM - 3:30 PM Influence of Therapeutic Horseback Riding on Motor Proficiency in Youth with Sensory Processing Dysfunction Brandon R. Rigby1, Ronald Davis1, Melissa Bittner2, Robin Harwell1, Eileen Leek2, Geoben Johnson3, David Nichols4, FACSM1, Texas Woman’s University, Denton, TX. 1California State University Long Beach, Long Beach, CA. 3ManeGait Therapeutic Horsemanships, McKinney, TX. (Sponsor: David Nichols, FACSM)

(No relevant relationships reported)

Individuals with sensory-integration delays may have some deficit in motor planning, or difficulty interacting with and influencing their surroundings. The demonstration of age-appropriate motor skills is therefore a primary outcome measure in this population. Therapeutic horseback riding may provide the necessary physical adaptations to improve motor skill proficiency. PURPOSE: To characterize motor skill proficiency following 8 weeks of therapeutic horseback riding with sensory integration training in children with sensory processing dysfunction. Methods: Twenty-seven children, ages 5 to 18 years, were recruited. All participants completed the same 32-week protocol that was separated into 4, 8-week blocks: a) a control period (no riding); b) a riding only period; c) a washout period (no riding); d) riding with additional sensory integration therapy (combination). Before and after each period, motor skills were assessed using the Bruininks-Oseretsky Test for Motor Proficiency (2nd edition). A one-way repeated measures ANOVA was used to determine any differences between testing periods. A significance level of 0.05 was used. Results: All subtest scores were statistically similar (p > 0.05), with the exception of manual dexterity, which was different between pre-control and post-washout (p = 0.01), post-control and post-washout (p = 0.024), and pre-control and post-combination (p = 0.037). Overall scores were different between pre-control and post-combination (p = 0.003) and post-control and post-combination (p = 0.009). Conclusion: Therapeutic riding may have a latent effect of improving overall motor skills in children with sensory processing dysfunction. Table 1: Average and overall scores on the BOT-2 subtests at different time points.
### Table 1: Descriptive values of the studies parameters of the COP

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-Treadmill test</th>
<th>Post-Treadmill test</th>
<th>OE</th>
<th>CE</th>
<th>OE</th>
<th>CE</th>
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<tbody>
<tr>
<td>TTD (mm)</td>
<td>225.0 ±25.4</td>
<td>264.1 ±34.2</td>
<td>236.5 ±14.5</td>
<td>242.1 ±19.1</td>
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<tr>
<td>COP radial area (mm²)</td>
<td>608.4 ±1419</td>
<td>520.1 ±158.5</td>
<td>495.0 ±79.3</td>
<td>546.7 ±130.0</td>
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<td>MVS (mm/s)</td>
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<td>4.6 ±0.6</td>
<td>4.1 ±0.3</td>
<td>4.2 ±0.3</td>
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<tr>
<td>MLD (mm)</td>
<td>4.2 ±0.6</td>
<td>3.9 ±0.6</td>
<td>3.9 ±0.3</td>
<td>3.7 ±0.3</td>
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<tr>
<td>APD (mm)</td>
<td>3.7 ±0.4</td>
<td>3.6 ±0.3</td>
<td>4.4 ±0.4*</td>
<td>3.5 ±0.3</td>
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<tr>
<td>MCOX X (mm)</td>
<td>8.7 ±1.8</td>
<td>9.9 ±1.8</td>
<td>7.4 ±1.8</td>
<td>7.1 ±1.7*</td>
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<tr>
<td>MCOX Y (mm)</td>
<td>-9.4 ±1.6</td>
<td>-10.9 ±1.5</td>
<td>-11.8 ±1.5</td>
<td>-11.5 ±1.5</td>
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</tbody>
</table>

Note: values are means (Standard Mean Error)

Abbreviations: OE = Open Eyes; CE = Closed Eyes; COP area: Center of Pressure area; TTD: total travel distance; MLD: mean medium-lateral displacement; APD: anterior-posterior displacements; MVS: mean velocity sway length; MCOX: mean COP X position; MCOY: mean COP Y position

* Significant difference (p < 0.05) between APD with OE
** Significant difference (p < 0.05) between MCOX X with CE

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### Adherence and Continued Participation in a Wellness Class for Individuals with Disabilities

Megan Ware, Kathleen DeMarrais, Kevin K. McCully FACSM. University of Georgia, Athens, GA.

Adherence and continued participation are areas of concern in wellness interventions and programming. For individuals with disabilities, this can be an even larger challenge because of barriers like transportation and decrease in overall health. However, the factors that could increase participation and adherence in this population group remains unclear. Adherence and continued participation were explored in a wellness class at the University of Georgia for people in the surrounding community with disabilities. This class is driven by students under the supervision of a graduate student and a faculty member. **PURPOSE:** To understand what factors impact participant adherence and participation in the unique environment of the wellness class. **METHODS:** Eight wellness class participants, with a wide range of physical and mild intellectual disabilities who had been in the class for 6-36 months, were chosen for in-depth qualitative interviews. Interview responses across participants were coded and analyzed for overarching themes. **RESULTS:** 71 codes were obtained from the interview data, with 7 categories from these codes. The primary theme identified was that adherence in the class was related to personal interaction with the student trainers. The personal interaction could be divided into subthemes of social accountability, motivation, supporting classroom environment, and student interaction. The overwhelming majority of these codes were positive, indicating satisfaction with the wellness class on the part of participants. Duration in the class did not influence the subthemes, other than longer durations were associated with a greater appreciation of the role of the participants educating the students. **CONCLUSION:** The primary factor that influences adherence and continued participation was related to personal interaction with the student trainers. These results suggest that encouraging positive social interactions related to social accountability and a positive environment can play a powerful role in maintaining exercise adherence in people with physical and intellectual disabilities.

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### A Multilevel Patient Engagement Model for Recruiting Hard-to-Reach Patients into Exercise Training Studies

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Many of the studies today involving exercise science research never reach their target sample sizes. This is particularly true for studies that include people with disabilities, as this population typically faces issues such as lack of transportation, exercise not individualized to their functional level, or intervention not targeting primary symptoms of their disabilities. Strategies for enhancing participant recruitment are needed to guide future exercise training studies in the disability population. **PURPOSE:** The purpose of this qualitative study is to describe a multilevel, patient-centered model for recruiting people with multiple sclerosis (MS) for a cluster-randomized controlled study named Tele-Exercise and Multiple Sclerosis (TEAMS), which involves a 12-week complementary and alternative medicine intervention consisting of neurorehabilitative exercise, yoga and Pilates. **METHODS:** A multilevel model that consists of three elements: 1) stakeholder engagement throughout the entire research process, 2) clearly defined research team effort shaping the study design based on stakeholder feedback, and 3) external support systems. The three elements of this model work together to disseminate research evidence that can be easily translated and
repeated in real world settings. RESULTS: The TEAMS study, which aims to enroll 820 individuals with MS across Alabama, Mississippi, and Tennessee over 24 months, has already garnered a list of 200 interested participants. Recruitment began for 8 of the 38 clinic sites in September 2017. Anticipated results include successfully reaching recruitment goals and participants demonstrating adherence to the study. CONCLUSION: Although this study was focused on MS, this multilevel recruitment model, starting with stakeholders at the center of the model in helping to design the study, is generalizable to other underserved, difficult-to-reach study populations. Exercise Physiologists can use this model as a framework for increasing their enrollment into various types of training studies.

The work of this abstract was supported by the Patient-Centered Outcomes Research Institute (PCORI), Award # MS-1511-33653.

**1872 Board #133 May 31 2:00 PM - 3:30 PM Changes in Physical Activity during a Pilot Weight Loss Program Before and After Knee Replacement**  
Christine A. Pellegrini1, Rowland W. Chang2, Dorothy D. Dunlop3, David E. Conroy2, Jung-ha Lee4, Kenzie A. Cameron2.  
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(No relevant relationships reported)

**PURPOSE:** Although knee replacement (KR) surgery typically results in pain reductions and functional improvement, most patients do not increase their physical activity. This study examined changes in objectively measured physical activity in KR patients who were participating in a weight loss program that started either before or after surgery.

**METHODS:** Consented patients scheduled for KR were randomized to a 14 session pilot weight loss program starting ≤6 weeks before surgery (PACE) or 12 weeks post-op (Delayed PACE). Participants were encouraged to increase activity, set weekly activity goals, and self-monitor using paper, website, app, or Fitbit. Coaching sessions took place weekly or biweekly based on patient preference. Activity (moderate-to-vigorous intensity physical activity [MVPA] bouts ≥10 min of ≥2020 cpm and daily steps) was assessed using Actigraph GT3X monitors. PROMIS was used to assess pain intensity and function. Assessments were completed at baseline (pre-op), 12, and 26 weeks after surgery. Intent-to-treat was used with the last observation carried forward. Repeated measures ANOVA(s) examined changes in activity across time and group. RESULTS: Thirteen participants (mean±SD 63.5±7.9 years, 69% female, 69% White, BMI 35.7±5.1 kg/m2) provided physical activity data at baseline. Physical activity data was obtained for 77% of the sample at 12 and 26 weeks. Pain intensity decreased (P<0.001) and function improved (P<0.001) significantly, but no significant changes were observed in physical activity (Table 1). CONCLUSIONS: On average, KR patients participating in a weight loss program did not increase physical activity (weekly bouted MVPA and daily steps) after surgery. The lack of change in activity, even in the presence of an intensive behavioral intervention and improvements in pain and function, highlight the challenges of altering behavior in this population. Future studies are needed to explore methods to increase activity after knee replacement.

<table>
<thead>
<tr>
<th>Physical Activity Pre- and Post-Surgery in PACE (n=6) &amp; Delayed PACE (n=7)</th>
<th>Baseline</th>
<th>12 Weeks</th>
<th>26 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bouted MVPA, min/week</strong></td>
<td>81.2±141.8</td>
<td>3.5±5.4</td>
<td>33.3±76.4</td>
</tr>
<tr>
<td><strong>PACE</strong></td>
<td>73.6±85</td>
<td>62.1±135.8</td>
<td>78.1±108.0</td>
</tr>
<tr>
<td><strong>Steps/day</strong></td>
<td>5715.7±3098.0</td>
<td>4255.6±1687.8</td>
<td>4991.8±2910.2</td>
</tr>
<tr>
<td><strong>Delayed PACE</strong></td>
<td>6062.4±2817.6</td>
<td>4943.6±1653.2</td>
<td>6324.4±2201.3</td>
</tr>
</tbody>
</table>

**1873 Board #134 May 31 2:00 PM - 3:30 PM Use of Video Modeling to Teach Weight Lifting Techniques to Adults with Down Syndrome**  
Kathy Carter1, Alexandra Roberts2, Robert Pennington1, Elizabeth Ledford1.  
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(No relevant relationships reported)

As adults with Down syndrome (DS) age strength decreases resulting in difficulty performing activities of daily living. Research suggests that progressive resistance training for adults with DS may lead to improvements in their functional ability. PRT requires minimal equipment, which may be important for individuals with DS, as they may have limited disposable income for gym memberships, and reduced access to transportation to and from training facilities. Video modeling (VM) involves the demonstration of a target behavior through the video recording of that behavior. PURPOSE: The purpose of this study was to determine whether the use of video modeling is appropriate for teaching adults with DS to perform weight lifting techniques. METHODS: Three adult males with Down syndrome, ages 24 to 34 years, participated in this study. A subject multiple probe design across behaviors (i.e. lifts) was used to evaluate the effectiveness of VM. A certified U.S. weight lifting coach completed a task analysis for split squat (SS), punch-out squat (POS), and overhead press (OP). For baseline measures participants watched a demonstration of each lift and were then recorded performing the lift. Once baseline measures became stable, participants viewed a video of a model using correct lifting technique three times. They were then video recorded performing the lift. No verbal or written corrections were given. Participants performances were scored by taking the number of steps performed correctly, dividing that number by the total number of steps in the task, then multiplied by 100. RESULTS: Participants were least successful with the SS averaging 16% correct at baseline and 36% correct after viewing the video. POS went from 50% correct to 87%; OP started at 42% and increased to 90% correct movement. Our video-modeling intervention, alone was not sufficient to produce an effective outcome across all lifts, but did help participants acquire more components of each lift. CONCLUSION: This study suggests that VM might serve as a useful component of a larger intervention; one that includes VM, rehearsal with feedback, and programmed reinforcement contingencies. It is our hope that future research with provide a path forward in this critical area.

**1874 Board #135 May 31 2:00 PM - 3:30 PM Changes of Physical Activity Patterns among Down Syndrome Youth In a Weight-loss Randomized Control Trial**  
Qun Le, Philimmon Gona, Richard Fleming. UMass Boston, Boston, MA.  
(No relevant relationships reported)

Children with intellectual and development disabilities (IDD) engage in lower levels of moderate to vigorous intensity physical activity (MVPA) than do typically developing children. In addition, research suggests that light intensity physical activity (LPA) might have health benefits independent of those recognized for MVPA in people in general. To our knowledge, there is no recommendation for LPA, and the recommendation for all people with disabilities is to simply encourage them to “do as much physical activity (PA) as they can.” PURPOSE: The purpose of this study was to analyze the baseline PA patterns of adolescents and young adults with Down syndrome (DS) who participated in a 12-month weight loss intervention, and to assess whether the intervention would change PA patterns. METHODS: A total of 21 adolescents and young adults with DS aged 13 to 26 years were enrolled and randomized to either a 6-month nutrition and activity education intervention (NAE;HI) or a nutrition and activity education + behavioral intervention (NAE+HI), with a 6-month follow-up. Accelerometers were used to assess the PA levels of participants at baseline, 10-weeks, 6-months, and 12-months. RESULTS: Results indicated that at baseline participants spent a high proportion of their time in SB (68.2%), and lower proportions in LPA (28.5%) and MVPA (3.2%). At the same time, a strong negative linear correlation was found between SB and MVPA (r = -0.468, p=0.038). Linear trend analysis showed that SB decreased more in the NAE+HI group than in NAE at 6-months, and the trajectory of LPA increased more steeply at 10-week, 6-month, and 12-month in NAE+HI than in NAE. CONCLUSIONS: LPA was found to have a stronger inverse association to SB than did MVPA to SB. We conclude that decreasing SB and promoting healthy outcomes may be achieved more effectively by increasing LPA, as compared to increasing MVPA, among this population. The implications could be used to fill in the gap of PA guidelines to include promoting LPA among adolescents and young adults with IDD, a step that could bring health benefits. Supported by: National Institutes of Health SRO3DK70627-02.

**1875 Board #136 May 31 2:00 PM - 3:30 PM Influence of Pain and Mood on Physical Activity after Knee Replacement**  
Sara M. Rothberger, Courtney M. Monroe, Christine A. Pellegrini. University of South Carolina, Columbia, SC.  
(No relevant relationships reported)

Many patients undergoing knee replacement do not increase physical activity levels after surgery. PURPOSE: The proposed study aimed to use ecological momentary assessment (EMA) and accelerometry to examine the time-varying associations between mood, pain, and physical activity following knee replacement to determine if mood is influencing activity. METHODS: Over one week, knee replacements patients ≤12 months of surgery rated their mood (1 negative to 9 positive) and pain (1 none to 9 extreme) after 6 random prompts during waking hours. Physical activity was assessed during the same week using an Actigraph GT3X worn on the wrist. Only valid days of ≥10 hours/day were included. Average steps/day and the time spent in sedentary (<100 cpm)
and moderate-vigorous physical activity (≥2020 cpm) were calculated across all participants. Pearson or Spearman correlations were used to examine the relationship between pain, mood, the time from surgery, and physical activity counts.

RESULTS: Fourteen participants (mean±SD 64.7±6.4yrs, 57% female, 79% white, 70.3±75.9 days after surgery) completed the study. One participant had less than four accelerometer valid wear days and was excluded from analyses. Participants spent 74.1±10.4% of the day in sedentary behavior, took 3352.1±1861.9 steps/day, and engaged in 36.8±28.6 min of MVPA on average over the study period. The patient had a secondary prosthetic limb which was fitted by the prosthetist for use in the underwater treadmill.

RESULTS After UTT, the patient was classified as a K-3 with a total score of 37. Time to complete the 10 M Test was 12.8 s before, 11.4 s after, and 11.1 s at 3-months. TUG test times pre, post, and 3 months post-UTT were 15.6 s, 13.5 s, and 13.3 s, respectively. The patient was unable to balance for 30 s with eyes closed before UTT and was able to complete this task after UTT and 3-months post-UTT. He was unable to perform a single leg balance test without assistance for 30 s on either limb at any time-point. Total underwater treadmill walking time increased from 26 min to 48 min and walking speed increased from 1.1 mph to 1.6 mph.

CONCLUSION: Following UTT, the patient achieved a higher K-level. Patients classified as a K-3 or higher are eligible for health care coverage for higher level componentry for the prosthetic device. His walking speed improved and fall risk decreased following UTT with only minor improvements in balance.

1877 Board #138 May 31 2:00 PM - 3:30 PM
Feasibility of Underwater Treadmill Training to Improve Mobility: A Case Study of a Transatlantic Amputee
Shannon L. Mathis1, Ryan T. Conners1, Adam Vazquez2, David E. Walls2, Marie Knoll2, Catherine Ivey3, Michael W. Beets1, 1The University of Alabama in Huntsville, Huntsville, AL. 2Fourroux Prosthetics, Huntsville, AL. (No relevant relationships reported)

Underwater treadmill training (UTT) has been shown to be successful in improving health related fitness in inactive populations with reduced mobility. Walking on a treadmill submerged in a self-contained tank of water allows for precise control of walking speed, water depth, and water temperature while unloading one’s body weight.

PURPOSE: The purpose of this study was to determine the feasibility and efficacy of an 8-week (3d·wk-1) UTT program in a unilateral, transtibial amputee with limited ambulation potential. The hypothesis was that the participant’s post-UTT and three month scores relative to pre-UTT scores would improve in mobility (Amputee Mobility Predictor [AMP]), walking speed (10-M Walk Test), balance (single leg stance and Romberg test), and fall risk (Timed-Up-And-Go [TUG]).

METHODS: The patient was a 72 year-old male who underwent transtibial amputation for the development of a chronic neuropathy. He has used a prosthetic device two years. He walks with a cane in the community and uses a wheelchair while at home. Mobility is defined by the Medicare Functional Class K-Level system with stages ranging from K-0 to K-4 and is determined by the score of the AMP. Prior to UTT, a prosthetist administered the AMP and classified the patient as a K-2 with a total score of 32. The AMP is a 49 item functional mobility instrument that classifies patients based on their ability to perform daily tasks. The AMP is scored from 0 to 100 with a score of 0 indicating total disability and a score of 100 indicating no limitations from mobility. AMP total scores range from 0-100 and higher scores indicate better mobility.

RESULTS: Pre-UTT AMP total score was 32 and post-UTT AMP total score was 37.

CONCLUSION: Following 8 weeks of UTT, the K-2 patient improved to a K-3 (total score of 37). Future studies are needed to explore alternative factors that may be influencing activity after surgery.
Amotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease that is characterized by muscular atrophy which leads to increased fatigue, loss of balance, and spasticity. Currently, there is no cure for ALS and limited medical treatments are available. Weak muscles make it challenging for these individuals to exercise although physical activity is important to prevent deconditioning. However, dynamic cycling, which utilizes a motor to assist rapid movement of the legs, may be an effective mode of exercise for individuals with muscle weakness and has yet to be investigated in this population. PURPOSE: The purpose of this case study was to determine the efficacy of two weeks (6 sessions) of dynamic cycling at a high cadence on gait function and daily activity function in an individual with ALS. METHODS: One male individual with ALS (67 years old) completed an amyotrophic lateral sclerosis functional rating scale revised (ALSFRS-R) assessment and a 6-minute walk test (6MWT) on a treadmill before and after the two week intervention. After the baseline visit, the six subsequent visits consisted of the dynamic cycling intervention and 6MWT. The dynamic cycling sessions consisted of repeated bouts of cycling at 75-85 revolutions per minute for 5 minutes with 5 minutes of rest between each bout. The individual was able to successfully complete the intervention despite muscle weakness. The promising results of dynamic cycling in our subject warrants the need for further studies within the ALS population.

**CONCLUSION:** These results suggest most parents of children with developmental delays have concerns about obesity-related topics and are interested in receiving digital programs targeting these areas, with opportunities to leverage various mediums. Future studies should verify these findings in larger samples.
METHODS: This prospective cross-sectional study, included 36 child/parent dyads stratified by child’s age (4-7, 8-12, and 13-18 years), diagnosis and ambulatory status (spina bifida-ambulatory n= 9; Down spina bifida-wheelchair n= 9; and control n= 9). PA energy expenditure by weight (kcal kg⁻¹ day⁻¹) was calculated from total energy expenditure, measured via DLW, by subtracting an estimated resting metabolic rate and thermic effect of food and then dividing by the child’s weight. Self-reported PA (MET min⁻¹ day⁻¹) was measured by an activity journal completed by parents and children ≥3 years for four weekdays and two weekend days. T-tests compared MET min⁻¹ day⁻¹ reported between the parents and children. Pearson correlations assessed relationships between journals and DLW.

RESULTS: No significant differences between activity levels reported by parents and children (25.05 vs. 27.32 MET hrs day⁻¹; p = 0.29). Parent and child self-reported activity levels were moderately correlated to DLW (r=0.63, p=0.001; r=0.74, p=0.005, respectively). When examined by age, parent reported activity and DLW were significantly related all age groups. No significant relationship between self-reported activity levels and DLW based on diagnosis.

CONCLUSION: With their increased involvement, parents of children with SN were able to report activity levels of their child similar to the child’s self-reported activity. Both parent and child reporting had moderate relationships to the criterion. Self-report methods while cost-effective, have been minimally tested in children with SN. Therefore, further examination in larger samples is recommended along with utilizing objective measures of PA.

1884 Board #145 May 31 2:00 PM - 3:30 PM Guardian Perception Of Self-esteem And Mastery In A Special Needs Population

Kelly D. Barns, Jason D. Wagganer, Anthony J. Faber, Thomas J. Pujol, FACSM, Southeast Missouri State University, Cape Girardeau, MO. (Sponsor: Thomas Pujol, FACSM) (No relevant relationships reported)

Self-esteem and mastery are psychological factors that may be affected by learning a new physical skill. The primary objective of iCan Bike (ICB) is to instruct individuals with special needs and/or disabilities on how to ride a two-wheeled bicycle. Very few studies have assessed the effects of learning a new physical skill on self-esteem and mastery in special needs and/or disabled populations.

PURPOSE: To assess guardian perceived self-esteem and mastery scores, of the ICB participant, as measured by the Rosenberg Self-Esteem Scale (RSES) and Pearlin Mastery Scale (PMS).

METHODS: The RSES (10 items; 5 positive and 5 negatively worded items) and PMS (7 items) questionnaires were completed by the guardian of the participant in the ICB activity.

A one-way repeated measures Analysis of Variance, with a Bonferroni post-hoc test, was conducted to compare questionnaire results across pre-, post-, and 30 days post-camp. All data was analyzed using SPSS (v24.0) with significance set at p<0.05.

RESULTS: A total of 141 questionnaires were completed on an ICB participant sample consisting of 63.8% (n=90) males and 36.2% (n=51) females. A total of 163.1% (n=76) of participants independently rode a bicycle.

A significant increase in mastery was observed [F(2,280)=23.699, p<0.001], with significant increases observed pre- (23.03±4.64) to post-camp (25.44±4.60) (p<0.001), and post- to 30-days post-camp (26.61±5.24) (p<0.001). No significant RSES effect was observed.

CONCLUSIONS: A significant increase in mastery may be related to the daily observable progress associated with watching the participant learn to ride a bicycle. The success rate of this study (63.1%) was lower than the ICB advertised rate of 80%, which may be a primary reason for the lack of change in self-esteem scores. The success rate of this study (63.1%) was lower than the ICB advertised rate of 80%.

1885 Board #146 May 31 2:00 PM - 3:30 PM Replacing Sedentary Time with Light Physical Activity Reduces Mobility Limitation in Older Adults: NHANES 2003-2006

Nicholas L. Lerma, Chi C. Cho, Hotaka Maeda, Ann M. Swartz, FACSM, Scott J. Strath, FACSM, University of Wisconsin - Milwaukee, Milwaukee, WI. (Sponsor: Scott Strath, FACSM) (No relevant relationships reported)

PURPOSE: Increased time spent in sedentary behavior (SB) and reductions in total physical activity (PA) are linked to functional limitations in aging populations. The purpose of this study is to examine the relationship of replacing SB time with light intensity PA (LPA) and/or moderate-vigorous-intensity PA (MVPA) on physical function in a nationally representative sample of older adults.

METHODS: A cross-sectional analysis using time period substitution models with multinomial regression was performed in older adult participants from the 2003-2006 National Health and Nutrition Examination Survey (NHANES 2003-2006). Accelerometers worn on the hip were used to estimate the number of hours spent in primary SB categories (SB, light activity, and MVPA). The primary outcome was the presence of two+ self-reported functional limitations when replacing SB with LPA and/or MVPA.

RESULTS: The analysis included a sample of 1971 older adults (60-85 years) averaging 583 ± 166 min d⁻¹ (mean ± SD) in SB, 287 ± 102 min d⁻¹ in LPA, and 11 ± 15 min d⁻¹ in MVPA. Within the sample 39.8% reported no limitation, 16.7% with one limitation, and 43.5% with two+ limitations. The odds of having one functional limitation was significantly reduced when replacing 60 min of SB with 60 min MVPA (odds ratio 0.303, 95% CI 0.116-0.791), but not with 60 min of LPA (0.926, 0.832-1.031).

However, replacing 60 min of SB with a combination of 55 min of LPA and as little as 5 min of MVPA significantly reduced the odds of having one limitation (0.844, 0.746-0.955). The odds of having two+ limitations was significantly reduced when replacing 60 min of SB with LPA (0.756, 0.679-0.798) or MVPA (0.074, 0.018-0.293). Lastly, the odds of transitioning from one to two+ limitations was significantly reduced when replacing 60 min of SB with LPA (0.794, 0.716-0.881) or MVPA (0.245, 0.070-0.858).

CONCLUSION: While the functional benefits of MVPA are well-established, altering the daily balance between LPA and SB is shown to be protective against developing functional limitations. Further, replacing SB with LPA and complimentary doses of MVPA may be a more practical approach to effectively prevent or reduce functional limitations among older adults.
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1887 Board #148 May 31 2:00 PM - 3:30 PM

**Difference In Physical Activity Between Children Without Siblings And With Siblings**

Chelsea L. Smith1, Emily Guseman2, Laura Hubbs-Tait3, Jennifer Graef4, Sandra Arnold2, Allin Kneehans1, Susan B. Sisson, FACSM4.* 1University of Oklahoma Health Sciences Center, Oklahoma City, OK; 2Ohio University, Athens, OH; 4Oklahoma State University, Stillwater, OK. (Sponsor: Susan B. Sisson, FACSM) (No relevant relationships reported)

Children without siblings, singletons, have higher rates of obesity than children with siblings, non-singletons. Physical activity, such as increased moderate-to-vigorous physical activity (MVPA) and decreased sedentary behavior, can curb excess weight gain early in life. **PURPOSE:** The purpose of this study is to examine the differences in physical activity and sedentary behavior between singleton and non-singleton children. **METHODS:** Mothers of singleton children ages 5.0-7.9 years old and mothers of non-singleton children ages 5.0-7.9 years old with a sibling between the ages of 2.0-4.9 years old in their primary household were recruited. Height, weight, and waist circumference (WC) of child were objectively measured. Mothers reported demographic characteristics of the child and self, and completed a questionnaire on their physical activity. Children wore an accelerometer at the ankle for at least for 5 full days while parents recorded daily activities and time spent in away from home care (such as child care or kindergarten). Body mass index (BMI) was calculated, and BMI and WC percentiles were calculated for age and sex. MVPA and sedentary behavior per hour were calculated using accelerometer cut points and total wear time. **RESULTS:** 43 mother-child dyads (10 singletons and 33 non-singletons) participated. On average mothers were 34.7 years old, employed full time (69%), married (77%), and the child's biological mothers (97%); while children were 5.81 years old and predominantly white (62%). Singletons had a higher BMI percentile (80.12[1.23] and waist circumference percentile (77.61±21.7) compared to non-singletons (55.72±29.0, p=0.02; 53.4±21.3, p=0.01). In individual models, singletons did not differ in time away from home care (p=0.60) or in their mother’s average MET minutes per week compared to non-singleton children (p=0.90). After adjusting for child BMI percentiles and month of wear, singletons spent 2.96 less minutes per hour in MVPA (p=0.01) and 5.18 more minutes per hour in sedentary behavior compared to non-singletons (p=0.01). **CONCLUSIONS:** In this sample, singletons had a higher BMI percentile and were less active compared to non-singletons. Investigation into differences in singleton/ non-singleton families, including family health behaviors, may support understanding of the mechanism.

1888 Board #149 May 31 2:00 PM - 3:30 PM

**Parent Physical Activity Practices and Associations with Physical Activity and Sedentary Time in Preschool-Age Children**

Emily C. Huber1, Jessica R. Meendering2, 1Loras College, Dubuque, IA; 2South Dakota State University, Brookings, SD. (Sponsor: Matt Vukovich, FACSM) (No relevant relationships reported)

Preschool-age children have the potential to be influenced by parent physical activity (PA) practices more than older children as preschool-age children are more reliant on parents for PA opportunities. Previous research with this focus has relied predominantly on various subjective assessments of child activity which often results in an overestimation of PA and an underestimation of sedentary time (ST). **PURPOSE:** The purpose of this study was to explore associations among parent PA practices and child PA and ST by utilizing objective measures of activity and the full range of PA intensities in a cross-sectional sample of preschool-age children. **METHODS:** Child PA was assessed for 7 days via accelerometer (ActiGraph GT3X+) using age- and sex-specific activity intensity cut points. PA and sedentary behavior per hour were calculated using accelerometer cut points and total wear time. Results: 375 parent-child dyads (105 singletons and 270 non-singletons) participated. On average parents were 36.9 years old, employed full time (72%), married (69%), and the child’s biological mothers (98%). Singletons had a higher BMI percentile (80.12[1.23]), waist circumference percentile (77.61±21.7) compared to non-singletons (55.72±29.0, p=0.02; 53.4±21.3, p=0.01). In individual models, singletons did not differ in time away from home care (p=0.60) or in their mother’s average MET minutes per week compared to non-singleton children (p=0.90). After adjusting for child BMI percentiles and month of wear, singletons spent 2.96 less minutes per hour in MVPA (p=0.01) and 5.18 more minutes per hour in sedentary behavior compared to non-singletons (p=0.01). **CONCLUSIONS:** In this sample, singletons had a higher BMI percentile and were less active compared to non-singletons. Investigation into differences in singleton/non-singleton families, including family health behaviors, may support understanding of the mechanism.

1889 Board #150 May 31 2:00 PM - 3:30 PM

**The Relationship Between Screen Time and Sleep Duration in Children**

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Excess screen time (ST), low sleep duration (SLD), and physical inactivity, are risk factors for childhood obesity. Also, excess ST has been associated with poorer sleep quality and shorter SLD. The American Sleep Foundation recommends 9-11 hours of sleep per night for school aged children. **PURPOSE:** To determine the relationship between ST and SLD among children who participated in a school based nutrition and physical activity intervention. **METHODS:** Cross sectional analysis of 5th grade public school students (N = 742, mean age 10.5 years, range 9-13 years). Participants self-reported their ST, SLD, and wake time. **RESULTS:** A Pearson correlation coefficient indicated a small but significant negative correlation between ST and SLD (r = -0.13; p < 0.01). A one-way ANOVA comparison between three groups categorized into “low,” “medium,” and “high” ST levels showed a significant difference in SLD between groups (F 2.739) = 6.82, p < 0.001). Post hoc comparisons using the Tukey HSD test indicated the mean SLD for the low ST group (M=10.17, SD=1-20) was significantly higher compared to the SLD in the high ST group (M=9.77, SD=1.29), but the Cohen’s effect size value (d = 0.34) indicated a small effect size in magnitude. **CONCLUSIONS:** The results suggest an inverse relationship between ST and SLD. The children who had low ST had significantly higher SLD versus children with high ST, though the mean hours of sleep for all groups met current recommendations. Intervention studies in youth should consider incorporating strategies to decrease ST in youth not only increase physical activity, but also to improve SLP duration. Funding Sources: -Blue Cross Blue Shield Foundation of Michigan; -Michigan State University Extension USDA Supplemental Nutrition Assistance Program; -Superior Health Foundation, Marquette MI.

1890 Board #151 May 31 2:00 PM - 3:30 PM

**Lipoprotein Subclasses And Their Associations With Physical Activity, Cardiorespiratory Fitness And Adiposity In Norwegian Schoolchildren**

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Physical activity (PA), cardiopulmonary fitness (CRF) and adiposity are associated with certain lipoproteins. Research in adults has shown that these associations are not consistent across lipoprotein subclasses. **Purpose:** To examine cross-sectional associations in children between objectively measured PA and sedentary time (SED), CRF and adiposity with a number of biomarkers of lipoprotein metabolism. **Methods:** We included 1056 healthy fifth-grade (mean age 10.2 yrs) Norwegian children (47.3% females). Total PA (PA), PA intensity (light (LPA); moderate (MPA); vigorous (VPA)), and SED were assessed using triaxial accelerometry. We used the Andersen test to measure CRF, and waist circumference to measure abdominal adiposity. We quantified 31 measurements of lipoprotein metabolism including concentrations of 15 subclasses and particle size of three major classes (VLDL, LDL, HDL) using nuclear magnetic resonance spectroscopy. We used multiple linear regression models adjusted for age, sex, pubertal development and socioeconomic status (standard model). Additional PA, PA intensity and CRF models were adjusted for moderate-vigorous PA (MVPA) and CRF separately. We applied a false discovery rate (FDR) correction to p-values of each regression model. **Results:** Adiposity was associated with all 31 biomarkers in the standard and PA-adjusted models, and 30 biomarkers having adjusted for CRF. CRF was associated with 29 of the biomarker measures in the standard model and 22 having adjusted for adiposity. Total PA, VPA, MPA, LPA and SED were associated with 13, 21, 14, 0 and 9 of the 31 biomarker measures, respectively in the standard model. After adjusting for adiposity, there were 8, 7, 7, 0, and 4 biomarker associations, respectively. All FDR-corrected p-values < 0.05. **Conclusion:** CRF is associated with the majority of markers of lipoprotein metabolism independent of adiposity. Physical activity, especially of higher intensity, is associated significantly with preschool-age child activity. However, there is a need to help parents understand other strategies to promote PA and discourage ST in young children.
Asthma is an important health issue in adolescents, particularly among African Americans (AA). Previous research has identified obesity as a risk factor for childhood asthma, however, less research has examined whether asthma predicts obesity. It is plausible that the presence of asthma symptoms may contribute to inactivity and subsequent obesity risk in AA youth.

**Purpose:** The purpose of this study was to assess the cross-sectional relationships between the presence of asthma symptoms, weight status, moderate-vigorous physical activity (MVPA) and sedentary time (SED) among AA adolescents.

**Methods:** A community-based sample of 163 AA youth (55% female, 31% obese, ages 11-18 years), recruited from southeast Michigan were included in this analysis. Asthma symptoms were evaluated and given a single score from 0 (no symptoms ever) to 11 (all symptoms often) using the International Study of Asthma and Allergies in Children’s Phase Three questionnaire. MVPA and SED were measured via accelerometry. Weight status was assessed via body mass index (BMI) where weight and height were measured via an electronic scale and stadiometer, respectively.

**Results:** Of the 163 adolescents included in the analysis, 68 reported no symptoms of asthma (54% female, 22% obese). T-tests revealed those with no symptoms of asthma engaged in less time and lower intensity MVPA compared to those with one or more symptoms of asthma. After accounting for the confounding effects of sex, parental education, and pubertal development; asthma symptom score was positively associated with BMI (β=0.010, p=0.004). When MVPA and SED were included in the model, the relationship between asthma symptom score and BMI remained significant (β=0.5±0.2, p=0.007).

**Conclusion:** A higher presence of asthma symptoms predicted increased weight status in AA adolescents. Physical activity participation and sedentary time did not modify this relationship, suggesting that other factors contributed to the increased obesity risk in children exhibiting asthma symptoms. Longitudinal studies are needed to better understand the relationship between asthma and obesity in AA adolescents.
Purpose: This cross-sectional study included 450 children aged 9-11 from New Zealand. Objective SB and physical activity were measured via wrist-worn accelerometers for 3 days. Activity was classified as long (>10 min) and short (<10 min). Regular physical activity was associated with SB in girls and not associated in boys. Short bouts were inversely related to higher fitness and were associated with lower adiposity. Substituting with short bouts SB and moderate-to-vigorous physical activity was associated with lower SB.

Methods: This study was conducted by the Center for Research Resources, M01-RR00059 supported this work. The National Institute of Dental and Craniofacial Research R01-DE12101 and R01-DE12102, and the General Clinical Research Centers Program from the National Institute of Health supported this work. The University of Pittsburgh, Pittsburgh, PA, 1National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. 2Ehime University, Matsuyama, Japan. 3Juntendo University, Tokyo, Japan. 4National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. 5Ehime University, Matsuyama, Japan. 6Central Sports Co., Tokyo, Japan. 7National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. 8Ehime University, Matsuyama, Japan. 9Juntendo University, Tokyo, Japan. 10Ministry of Science, Technology and Sports, Tokyo, Japan.

Conclusions: These findings suggest that associations between active school transport modes and obesity differ by sociodemographic characteristics, including race/ethnicity and grade. Population-based approaches to childhood obesity prevention may benefit from understanding disparities in opportunities for school transport modes. Supported by the Texas DHS with funds from the Title V MCH Block Grant to Texas, the CDC HHS Block Grant, and the Michael & Susan Dell Foundation.

Various studies, including genetic studies, to find elite athletes have been carried out. Childhood records may be a good index for finding elite athletes. However, limited data are available on this topic. Purpose: The purpose of this study was to evaluate the relationship of freestyle swimming performance between childhood and adolescence of Japanese top-class swimmers. Methods: Subjects were male and female swimmers who participated in official competition accredited by the Japan Swimming Federation held from April 2007 to April 2017. The records of 100 m freestyle short-course performances of 22 year olds during 2016 to 2017 (latest TIME), and 12 to 21 year olds during 2006 to 2016 were analyzed. We evaluated the relationship between the latest TIME and the record of each age using Pearson’s correlation coefficient. Also, we compared the average value of the records of the 2 groups, divided into the upper group and the lower group using the median of the previous record. In females, a clear tendency was not observed. The difference between the records of the upper group and the lower group was statistically significant (P <0.05) before the record at 17 years old in males and 16 years old in females. The difference between the records of the upper group and the lower group was statistically significant (P <0.05, 95% CI: 1.25, 24.00). Students in 8th grade who walked to school were significantly less likely to have obesity than 4th or 11th grade students who did not walk to school (OR=0.42, p=0.05, 95% CI 0.19, 0.91).

Conclusions: These findings suggest that associations between active school transport modes and obesity differ by sociodemographic characteristics, including race/ethnicity and grade. Population-based approaches to childhood obesity prevention may benefit from understanding disparities in opportunities for school transport modes. Supported by the Texas DHS with funds from the Title V MCH Block Grant to Texas, the CDC HHS Block Grant, and the Michael & Susan Dell Foundation.

Purpose: The decline of cardiovascular fitness (CRF) in adolescents has become a major concern. Efforts have been to improve adolescents’ CRF through exercise interventions, but the dose response of the interventions has not been summarized. This study was to determine the exercise dose response needed for increasing CRF in adolescents (12-19 yr. old).

Methods: Google scholar, Web of Science, PsycINFO, Scopus, SPORTDiscus, and Cochrane databases were searched. In addition, the listed studies’ methodological quality was assessed. The standardized mean differences and 95% confidence intervals (95% CIs) were calculated as the effect size measures (ES).

Purpose: To examine the prevalence of school transport modes and obesity by gender, grade, physical activity, race/ethnicity, and economic disadvantage in a representative sample of Texas school children.
RESULTS: The search yielded 50 studies, a total of 15 studies were included in the review. Most of the included studies employed a randomized controlled trial study design (12/15, 67%). Samples sizes ranged from 20 to 60. Intervention length ranged from 6-60 weeks. The major indicator of CRF was VO2max, measured by laps (20-m shuttle run) or minutes (1-mile run). Aerobic exercise was utilized in most of the interventions (73%), followed by resistance training (20%), and a combination of aerobic and resistance training (6.7%). Interventions with intensity of ≥ 60% maximal heart rate (HRmax) were statistically significantly significant for improving CRF (ES = 0.87, 95% CI 0.23 to 1.11, p = 0.004). Frequency of “3 times weekly” was found to be statistically significant for improving CRF (ES = 1.07, 95% CI 0.37 to 1.77, p = 0.003). Duration of an intervention that was “10-15 weeks” yielded statistically significant in improving CRF (ES = 1.02, 95% CI 0.27 to 1.27, p = 0.002). The effects of CRF interventions were moderate to significant (ES = 0.59, 95% CI 0.50-0.88), with high heterogeneity (I² = 94 %). There was no sex difference (p = 0.07) in terms of the interventions.

CONCLUSIONS: Exercise interventions achieving at least 60% of HRmax, meeting 3 times weekly for 10-15 weeks seem to have a positive effect on CRF among adolescents, but there is a high heterogeneity among those studies.

Dose-response Effects Of Exercises In Children With Asthma: A Review
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PURPOSE: Exercise is shown to improve pulmonary function of asthmatic children, reduce asthma-related symptoms, and reduce physician office visits. Exercise can also improve physical fitness and quality of life for both children and their parents. This systematic review provides a summary of the dose-response effects of various exercise interventions for children with asthma, specifically pulmonary function, asthma-related symptoms and quality of life.

METHODS: A systematic search in several databases was performed. Fourteen randomized controlled studies of exercise interventions for children with asthma (aged 7-14 yrs.) were identified and compared. The effect size (ES) and 95% confidence intervals (CIs) were computed and summarized.

RESULTS: Four studies were included in this review. Most of the studies performed a randomized controlled study design (93%), with 19 to 61 participants. Length of interventions ranged from 4 to 15 weeks. Aerobic exercises like swimming and Tai-Chi, were employed in 12 of 14 studies (86%). Anaerobic training was employed in 1 of 14 studies (7.1%). Exercise interventions with moderate to vigorous intensity, 50%-75% VO2max, were shown to most effectively improve cardiovascular fitness as well as pulmonary function for asthma control. Interventions with a duration from 8 to 12 weeks with a frequency of 2 to 4 times a week showed statistically significant improvements in pulmonary function. Pulmonary function was indicated by forced expiratory volume (ES= -0.77, 95% CI, 0.56 to 0.99, p = 0.002), peak expiratory flow rate (ES= -0.50, 95% CI 0.25 to 0.97, p = 0.007) and maximal inspiratory/expiratory pressure (ES = 0.80, 95% CI 0.36 to 1.21, p = 0.008). Most of the studies demonstrated reduced symptoms and physician visits, along with increase in self-reported quality of life.

CONCLUSIONS: Exercise interventions are safe and beneficial to asthmatic children. Effective interventions are suggested to have a duration of three months, with 3 training sessions per week consisting of 40-50 min of aerobic exercise. Moderate to vigorous intensity is recommended with resting period during each session.

Exercise Interventions for Children with Autism: A Review
Samuel Streeter, Zezhao Chen, and Weimo Zhu. University of Illinois at Urbana-Champaign. (No relevant relationships reported)

PURPOSE: Autism is a spectrum of closely-related disorders with a collective core of symptoms. Research has been conducted to determine what the best exercise intervention for autism would be. However, the dose response of an exercise intervention for autism was not known. The purpose of this study was to determine the dose response of exercise interventions for children (aged 2-12 yr. old), with autism spectrum disorder (ASD). Method: A systematic review of research, published from 1985 to 2017, was conducted using a number of criteria, including application of an exercise intervention for individuals diagnosed with ASD and utilization of an experimental/quasi experimental, correlational, single-subject, or qualitative research design. The standardized mean differences and 95% confidence intervals (95% CIs) were calculated as the effect size measures (ES). Results: 25 articles were identified using Google Scholar, Web of Science, and Ovid MEDLINE, but only 10 met the criterion for the review. Of the 10 were randomized control trials, 3 were repeated measure trials, 2 were multiple-baseline studies, and 1 was a pilot study. Eight (80%) included aerobic types of exercises. Nine (90%) employed moderate intensity (64%-76% HRmax). The intervention length and duration that had the largest ES would be 20-45 minutes 3-4 days per week for 10-12 weeks. Seven (70%) included results that showed improvement in “social and behavioral issues” and “motor skill development” from pre-to post trial. One (10%) showed an effect size that was statistically significant (ES= 0.8, 95% CI 0.17-2.04, p = 0.00). Conclusion: The exercise interventions with moderate intensity, 20-45 minutes, 3-4 days per week, and lasting 10-12 weeks seemed helpful for children with autism.
RESULTS: (1) regional characteristics: the overall trend of urban girls aged 7-17 in China showed an upward trend, from east to west, from coastal to inland gradient decreasing trend. 5 provinces in North, 4 provinces in Northeast, 6 coastal provinces in southeast and Xinjiang Uygur Autonomous Region, higher than the central and northwest provinces.(2) characteristics of the times: With the increase of he year, the differences between provinces and cities gradually reduced . Until 2014, short students in all provinces had been eliminated. This feature is most significant change in Inner Mongolia from 1991-2000.(3)There was significant positive correlation between the temperature and the height of the urban girls in China. The temperature was positively correlated with the height of the female. The precipitation had a negative correlation with the height of the urban girls.

CONCLUSIONS: Air pressure and sunshine make a positive influence of girl's height, while a negative influence on temperature. The general trend of Chinese Female Students' height presented a trend of declining from east to west and decreasing from coastal to inland. GIS strong data management analysis and display function is the good way to explore the quality of students physical fitness database. It will serve and apply to student physique promotion and intervention.

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Thirty Years Secular Trend Of Rest Heart Rate In An Epidemiological Transition Society

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(Purpose) to analyze the rest heart rate secular trend among schoolchildren from Ilhabela, a city in a marked epidemiological shift. Methods: the study is part of the Mixe-Longitudinal Project on Growth and Development from Ilhabela, organized by CELAFISCS since 1978. Sample consisted of 197 boys, aged 12 to 14 years-old, divided into 4 decades: 1978 (n=41), 1988 (n=43), 1998 (n=61), and 2008 (n=52). Measures included body weight and height, and rest heart rate (RHR) measured right before a bicycle ergometer test. Statistical analysis included an ANOVA one way to determine eventual differences among RHR from different decades. A post hoc Scheffé test was used to localize these differences. A level of p<0.01 was taken as significant. Results: Mean RHR was 81.3 bpm in the 1978 decade, of 85.2 bpm in 1998 decade, of 89.4 bpm in 1998 decade, and of 91.7 bpm in the 2008 decade, confirming a positive secular trend with a significant increase of RHR between 1998 and 2008 in comparison to 1978 values. It represented an increase of 9.1% and 11.3%, respectively, when compared 1998 and 2008 values in 1978. It was also noted an increase in 1.4 kg in body weight, and an increase of BMI from 17.1 to 18.1, suggesting an important change in level of physical activity and/or diet. Conclusion: This positive secular trend in RHR values between 1978 and 1998 and 2008 represents a signal of cardiovascular health deterioration in that community under marked epidemiological shift, as consequence of a decline in active life standards.

1904

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Knowledge of the Adult and Youth 2008 Physical Activity Guidelines for Americans

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(Purpose): The 2008 Physical Activity Guidelines for Americans recommends adults engage in at least 150 minutes/week of moderate-intensity aerobic equivalent physical activity to achieve substantial health benefits. Youth should engage in 60 minutes of physical activity daily to receive overall health benefits. This study estimated the proportion of U.S. adults knowledgeable of the adult aerobic guideline and the proportion of parents knowledgeable of the youth aerobic guideline. METHODS: Data from a nationwide sample of U.S. adults who completed the 2017 Summer Consumer Surveys were analyzed. Participants were asked to identify the government recommended amount of physical activity needed for adults and youth to gain health benefits. Knowledge was defined as a response of “150 minutes spread out over a week” for the adult guideline, and “60 minutes, 7 days a week” for the youth guideline. RESULTS: Estimated of U.S. adults knowledgeable of the adult aerobic guideline was 22.9% (95% CI: 20.5, 25.7%) of parents were knowledgeable of the youth guideline. Knowledge of the adult guideline differed among respondents by sex, education, income, physical activity level, and BMI category, while knowledge of the youth guideline differed by parental education and physical activity level. For example, knowledge of the adult and youth guideline was lowest among those with a high school degree or less compared to those with a college degree or higher (adult: 1.9% [95% CI: 1.2, 2.6] versus 4.0% [95% CI: 2.9, 5.3]); youth: 16.1% (95% CI: 12.3, 20.8) versus 24.9% (95% CI: 21.1, 29.2). CONCLUSIONS: Despite the release of the 2008 Physical Activity Guidelines for Americans nearly a decade ago, most U.S. adults and parents lack knowledge of the adult and youth aerobic physical activity guidelines. Effective communication strategies may help raise awareness of current and future editions of national guidelines for physical activity.

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Member Movement Rates Of Fitness Facilities In England

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(No relevant relationships reported)

PURPOSE: Low retention rates of fitness centre customers have previously been reported in the UK. To understand the scale of this problem, data were collected from fitness centres across England with respect to acquisition and attrition rates, or ‘rate of movement’. METHODS: Data were obtained from 481 fitness facilities throughout England during 2016 (private 22%; public 73%; university <1%; council operated 4%), resulting in a representative sample of the UK fitness sector. Movement rates, which are defined as the net gain or loss of members from the beginning to the end of each month, are the main outcome measure, and are analysed using Friedman’s Two-Way ANOVA. Wilcoxon Signed tests, and linear regression, with significance set at p<0.05. RESULTS: An average annual movement rate of 0.12±0.03% (95% CI: 0.10 to 0.14) was calculated across all centres. A comparison of the data provided for each quartile resulted in significant differences between all quartiles (p<0.001). The highest movement rate was observed during the first quartile of the year (2.29±0.04%), with a continuous decrease until quartile four (1.38±0.02%). The rate reversed in quartile three from a net gain towards a loss of members. Regression analysis demonstrated a significant correlation between calendar month and movement rate (R=0.816, p<0.001), where calendar month explained over 60% of the variation (adjusted R²=0.632). On average, movement rates decreased by 0.4% each month (B=-0.404, 95% CI (-0.606 to -0.202)). CONCLUSIONS: Fitness centres in the UK only report a net increase of members during the first six months of the year, with a constant decrease in rates for each quartile. This indicates the need for interventions aiming to increase retention rates of members of fitness facilities. More information is needed to correlate attrition rates with member characteristics to identify high risk customers and develop suitable interventions.

1906

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Improving the Operationalization of Neighborhood Built Environment Exposures in Physical Activity Research: Houston TRAIN Study

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(No relevant relationships reported)

PURPOSE: Although evidence links the built environment (BE) to physical activity, findings remain inconsistent. Baseline Houston TRAIN study data were used to examine how geographic scale affects the relation between neighborhood BE measures (NBEMs) and physical activity. METHODS: Determine if model fit and statistical significance of the associations between NBEMs and physical activity vary by participant-centric buffer sizes and identify an optimal geographic scale for operationalizing NBEMs. METHODS: Using Geographic Information Systems, participant addresses were geocoded and a series of street-network, participant-centric buffers were built, with radii 250m-2500m in 250m increments. NBEMs studied were park access and transit stop access (counts/buffer). Physical activity was measured with wGT3X-BT Actigraph monitors, and weekly minutes of moderate to vigorous physical activity (MVPA) were estimated using Freedon cut-points. Linear regressions were run estimating the association between NBEMs and MVPA per buffer size. Optimal geographic scale was determined based on model fit (R²) and statistical significance. RESULTS: Data were available for 337 adults. For park access, significant (p<0.05) associations were observed at buffer sizes 225m and 250m. The 250m scale had the best fit (R²=0.15). Each additional park in the 250m buffer was associated with 1.0 additional minutes of weekly MVPA. The interquartile range for number of parks within 2500m was 13. For transit access, significant associations with MVPA were observed at all scales. The highest R² (0.16) was at 2000m. Each additional transit

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stop within 2000m was associated with 1.1 additional minutes of weekly MVPA. Those living in the highest quartile of transit access had 79 more transit stops within 2000m than those in the lowest quartile.

CONCLUSIONS: Larger scales (>2000m, i.e. ≥24 min walk) than those commonly used in physical activity research (400-1000m) may be better suited for studying the relation of the BE with physical activity. Despite low effect sizes per unit increase, the geospatial variability of park and transit access is large, and could account for substantial differences in physical activity across Houston. Supported by NIH R01 DK101593.

1907 Board #168 May 31 2:00 PM - 3:30 PM
Objectively Measured Physical Activity and Self-Reported Screen Time Behaviors in Omani Children: A Cross-Sectional Study
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World health organization recommends that children engage in at least 60 minutes of moderate- and vigorous-intensity PA (MVPA) per day, with at least 30 minutes of MVPA being achieved afterschool hours. Worldwide, the evidence shows that the prevalence of meeting PA recommendation in children is low. But the majority are from the Western and Asian countries and there is little data available from a country in the Middle-East that have different ethnic and cultural backgrounds. PURPOSE: This study examined the levels and patterns of objectively measured MVPA during afterschool hours in Omani children and to relate them with the self-reported PA and screen time behaviors. METHODS: 4th-grade children attending public elementary schools in Oman during October 2017 participated in the cross-sectional survey. A stratified, two-stage cluster sampling method resulted in a total of 324 children (boys=144; mean age=9.16 yrs old) completing all measures. Children were asked to wear the Polar Active watch across the three consecutive school days and to complete a questionnaire on PA and screen time behaviors. 30-sec epoch, metabolic equivalent (MET) data obtained from the device were used to estimate time spent in sedentary (≤2) and MVPA (≥4) during 7-hour of afterschool period. RESULTS: On average, boys were less sedentary (251.3 mins/d) and more active, with greater MVPA (35.9 mins/day) and vigorous-intensity PA (VPA; 11.5 mins/d) than girls (251.3 mins/d, 26.0 mins/d, and 5.3 mins/d, for sedentary, MVPA, and VPA, respectively). Boys (69.9%) were more likely meeting 30-min MVPA guideline than girls (30.9%; Odds Ratio = 0.3). Most children reported one or less hours of watching TV (76.6%) and using computer/video games (85.5%) during school days, with girls being more likely to report No-TV watching (20.0%) or using computers (62.8%) than boys (13.2% and 41.67%, respectively). Girls are less likely participating in at least one sport team outside of school (45.0%) than boys (62.5%); yet PA and screen time behaviors were not associated with a likelihood of meeting 30-min VPA guideline.

CONCLUSIONS: The results showed that objectively measured PA levels of Omani children during afterschool hours are similar with those from the western countries. However, gender-disparities shown in the results should receive further attention.

1908 Board #169 May 31 2:00 PM - 3:30 PM
Prevalence And Characteristics Of Us State-level Physical Activity And Public Health Planning
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PURPOSE. The prevalence and attributable risk of disease due to physical inactivity requires it be made a public health priority. Public health planning allows for prioritization and resource allocation, particularly at the state and local level. The extent to which state planning efforts for physical activity exist in the US is unknown. METHODS. We developed and conducted a standardized internet search audit of each of 50 US states and the District of Columbia to determine the prevalence and characteristics of health planning documents that include physical activity. Data regarding prevalence and characteristics and degree of alignment with existing physical activity guidelines were abstracted for each state. RESULTS. Overall, physical activity was part of 215 health planning documents in 50 states. These documents ranged from those addressing various chronic diseases in adults, physical education in children and/or adolescents, or specifically stand-alone physical activity physical activity plans (n=2). Only 9.8% of documents specifically mentioned older adults as a priority population. For children and adolescents, 28.5% of documents aligned correctly with current aerobic activity physical activity guidelines, 6.6% with current muscle strengthening guidelines and 5.3% with current bone-strengthening guidelines. For adults, 28.5% of health planning documents aligned with current aerobic activity guidelines and 11.6% aligned with muscle strengthening guidelines. Only 22 (11%) of state planning documents aligned entirely with the US National Physical Activity Plan sector-based approach to physical activity promotion.

CONCLUSION. Efforts to improve state-level physical activity planning in the US are needed.

1909 Board #170 May 31 2:00 PM - 3:30 PM
Global Physical Inactivity
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The World Health Organization (WHO) labelled physical inactivity the fourth leading risk factor for global mortality. The rate of physical inactivity is increasing globally. Participating regularly in physical activity reduces risk for many non-communicable diseases. PURPOSE: To investigate the extent of physical inactivity, causative factors, and common obstacles. METHODS: A descriptive analysis of data generated by the WHO, governmental, and non-governmental organizations was conducted to discern the extent of physical inactivity, causative factors, and common obstacles. Percentages were calculated and analyzed to provide global, regional, and individual country profiles of physical inactivity. RESULTS: Data are not available from all countries equally. Wide variability exists between countries as to the prevalence of, and obstacles causing physical inactivity. Almost one-third of adults are physically inactive globally (15.0% in Southeast Asia to 43% in the Region of the Americas and the Eastern Mediterranean Region). The prevalence was lowest in South-East Asia (15%) and Africa (21%). Women were less active then men with differences of 10% and greater in some areas and greatest in the Eastern Mediterranean Region and Region of the Americas. Physical inactivity was highest in countries with technologic advancement. CONCLUSIONS: Physical inactivity is a global issue affected by regional factors. It is also a universal problem world-wide and a leading cause of non-communicable diseases. Common factors: age, health, sex, socio-economic status, and urbanization are associated with the level of physical activity/inactivity. Cultural and religious factors limit opportunities for women in many places. Countries with high levels of physical activity rely on human powered transportation and physical labor. Leisure-time physical activity is low in all countries and does not make up for the lost activity associated with access to technology.

1910 Board #171 May 31 2:00 PM - 3:30 PM
Differences in Park Plans and Policies Across US Municipalities
Erin L. Peterson. 1CDC, Atlanta, GA. (Sponsor: David R. Brown, FACS1) (No relevant relationships reported)

Purpose: Park use has been positively associated with physical activity, and people are more likely to use parks they perceive to be safe and attractive. Park planning documents and municipality policy or budget provisions that address park safety and maintenance can play an important role in promoting park use. This study examines differences in the presence of park plans, policies, or budget provisions by municipality characteristics and examines the association between presence of park plans and municipal policy or budget provisions to provide safe and well-maintained parks.

Methods: Data from a survey of local officials from the 2014 National Survey of Community-Based Policy and Environmental Supports for Healthy Eating and Active Living (CBS HEAL) were analyzed for a nationally representative sample of US municipalities (n=2005, response rate: 45%). Data were merged with Census data to determine municipality characteristics, and ESRI Street Map Premium’s HERE GIS database to determine number of local parks in respondent municipalities. Prevalence of a parks and recreation plan, and policies or budget provisions (related to lighting, maintenance, police and security, and maintenance of green space and equipment) were analyzed using survey weights to create national estimates.

Results: Overall, 68% of US municipalities had a parks and recreation plan. A higher prevalence of plans was observed among municipalities that had more parks (≥2 compared with 0 or 1), had a larger population size, were classified as urban, were located in the West, and had a higher median municipal education level. Prevalence of specific policies or budget provisions in parks or outdoor recreation areas was 78% for lighting, 85% for patrols by police and security, and 87% for maintenance of green space and equipment. The presence of each policy or budget provision had a positive association with presence of a parks and recreation plan (p < 0.05) and population size (p < 0.05), controlling for other municipality characteristics.

Conclusions: About 7 out of every 10 US municipalities have a parks and recreation plan. Addressing differences across municipalities in plan prevalence can be an important step toward improving access to safe and well-maintained parks.
Adequate energy availability (EA) is important for the health of female athletes. EA is calculated by subtracting exercise energy expenditure from total energy intake, and normalizing by fat-free mass (FFM). The international consensus statement indicates that reproductive function, energy metabolism, endocrine function, and bone health are affected by the threshold of EA, which falls below 30 kcal/kg FFM/day. However, several previous studies have reported that low EA is not associated with menstrual function or metabolism. Further, these data have been based on active women of Caucasian, European, or European-American descent. There are no published scientific studies regarding EA in Asian athletes.

METHODS: Fifteen collegiate athletes participated in this study. Menstrual status was based on self-reported menstrual history and confirmed by the ovulation test kit. Energy intake was determined by 3-day weighed food records. Exercising energy expenditure was assessed by the HR-VO₂ method. REE was measured by indirect calorimetry using the Douglas bag technique during the early follicular phase. Body composition was measured by dual-energy X-ray absorptiometry (DEXA). RESULTS: Subjects with lower EA (<25 kcal/kg FFM/day) had lower REE/FFM than those with normal EA (25.2±3.1 vs. 27.0±2.4 kcal/kg FFM/day, p < 0.05), and had lower triiodothyronine (T₃) levels (80.8±8 vs. 101±9 ng/dl, p < 0.01). In addition, energy intake level was significantly lower (1615±317 kcal/day vs. 2102±364 kcal/day, p < 0.05) in subjects with lower EA. However, the levels of estradiol, insulin-like growth factor 1, luteal hormone, follicle stimulating hormone, and progesterone were not significantly different between the two groups.

CONCLUSIONS: In Japanese female athletes, energy metabolism was suppressed in subjects with lower EA, which was under 25 kcal/kg FFM/day, and was associated with lower REE due to lower T₃ levels. Thus, lower EA may influence energy metabolism in Japanese female athletes.

PRACTITIONERS: relative energy deficiency affects the health and performance of both female and male athletes. It is important to understand the total energy expenditure (TEE) and physical activity level (PAL) required by each sport to prevent energy deficiency. The purpose of this study was to examine energy deficiency and PAL in Japanese male runners, with a particular focus on the different training periods and characteristics of the sports.

METHODS: The subjects were 4 Japanese male sprint runners (SP group: age, 19.9±0.8 yr; height, 174±4.7 cm; body weight, 64.5±2.7 kg; body mass index (BMI), 21.2±0.3 kg/m²) and 5 Japanese male endurance runners (EN group: age 19.8±0.9 yr; height, 172±2.6 cm; body weight, 59.1±4.9 kg; BMI, 19.9±0.8 kg/m²). The evaluation index for energy deficiency was energy balance (ΔEE), which was calculated by subtracting the TEE from energy intake (EI) during normal training (NT) and tapering training (TT) periods. TEE was determined using the double-labeled water method. The PAL was defined as TEE divided by resting energy expenditure (REE), which was measured using a gas analyzer. Physical activity energy expenditure (PAEE) was determined by subtracting REE and diet-induced thermogenesis from TEE. EI was determined through self-reported dietary records.

RESULTS: The PAL and PAEE values in the SP group during the NT period were significantly higher than those during the TT period (p < 0.05 for both parameters), which was due to decreased training volume during the tapering period. Meanwhile, no significant differences between the NT and TT periods were observed in the EN group. Furthermore, the EI in the SP and EN groups did not change during the NT and TT periods, and the EI for all athletes was found to be insufficient, as a negative EB was observed in both groups. CONCLUSIONS: Our results identified severe energy deficiency in Japanese runners because the EB in both groups was negative. In particular, the PAL in the SP group changed during the training seasons, whereas the EI did not change. EI cannot be adjusted according to PAL, which may be the cause of energy deficiency. Therefore, EI for athletes can be managed by adjusting the PAL based on the type of sport and training period.

The ingestion of water is purported to enhance resting metabolic rate (RMR) and because of the absence of calories in water, it may be considered part of a weight loss intervention. This premise is not without controversy. Boschmann, et al. report a 30% increase in RMR following the ingestion of 500 mL of 22°C water at 40 min post ingestion, while Brown, et al. report no difference following ingestion of 480 mL of either distilled water or saline. PURPOSE: The purpose of this study was to determine the thermogenic effect of consuming two temperatures (4°C and 37°C) of water and two volumes of distilled water (7 and 21 mL) on body mass on metabolism. METHODS: 10 subjects (age 22.3±1.3 yr; ht 1.74±0.52 m; body mass 75.1±18.5 kg; 4 f) reported to the lab in a eucaloric state after being instructed to avoid ingestion of food and beverage (other than water) for 10 hrs and abstained from water for 2 hours prior to each trial. Subjects rested for 30 minutes on an examination table, in a quiet, dimly lit, 23°C lab. RMR was obtained by open circuit spirometry for ten minutes at the conclusion of the 30 minutes of rest (PRE), as well as four additional 10 min samples at 20 minute intervals following water ingestion (T1, T2, T3 & T4). Immediately following the PRE RMR, subjects ingested C7, C21, H7 or H21 with the volume calculated from individual bm at a mean of 526 and 1577 mL for 7 and 21 min post ingestion, respectively. Subjects served as their own control in the randomized assignment of trials. RESULTS: Statistical analysis by factorial ANOVA revealed NSD (p > 0.05) for changes in energy cost. The greatest deviation from the average RMR was a NSD of 4.4%, 6%, -4.2%, and 4.3% for C7, C21, H7, and H21, respectively.
Cross-sectional study of college tennis coaches’ nutrition knowledge was conducted.

Methods: Eighteen collegiate tennis athletes were classified into two groups; the Menstrual Status Among Japanese Female Athletes.

Abstracts were prepared by the authors and printed as submitted.

Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

Methods: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileaje; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy X-ray absorptiometry. Kilocalorie and macronutrient intake were assessed utilizing an online application. Subject weights were also recorded to assess the energy intake and expenditure ratio in these groups.

Results: Subjects in the middle distance group had a higher weekly mileaje (83.6±30.2 vs. 30.5±7.4 miles) and a lower Body Mass Index (BMI) (22.2±2.1 vs. 23.6±1.1) compared to the long distance group. Resting metabolic rate (RMR) was significantly lower in the middle distance group (260±58 vs. 269±67 kcal/day) and the Body Composition Analysis revealed a higher percentage of body fat (%BF) in the middle distance group (26.7±5.8 vs. 24.9±3.7 kg/m²).

Conclusion: This study suggests that middle distance female runners have a lower resting metabolic rate and a higher body fat percentage compared to long distance female runners. Further research is needed to determine the long-term impact of these differences on athletic performance and health outcomes.
availability (NEA) trial. Energy availability was manipulated to set as 20 kcal/kg FFM / day for LEA trial and 45 kcal/kg FFM / day for NEA trial, respectively. The subjects completed three consecutive days of endurance training (75 min of treadmill running at 70% of VO\textsubscript{2max}) during days 1-3. Venous blood samples were collected in early morning on days 1-4 and 3 h after exercise completion on day 3. Serum hepcidin, ferritin, iron, myoglobin and plasma IL-6 levels were evaluated. Muscle glycogen contents were evaluated in early morning on days 1-4 by C-MRS.

RESULTS: Average VO\textsubscript{2max} was 2.08±0.61 kcal/day in LEA trial and 3.96±0.90 kcal/day in NEA trial (p<0.001). Muscle glycogen content were decreased in LEA trial during days 2.4±0.5 vs. (p<0.05) days 1) whereas no significant change was observed in NEA trial. Area under the curve of serum hepcidin levels during days 1-4 was significantly higher in LEA trial (40.2±11.8 ng/ml in LEA trial) than in the NEA trial (17.0±6.0 ng/ml, p=0.04).

CONCLUSIONS: Three consecutive days of endurance training under LEA decreased muscle glycogen content and increased serum hepcidin levels in male long distance runners.

1920 Board #181 May 31 2:00 PM - 3:30 PM
The Effects of Wearing Cold Garments on Energy Expenditure
John P. Porcari, FACSM, Samuel Hartinger, Scott Doberstein, Kimberly Radtke, Abigail Ryskey, Carl Foster, FACSM. University of Wisconsin - La Crosse, La Crosse, WI. (No relevant relationships reported)

Stimulation of brown adipose tissue (BAT) by cold exposure purportedly upregulates such products are the Cool Fat Burner and the Cool Gut Buster. The Cool Fat Burner garments that contain ice packs and are designed to be worn over these areas. Two places ice packs against the shoulders and neck, while the Cool Gut Buster targets the rest phase, wore both the Cool Fat Burner and the Cool Gut Buster during the high-intensity phase, and wore both garments and drank cold water during the low-intensity phase. Both were trained in the laboratory and wore each garment for six sessions. Both groups wore garments for 60 minutes, with each session lasting 30 minutes. During the low-intensity phase, subjects completed 30 minutes of walking at 63% of their VO\textsubscript{2max}. During the high-intensity phase, subjects performed 30 minutes of cycling at 85% of their VO\textsubscript{2max}.

RESULTS: During the low-intensity phase, both groups burned similar amounts of energy. However, during the high-intensity phase, the Cool Fat Burner group burned significantly more energy than the Cool Gut Buster group (28.3±6.1 kcal vs. 21.9±4.7 kcal, p<0.05). No significant differences were observed in heart rate or RQ between the two groups.

CONCLUSIONS: Wearing cold garments resulted in a significant increase in energy expenditure. However, the magnitude of the increase may not be practically useful as a weight loss tool.

1921 Board #182 May 31 2:00 PM - 3:30 PM
Test of Two Distinct Protocols in Indirect Calorimetry
Andressa F. de Abreu, Anderson Santana, Domingos R. Pandeljo Jr. Centro de Alta Performance, Santos, Brazil. (No relevant relationships reported)

Andressa F de Abreu; Anderson Santana; Domingos R Pandeljo Jr. High Performance Center (CAP). Federal University of Sao Paulo/UNIFESP

Indirect calorimetry is an interesting tool for establishing diets. Through this test we can calculate the resting metabolic rate and the percentage of carbohydrate and fat oxidation in the energy metabolism.

Purpose: Although it is an important exam, in clinical practice, it is observed that there is no standardization in relation to the protocols used to perform the exam. Some are done with the patient in the sitting position while others are done with the patient in the lying position. The objective of this research was to verify the existence, or not of differences, in practical terms, in relation to such protocols.

Methods: To perform the tests, 10 volunteers, all male, and physically active were selected. The mean height of the volunteers was 1.75m (SD 12.18 cm) and the mean weight was 74.78 kg (SD of 11.32 kg). A properly calibrated gas analyzer was used, as recommended by the manufacturer. Gas collection was established with a 30-minute duration and was performed on the same day. Each volunteer did a sit-down and lay-down. The interval between one evaluation and another was recorded within 15 minutes. To verify the existence or not of differences between the groups (sitting) and (lying down) the Hedges g was used as a measure of effect size. The purpose of such a measure was to assess practical significance.

Results: As can be seen in Table 1, there was no difference in the resting metabolic rate, and even in the case of oxidation of energetic substrates (fat and carbohydrate), the difference was not significant, considering the mean, since the effect size (hedges g) was 0.012.

Conclusions: For clinical purposes, the use of the sitting or lying position does not present differences in terms of resting metabolic rate, as well as energetic substrate oxidation.

Table 1: RMR and Oxidation of FAT and CHO

<table>
<thead>
<tr>
<th></th>
<th>RMR (sitting and lying)</th>
<th>% Fat Sitting Lying</th>
<th>% CHO Sitting Lying</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1885.0</td>
<td>48.82</td>
<td>51.18</td>
</tr>
<tr>
<td>2</td>
<td>1777.3</td>
<td>41.03</td>
<td>58.97</td>
</tr>
<tr>
<td>3</td>
<td>1279.8</td>
<td>16.83</td>
<td>83.17</td>
</tr>
<tr>
<td>4</td>
<td>1332.8</td>
<td>7.25</td>
<td>92.75</td>
</tr>
<tr>
<td>5</td>
<td>1502.6</td>
<td>5.09</td>
<td>94.91</td>
</tr>
<tr>
<td>6</td>
<td>1526.0</td>
<td>21.47</td>
<td>78.53</td>
</tr>
<tr>
<td>7</td>
<td>1598.8</td>
<td>43.22</td>
<td>56.78</td>
</tr>
<tr>
<td>8</td>
<td>1958.7</td>
<td>24.63</td>
<td>75.37</td>
</tr>
<tr>
<td>9</td>
<td>1958.7</td>
<td>43.78</td>
<td>56.22</td>
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<tr>
<td>10</td>
<td>1516.6</td>
<td>74.83</td>
<td>25.17</td>
</tr>
<tr>
<td>11</td>
<td>1311.6</td>
<td>74.83</td>
<td>25.17</td>
</tr>
<tr>
<td>Mean</td>
<td>1604.9</td>
<td>38.52</td>
<td>61.14</td>
</tr>
<tr>
<td>SD</td>
<td>268.5</td>
<td>22.98</td>
<td>20.78</td>
</tr>
</tbody>
</table>

Conclusion: Wearing cold garments resulted in a significant increase in energy expenditure. However, the magnitude of the increase may not be practically useful as a weight loss tool.
METHODS: Blended CO$_2$ and N$_2$ simulated VO$_2$ by displacing O$_2$ and added CO$_2$ represented VCO$_2$. Traceability to NIST was maintained by calibrating the infusion system to a primary standard. Three MC were tested (Max II, AEI Technologies, Pittsburgh, PA; and two TrueOne 2400, Parvo Medics, Sandy, UT). MC were prepared and flow set as recommended by the manufacturer. High and low inflows (Low: VO$_2$ = 230, VCO$_2$ = 170 mL/min, EE = 1.1 kcal/min, RQ = 0.74; High: VO$_2$ = 330, VCO$_2$ = 287, EE = 1.6, RQ = 0.87) were made for 10 min followed by a null test. Gases were delivered into the MC matching chamber. VO$_2$ and VCO$_2$ calculated by MC were averaged for 7 min. Average error was differences between simulated and measured VO$_2$ and VCO$_2$.

RESULTS: Infusions were made without leaks despite differences in MC design. VO$_2$ and VCO$_2$ measurements ran off the TrueOne 2400. High infusion error was 2.6% (Range: 1.7 to 3.9%) for VO$_2$ and 1.9% (Range: 0.5 to 2.3%) for VCO$_2$. Low infusion error was 6.5% (Range: 4.3 to 8.6%) for VO$_2$ and 1.7% (Range: 1.7 to 2.9%) for VCO$_2$. VO$_2$ and VCO$_2$ inflows were run on the Max II: High infusion error was 7.4% (Range: 5.0 to 13.4%) for VO$_2$ and -3.2% (Range: -8.9 to 3.0%) for VCO$_2$. Low infusion was 8.9% (Range: -6.2 to 17.8%) for VO$_2$ and -3.2% (Range: -15.4 to 7.5%) for VCO$_2$. Variations were seen in baseline O$_2$ and CO$_2$ readings taken at the beginning of the test then every 5 min: O$_2$ (20.85 - 20.94 vol%); CO$_2$ (0.037 - 0.12 vol%).

CONCLUSIONS: Gas infusions are an indepedently traceable standard providing calibration and validation for most RC across a wide range of VO$_2$ and VCO$_2$. Traceability also establishes a standard between labs independent of model and manufacturer. Extending the same techniques to MC provides essential assurance to users, allows data to be analyzed between locations, and enables manufacturers to improve performance. More testing will determine best practices for MC, and possibly reduce the effects of environmental changes on MC.

1923 Board #184 May 31 2:00 PM - 3:30 PM
Comparison of Predicted and Measured Resting Metabolic Rate Methods Among CrossFit-Trained Athletes.
Ayliis Rodriguez, Isabel Fabacher, Kathryn Brown, Alyssa J. Holmes, Trisha A. VanDusseldorp, Gerald T. Mangine, Tiffany A. Emsiat, Yuri Feito, FACSM. Kennesaw State University, Kennesaw, GA.
(No relevant relationships reported)

The use of prediction equations and machinery estimation for the assessment of resting metabolic rate (RMR) has grown in popularity. While RMR is crucial when assessing dietary intakes, the accuracy may be dependent on the distinct characteristics of the individual. PURPOSE: To compare RMR assessed by indirect calorimetry with estimates obtained from three predictive equations for a group of advanced CrossFit-trained athletes. METHODS: RMR was estimated for six-experienced CrossFit-trained athletes [3 men (27.5 ± 6.5 yrs.; 87.5 ± 5.9 kg; 179.2 ± 2.2 cm), and 3 women (27.7 ± 1.5 yrs.; 68.7 ± 3.3 kg; 168.1 ± 5.3 cm)] using the ParvoMedics 2400 metabolic system (ParvoMedics, Sandy, UT). RMR was calculated using the Harris-Benedict (HB), Mifflin-St. Jeor (ME) and Nelson (NE) prediction equations. All data is presented as mean ± standard deviation (M ± SD). RESULTS: Repeated measures analysis of variance revealed significant differences among the four models (F(3) = 7.1, p = 0.003, δ = 0.59), where a greater (p = 0.01) predicted RMR was seen in baseline O$_2$ and VCO$_2$. PRiming the chamber to a CO$_2$ level that brings the chamber into its calibrated range could significantly reduce the time after a participant enters a whole-room calorimeter before valid data is observed. This could improve experimental efficiency and reduce participant burden by 80 min on average.

1924 Board #185 May 31 2:00 PM - 3:30 PM
Priming Whole-room Calorimeters With CO$_2$ To Improve Performance And Reduce Test Time
Michael Busa1, Eric Rudd2, Erica Wolhers-Kariach2, Jon Moon2.
1University of Massachusetts Amherst, Amherst, MA; 2MEI Research, Ltd., Enida, MN. (Sponsor: Patty Freedson, FACSM)
(No relevant relationships reported)

PurPOSE: Studies using whole-room calorimetry to quantify resting and/or long-term metabolic rate often exclude initial data from analysis. Controlled gas infusions to simulate metabolic rate also show higher error in these initial measurements. This study examined if infusing CO$_2$ into the chamber prior to measurement reduced the time before measurements are within error specifications. We hypothesized that priming the chamber to 0.2% CO$_2$ will significantly reduce the time to get valid measurements of VO$_2$ and VCO$_2$.

METHODS: We used a precision gas blender to infuse pure gases (N, and CO$_2$) into a 32,500 L metabolic chamber (MEI Research Ltd, Edina, MN). Five different infusion profiles constructed to mimic VO$_2$ and VCO$_2$, associated with 1.1 METS in 50, 70, 90, 110, and 130 kg individuals with an RQ of 0.74, with and without infusing CO$_2$ to bring the chamber to 0.2% CO$_2$ prior to infusion. Ambient inflow rate to the chamber was held constant at 45 L•min$^{-1}$. Additionally, an 88 kg male individual completed a resting metabolic rate study and the time it took to for the chamber to reach 0.2% CO$_2$ i.e. enter the validated range, was found experimentally. A pairwise-t test was used to compare the time before both VO$_2$ and VCO$_2$ to exhibit error of less than 4% in CO$_2$ primed vs. ambient (~0.04% CO$_2$) conditions, α=0.05. For the human data, the time it took for the chamber to reach 0.2% CO$_2$ is reported. No statistical comparison was made for the human data.

RESULTS: Priming the chamber to 0.2% CO$_2$ significantly (p=0.02) reduced the time it took for the chamber to be brought into the calibrated range. Specifically, when the chamber was primed to 0.2% CO$_2$, it took 101, 91, 62, 75, and 31 min before the infusion data came within the chamber specification compared to greater than 120 min in every condition when the chamber was not primed. It took 190 min before the chamber reached the 0.2% CO$_2$ when the participant entered a chamber with ambient CO$_2$ levels.

CONCLUSIONS: Priming a metabolic chamber to a CO$_2$ level that brings the chamber into its validated range could significantly reduce the time after a participant enters a whole-room calorimeter before valid data is observed. This could improve experimental efficiency and reduce participant burden by 80 min on average.

1925 Board #186 May 31 2:00 PM - 3:30 PM
The Effects Of Aerobic, Concurrent, And Resistance Exercise On Compensatory Eating Behaviors
Mark P. Takacs, Shawn Munford, Chad A. Wittmer, Emily J. Sayers. East Stroudsburg University, East Stroudsburg, PA.
(No relevant relationships reported)

Obesity is a worldwide epidemic and can be defined as a disorder of positive energy balance, which occurs when the amount of energy consumed is greater than the amount of energy expended. PURPOSE: To observe the differences in compensatory eating behaviors between four groups (aerobic training, concurrent training, resistance training, and a non-exercise control) in recreationally active, resistance trained, college-aged subjects. METHODS: Ten recreationally active college-aged (21.7 ± 1.3yrs) males and females participated in this study. A 5-week, randomized, crossover design with one full week between each session. Preliminary assessments consisted of a PAR-Q, informed consent, body composition, rep-set best, and VO$_2$max. Aerobic exercise (AE) consisted of 30-minutes of cycling at 70% HR$_{max}$. Resistance exercise (RE) consisted of seven, full-body circuit of three sets of 12 repetitions at 70% set-rep best. Concurrent exercise (CE) consisted of four resistance exercises at the same intensity with 15-minutes of cycling at 70% HR$_{max}$. The control (CON) consisted of 30-minutes of sitting. Food logs via MyFitnessPal were required for the 24-hour period following each session. SPSS 24.0 was used for data analysis using one-way and two-way ANOVAs and deltas. Level of significance was set at p≤0.05. Results: There were no significant differences in total caloric (CON: 2194.2 ± 657.2kcal, AE: 1923 ± 674.8kcal, RE: 2354 ± 1077.0kcal, p = 0.743), carbohydrate (CON: 219 ± 66.4g, AE: 244 ± 87.3g, CE: 204 ± 55.4g, RE: 237 ± 94.9g, p = 0.657), fat (CON: 57 ± 21.9g, AE: 58 ± 24.0g, CE: 59 ± 31.3g, RE: 63 ± 23.8g, p = 0.964), or protein intake (CON: 97 ± 48.6g, AE: 101 ± 48.0g, CE: 99 ± 53.4g, RE: 99 ± 46.4g, p = 0.942). HR (CON: 77 ± 10.3bmp, AE: 151 ± 21.9bmp, CE: 153 ± 16.2bmp, RE: 136 ± 15.8bpm, p = 0.012), or RPE (CON: 0.0 ± 0.0, AE: 5 ± 2.1, CE: 12 ± 1.9, RE: 10 ± 2.7, p = 0.147) between the four sessions. Conclusion: These findings demonstrate that the exercise-induced calorific deficit was not compensated via an increase in caloric and/or macronutrient intake, therefore, resulting in a negative energy balance. Further, the aforementioned findings provide evidence that exercise is a viable mechanism to create an energy deficit, which can ideally lead to successful weight loss.

Leptin and ghrelin are counterregulatory hormones that control food intake and energy expenditure to maintain energy balance. PURPOSE: To determine changes in leptin and ghrelin between collegiate female runners (n=12; age 22.2±3.3 years) and inactive females (n=14; age 25.3±1.9 years) across time.

(No relevant relationships reported)

Leptin and ghrelin are counterregulatory hormones that control food intake and energy expenditure to maintain energy balance.
POST-EXERCISE WHOLE BODY CRYOTHERAPY TREATMENT INCREASES ENERGY INTAKE AMONG WELL-TRAINED ATHLETES

Chihiro Kojima1, Nobukazu Kasa1, Chika Kondo1, Yasushi Suzuki1, Kimu Ebi2, Kazushige Goto1, Ritsumeikan University, Shiga, Japan. 1Saraya Co., Ltd., Osaka, Japan. (Sponsor: Robert R Kraemer, FACSM) (No relevant relationships reported)

PURPOSE: Exercise-induced loss of energy intake during post-exercise period may delay recovery and impair exercise performance among athletes. However, the efficient procedures which can attenuate post-exercise reductions of appetite and energy intake have not been investigated. Previous studies demonstrated that cold environment was likely to promote appetite and energy intake. The aim of the present study was to investigate the effect of whole body cryotherapy (WBC) after exercise on appetite regulations.

METHODS: Thirty male athletes (20.5 ± 0.2 years, 174 ± 8.5 cm, 66.6 ± 1.4 kg) were recruited in the present study. They conducted two trials on different days; consisting of WBC trial and CON trial. Subjects performed repeated sprint exercise initially in both trials. In WBC trial, WBC treatment for 3 min (about -10°C) was applied from 10 min after completing the exercise. In CON trial, subjects kept resting for identical periods of WBC trial after exercise. At 30 min following exercise, ad-libitum buffet meal test was conducted to evaluate energy intake and macronutrient intake ratio. Blood samples were obtained to measure plasma acylated ghrelin, PYY3-36, serum leptin and other metabolic hormonal concentrations before and after exercise. Subjective feeling parameters, respiratory gas samples and skin temperature were also measured after exercise.

RESULTS: Skin temperature was decreased rapidly after WBC (pre: 31.6 ± 0.2°C, immediately after WBC: 7.1 ± 4.1°C), and the temperature remained significantly lower until the onset of buffet meal test (P < 0.001). Although plasma ghrelin, PYY3-36 and serum leptin concentrations were significantly changed after exercise (P < 0.05), no significant differences between trials were observed at any points for these hormones. During post-exercise period, minute ventilation and heart rate were significantly lower in WBC trial than those in CON trial (P < 0.05). Energy intake during buffet meal test was significantly higher in WBC trial (1371 ± 139 kcal) than in CON trial (1106 ± 130 kcal, P = 0.007).

CONCLUSIONS: Cold exposure using WBC following strenuous exercise increased energy intake in male athletes.

1929 Board #190 May 31 2:00 PM - 3:30 PM
MCT1 Gene Function on Percentage Fat Responses in Overweight and Obese Humans
Rocio Cupeiro1, Barbara Szendrei1, Teresa Amigó1, Pedro J. Benito1, Domingo González-Lamuño1, Universidad Politécnica de Madrid, Madrid, Spain. 1University of Cantabria / DIFAV, Santander, Spain. (No relevant relationships reported)

Transgenic mouse for the Monocarboxylate Transporter 1 (MCT1) gene (SLEC1A1) with one invalidated allele presented resistance to diet-induced obesity. In humans a single-nucleotide polymorphism (SNP, T1470A (rs1049434), for this gene has been related with an impaired lactate transport in T male carriers. Therefore, this SNP could have an influence in body composition changes, simulating the results seen in transgenic mice.PURPOSE: To investigate the influence of the T1470A SNP of the MCT1 gene on percentage fat (%fat) changes after a 6-month weight loss program in obese and overweight healthy people.

METHODS: 91 women (39.1±8.3 years, 80.7±10.5 kg) and 84 men (39.6±8.2 years, 96.1±10.7 kg) followed a 24-week weight loss intervention including a controlled training program (supervised exercise group, S; 3 times/week, 38-60 min/session; strength, endurance and combined training; N=134) or exercise recommendations (non-supervised exercise group, NS; N=39). All groups had caloric restriction of 25-30% of their energy expenditure. Genotyping was done using PCR and direct sequencing or Real Time PCR. Three-way (genotype x exercise group x sex) ANCOVA was conducted for compare the final values of %fat, adjusting by the initial values. Effects sizes (ES) and their 95% confidence intervals (CI) were calculated to show the magnitude of the effect (standardized differences in means: Cohen’s units) of carrying the A allele.

RESULTS: A genotype x exercise group x sex interaction was observed (p=0.017). TT women had less final %fat in the whole group (p=0.025, 1.94%) as well as within the NS group (p=0.002, 4.49%) than A carriers. The ES associated indicate that the A allele has a moderate (ES=1.15, CI=1.88, 0.42) and very likely positive effect only in women within the NS group. For men the A carriers ended with less %fat than TT subjects (p=0.037, 1.87%), with small and possibly negative ES in the S group (ES=0.25; CI=−0.02, 0.52) and small and likely negative in NS (ES=−0.46, CI=−0.01, 0.91).

CONCLUSIONS: The T1470A SNP might have an influence on %fat changes after a weight loss program. The effect seems to be different depending on sex and type of exercise intervention. Further studies are necessary to confirm this association and to clarify the underlying mechanisms. Supported by Spanish Government Grant DEP2008-06354-C04-01.

1930 Board #191 May 31 2:00 PM - 3:30 PM
Effects Of Exhaustive Exercise On PHB1 Expression And Mitochondrial Function In Rats
Hong Feng1, Z Li1, Wen Fang1, Zhaoming Liu3, Li Li Ji1, FACSM1, 1Tianjin University of Sport, Tianjin, China. 1Tsinghua University, Beijing, China. 2University of Minnesota, Minneapolis, MN. (Sponsor: Li Li Ji, FACSM) (No relevant relationships reported)

FOF1-ATP synthase is the key enzyme of mitochondrial oxidative phosphorylation, which largely determines the exercise endurance. PHB1 participates in mitochondrial oxidative phosphorylation. The content of PHB1 predicts that of FOF1-ATP synthase in many biological conditions.

PURPOSE: To observe the changes of PHB1 content in mitochondria and its relationship with mitochondrial function and energy metabolism in response to an acute bout of exhaustive exercise.

METHODS: Male Sprague-Dawley rats were subjected to an acute bout of exhaustive exercise on treadmill at 20 m/min, at which...
The satiating effects of protein and its role in energy expenditure have been compared to carbohydrates and fats. Less data exists on the effects of a high fat ketogenic supplement consumed as part of a breakfast smoothie on metabolism, ratings of appetite and satiety. PURPOSE: To determine the effects of whey protein (WP) vs. a ketogenic supplement (KS), added to a breakfast smoothie on energy expenditure (EE), appetite and energy intake. METHODS: Fifteen women (age, 30.1±1.3 yrs; body fat 25.3±1.5%) participated in this randomized, double blind, crossover study. After a 12-hr fast, resting oxygen consumption (VO2) and respiratory quotient (RQ) were assessed via indirect calorimetry. Ratings of appetite (hunger (H), fullness (F), desire to eat (DE) and prospective food consumption (PC)) were assessed via visual analog scales (VAS). After consuming the isocaloric (450 kcal) test meal containing either 54 g WP (40 kcal proteins) or 52 g KS (40 kcal fat), VAS on appetite were administered every 30 min for the 3 hr post-prandial period. The thermic effect of the meal (VO2) and RQ were assessed at 45, 105 and 165 min after meal completion. An ad libitum lunch meal was provided to assess subsequent energy intake. Repeated measures ANOVA were used to analyze data. RESULTS: There was a significant group by time effect for VO2 (p<0.001) and RQ (p<0.001). WP elicited a greater VO2 compared to KS at 45, 105 and 165 min (WP: 4.05±0.59, 3.86±0.53, 3.57±0.55 vs. KS: 3.43±0.60, 3.26±0.45, 3.08±0.40). RQ was significantly lower after WP compared to KS at all three time points (WP: 0.79±0.03, 0.79±0.04, 0.77±0.03 vs. KS: 0.84±0.04, 0.80±0.06, 0.77±0.08). Significant group by time interactions were observed for H (p<0.02), F (p<0.001) and DE (p=0.02) but not PC (p=0.17). Perceived H and DE were significantly lower, and perceived F was greater in the WP condition compared to KS. Energy intake (WP: 578±282 vs. KS: 625±220 kcal) did not differ between conditions (p=0.197). CONCLUSION: WP appeared to have a modest improvement in increasing both fat oxidation and energy expenditure during the post-prandial period. As such, WP would seem to be more advantageous than KS in promoting overall fullness, however it did not elicit lower subsequent energy intake at an ad libitum lunch meal.

1932 Board #193 May 31 2:00 PM - 3:00 PM Changes In 6-Minute Walk Performance Is Associated With Weight Loss Following A 6-Month Weight Loss Program

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There is evidence of a relationship between obesity and decrements in mobility and function, making these important targets for weight loss interventions. Within commercial weight loss programs, there is limited data to quantify changes in functional outcomes such as walking performance and whether weight loss contributes to improvements in the important health outcome.

PURPOSE: To examine change in body weight and walking performance in participants enrolled in a commercial weight loss program, and to examine the association between weight loss and walking performance.

METHODS: Participants (N=140, 93.3% of enrolled participants, age: 46.9±12.6 years; body mass index: 32.6±6.5 kg/m²) who enrolled and provided complete data following a 6-month commercial weight loss program (Weight Watchers). The intervention was delivered by trained Weight Watchers staff and outcomes were evaluated by independent research staff who were not engaged in the delivery of the weight loss intervention. The intervention included weekly group sessions, instruction on behavioral strategies for weight control, and the use of a mobile app to self-monitor weight loss behaviors. Assessment of body weight and walking distance and gait speed using the 6-minute walk test occurred at baseline and 6 months.

RESULTS: Weight decreased from 88.0±16.2 to baseline at 81.0±15.6 kg at 6 months (weight loss = 7.0±5.6 kg) (p<0.001). Walking distance increased from 526.6±15.7 meters at baseline to 553.4±63.9 meters at 6 months (p<0.001). Gait speed during the 6-minute walk test increased from 1.46±0.17 meters per second to 1.54±0.18 meters per second from baseline to 6 months (p<0.001). Weight loss was significantly associated with improved walking distance (r=0.312, p<0.001) and gait speed (r=0.312, p<0.001) during the 6-minute walk test.

CONCLUSION: These findings indicate that this commercial weight loss program resulted in significant weight loss, and the magnitude of weight loss was associated with improved walking distance and gait speed. Thus, this type of commercial weight loss program appears to be effective for individuals seeking weight loss, which may also result in additional function benefits in adults with obesity.
CONCLUSION: Length of treatment and reported step counts were associated with increased pregnancy rates. Additional investigation with larger samples is warranted to evaluate the magnitude of weight loss and the potential independent contributions of weight loss and physical activity to improve conception.
The relationship between cognition and aerobic fitness is well studied in breast cancer survivors (BCS); however, there is a lack of research evaluating the relationships between cognition and anaerobic fitness. PURPOSE: This study examined the relationship between cognition, muscle power, strength, and the 6-min walk (6MW) in BCS. METHODS: Forty-four BCS (60±8 yrs; BMI: 29.9±6.5 kg/m²) completed Trail-Making Test A and B (TMTA, TMTB) and Digit Span Forward (attention) and Backward (working memory), and Controlled Oral Word Association Test (COWAT) prior to admission. Linear regression evaluated the relationship between cognition and anaerobic fitness. Significance was accepted at p<.05. RESULTS: Faster TMTA and TMTB scores were correlated with greater ISK average power for extension at 60 degrees/sec (r=0.40; TMTB: r=-0.31) and 180 degrees/sec (TMTA: r=-0.45; TMTB: r=-0.30) while COWAT was correlated with greater ISK average power for extension at 120 degrees/sec (r=-0.34). A subcategory of the COWAT was correlated with greater 6MW distance (r=0.31) and greater ISK average power for extension at 180 degrees/sec (r=0.30). CONCLUSION: Higher cognitive functioning, specifically processing speed and executive function domains, may be correlated to greater average power. These findings warrant more research on the benefits of power and strength training on cognition in BCS.

Hematopoietic stem cell transplant (HSCT) treatment, used to treat an array of hematological cancers, significantly impacts patients' physical, psychological, and psychosocial stress before, during, and after treatment. HSCT is associated with severe symptomology, including nausea, pain, and fatigue, which may discourage movement and significantly increase sedentary behavior. Patients are advised of the benefits of increased physical activity during HSCT, including attenuation of the severity of their symptoms. However, there is a paucity of research on patients' perceptions of the benefits of exercise and how that translates to their participation in physical activity. PURPOSE: To evaluate the relationship between perceived benefits and barriers of exercise and self-reported physical activity levels in patients undergoing HSCT. METHODS: Twenty-three subjects (13M, 10F; 58.1±4.8 years) were enrolled in an in-patient physical activity intervention, administered the Exercise Barriers and Benefits Survey (EBBS) and the International Physical Activity Questionnaire-Short Form (IPAQ) prior to admission. The EBBS is associated with severe symptomology, including nausea, pain, and fatigue, which may discourage movement and significantly increase sedentary behavior. The EBBS was completed prior to admission. A Pearson correlation coefficient was computed to assess: the relationship between the EBBS Benefits scale, WALK, and SIT, and the relationship between the EBBS Barriers scale, WALK, and SIT. RESULTS: Results of the Pearson correlation indicated that there was a significant positive correlation between the benefits score and patient-reported WALK (r=0.44; p=.04). There was also a significant negative correlation between the benefits score and patient-reported SIT (r=0.41; p=.03). There was no significant correlation between the barriers score and WALK (r=0.23; p=.30) or SIT (r=0.18; p=.42). CONCLUSION: These preliminary results indicate that HSCT patients who report higher benefits to exercise are more likely to spend more time walking and less time sitting.

There are over 12 million cancer survivors in the United States. Nearly all of them have experienced physical, emotional, and psychological symptoms including fatigue, insomnia, and depression. This can contribute to the erosion of overall quality of life. While exercise is commonly prescribed to mitigate these symptoms, the optimal dose and characteristics of its prescription require further investigation. PURPOSE: To evaluate the efficacy of structured exercise on fatigue, insomnia, and depression in cancer survivors. METHODS: We enrolled 157 cancer survivors in a 10-week exercise intervention that included aerobic, resistance, and flexibility training. At baseline, patients completed the Fatigue Symptom Inventory, Athens Insomnia Instrument, and Zung-Self Rating Depression Scale to assess fatigue, insomnia, and depression respectively. Upon conclusion of the program, follow-up data were collected. Paired-samples t tests were conducted on patients who completed the intervention. Logistic regression tested the effect of fatigue, insomnia, and depression on odds of completion. Linear regression evaluated predictors of fatigue, insomnia, and depression. RESULTS: Among patients who completed the intervention (n=58), fatigue decreased (p=0.001); insomnia (p=0.673) and depression (p=0.675) were unchanged. Fatigue (p=0.432), insomnia (p=0.759), and depression (p=0.932) did not predict program completion. Patients who were more fatigued at baseline experienced greater reductions in fatigue at follow-up, assessed by score (r=−0.677; p<0.001) and category (r=−0.685; p<0.001). Patients with worse insomnia at baseline reported greater improvements at follow-up (r=−0.761; p=0.079); elevated depression did not facilitate greater improvement (p=0.228). CONCLUSIONS: Fatigue, insomnia, and depression are often indissoluble from the daily experience of a cancer survivor. A biweekly exercise intervention improved fatigue and insomnia after 10 weeks, with greater improvement among the more severely affected; however, we did not find significant alleviation of depression symptoms. These findings suggest exercise is a safe, effective strategy to relieve some symptoms associated with cancer. Further research is required to address potential bias owing to the high rate of attrition in our study.

PURPOSE: This study compared ratings of perceived exertion (RPE) among participants performing the same energy expenditures while wearing NIOSH-approved powered air-purifying respirators (PAPRs) from different manufacturers: one tight-fitting (PAPR-T) and three different models of loose-fitting PAPRs (small hood (PAPR-S), medium hood (PAPR-M), and large hood (PAPR-L)). METHODS: The study consisted of six trials: Initial exercise evaluation to determine treadmill speed and elevation to achieve three absolute energy expenditures, labeled LOW (VO_2 1.0 L/min, STPD), MODERATE (VO_2 2.0 L/min, STPD), and HIGH (VO_2 3.0 L/min or maximum, STPD); a baseline evaluation wearing no respirator; and four PAPR evaluations randomly assigned between two visits. Eleven men and 11 women provided informed consent approved by the NIOSH IRB (#12-NPPTL-01). Baseline and PAPR evaluations consisted of four minutes each during standing rest and the three energy expenditures. All PAPRs used HEPA filters. RPE using the 6-20 Borg scale were obtained during the last 15 seconds of each energy expenditure. RESULTS: RPE results for the men and women were not statistically different. Table 1 provides the average RPE for men and women by experimental trial: Table 1. Average RPE for each study trial by energy expenditure (n=22).
**CONCLUSIONS:** RPE while using PAPRs were greater compared to loose-fitting PAPRs. The lower RPE for PAPR-M included, can enhance psychological responses during exercise. The current findings may help address common exercise barriers and inform exercise practitioners on music selection to improve exercise adherence.

### Does Body-weight Circuit Training Have The Ability To Induce Hypoalgesia?

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**PURPOSE:** Exercise-induced hypoalgesia (EIH) is a phenomenon that often occurs following exercise. It is believed to be related to the endogenous opioids that are released during physical exercise that affect pain perception. Many of the studies investigating EIH have used either aerobic, isometric or resistance training protocols. It is not clearly known if circuit training, using bodyweight exercises, can lead to EIH. Therefore, the purpose of this study was to determine if EIH can be elicited by bodyweight exercise circuit training.

**METHODS:** Thirty (11 men, 19 women; age 22.8±3.3 years, height 169.7±1.04 cm, mass 75.7±4.21.56 kg) healthy recreationally active individuals volunteered for this study. Subjects were asked to participate in a laboratory, in a randomly assigned order, for two visits: once for a control condition and once for a circuit training condition. In the control condition, subjects were asked to simply rest quietly for 20 minutes. In the experimental condition, they were guided through a series of bodyweight exercises such as squats, lunges, push-ups and chair dips. Pre-post, and at various points during recovery, the pain pressure threshold (PPT) was assessed with a strain algometer. Four sites were tested: upper trapezius, index finger, patellar tendon and the dorsal foot. A repeated-measures 2 (condition) by 7 (time: pre/post) ANOVA was performed for each site. Results: There was only a significant main effect of condition seen in the upper trapezius (F(1, 24) = 4.94, p< 0.05). A significant increase was seen in PPT for the index finger immediately after exercise (2.87±0.15 kg/cm² at pre and 3.24±0.19 post; means(SD)) and the dorsal foot (2.63±0.14 pre and 2.94±0.15 post). While the index finger PPT returned to baseline quickly, the patellar tendon PPT reached significance at the 10 min post exercise point, and remained elevated.

**CONCLUSIONS:** Three out of the four sites showed increased PPT following exercise, suggesting that EIH may be elicited through circuit training implementing bodyweight exercises. Further research is needed but there is a possibility for certain populations such as the elderly or individuals with chronic pain that could benefit from EIH, especially those that cannot perform traditional training methods.

### Concurrent Validity Of The Children's Omni Scale Of Perceived Exertion In A Field Setting

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The children’s OMNI RPE Scale was developed because of a need and want to measure perceptions of physical exertion in children and adolescents. The term OMNI is from the word omnibus, referring to its wide encompassing properties. The OMNI RPE Scale is a multivariate, manually scored and verbal descriptions position on a 0-10 rated scale. Previous research with children and the OMNI RPE Scale were validated in controlled lab settings using exercise equipment.

**PURPOSE:** The purpose of this study was to determine if the Children’s OMNI RPE Scale is valid in a field setting (at school during recess and Physical Education Class (PE)). **METHODS:** 93 healthy children (male (n=44) and female (n=49) age 8.5±1.4 years volunteered as subjects. Subjects were recruited from a local public elementary school with parental consent. All subjects demonstrated sufficient ability to read out loud and understand each verbal descriptor on the OMNI RPE Scale. The instruments that were used during this study consisted of a Polar Heart Rate Monitor and a copy of the Children’s OMNI-walk/run Scale. A definition of perceived exertion specifically written for children and a standard set of instructions regarding the usage of the OMNI-walk/run Scale to rate perceptions of exertion were explained to the subjects immediately before the testing. Data was collected during 30-minute testing sessions, one week apart, during recess and PE class. Heart rate was recorded every 5-minutes for a thirty-minute period, along with perceived exertion. **RESULTS:** Repeated measure ANOVA procedure identified
that Heart Rate and RPE each had a significant (p<0.01) change over time during both recess and PE. **Results:** HR (157.9±2.8; 170.1±2.2; 173.8±2.2; 173.9±2.4; 179.7±2.1; 185.0±2.2; RPE (4.3±0.2; 5.2±0.2; 5.8±0.2; 6.3±0.2; 6.8±0.2; 7.4±0.2); PE: HR (148.8±2.4; 153.9±1.8; 160.3±1.7; 164.6±1.9; 167.3±1.9; 168.3±1.9); RPE (3.6±0.2; 4.2±0.2; 4.9±0.2; 5.2±0.2; 5.3±0.2; 5.6±0.2). Pearson correlation analysis indicates a significant relation between Heart Rate and RPE during recess (r=−0.8; p<0.001) and PE (r=−0.52; p<0.001). **Conclusion:** Data from the present study suggests that the Children’s OMNI RPE Scale is a valid indicator of children’s physical effort during structured and unstructured physical activity.

**Exercise and Psychological Health:**

Exercise has tremendous beneficial effects on human psychological and physical health, yet many people still choose not to exercise. **Purpose:** Our study investigated how girls’ responses to exercise intensity and exercise environment as they age through adolescence. **Methods:** We recruited female runners of different ages (middle school, high school, college) to perform running sessions on a treadmill and in an outdoor environment. Each participant ran at three different intensities, 6 minutes per intensity, for both the treadmill and outdoor environment. Data were collected on how the runners thought about while running (Thoughts During Running Inventory), how they felt (Feeling Scale), how their bodies physiologically responded to the running (blood lactate, heart rate), and how fast they ran (speed). **Results:** Participants ran faster and harder, indicated by speed (ANOVA, p < 0.0001), blood lactate levels (ANOVA, p = 0.008), and heart rate (ANOVA, p = 0.004), in the outdoor environments, and younger participants were more likely to feel worse after exercise (ANOVA, p < 0.0001). **Conclusions:** We extended the work of Reich and Quaetem (in review) to females, demonstrating that despite their very different hormonal milieu as they age through adolescence, female endurance runners respond to environment and exercise intensity in much the same way as male endurance runners of similar ages. Our study suggests that outdoor running may confer greater health benefits than treadmill running because exercisers push themselves harder in outdoor conditions. In addition, we surmise that either girls acquire more positive affective responses to exercise as they mature, or only those girls who respond positively to exercise continue to run competitively as they age.
Exercise performance, ventilation, and RPB did not differ in trained cyclists during exertion (RPE) did not differ at 50% (13.1±2.9 vs. 12.1±2.4, p=0.266) and 100% (107±26 vs. 101±18.4 cmH₂O pressure did not differ at 50% (133±31.8 vs. 123±22.0 L·min⁻¹). During the second visit, cyclists completed a fixed-work, non-exercise control and validated measures of depression, anxiety, fatigue, and pain derived from NMES exercise. An alternative to voluntary exercise may be due to lack of familiarity and perceived discomfort during treatment. PURPOSE: The purpose of this study was to determine attitude toward NMES exercise and perceived pain and muscle soreness experienced from NMES exercise with increasing stimulation intensity. METHODS: Thirty healthy adults (age: 23.6 ± 0.5 years) who had not experienced electrical stimulation within the last year completed the study. Repetitive, intermittent stimulation of 10 seconds on and 15 seconds off was applied to the quadriceps muscles for 60 minutes with the stimulation frequency set at 60 Hz. Stimulation intensity was increased every 5 min throughout the course of the intervention to achieve a target torque of 15% maximal voluntary contraction as measured by an isokinetic dynamometer. During the NMES application, participants rated the pain they experienced using a standard pain scale (0-10 scale: 0 = no pain; 10 = most pain possible) at minute 0, 15, 30, 45, and 55 of the treatment. Participants were also asked to rate muscle soreness felt 48 hours after exercise (0-10 scale: 0 = no soreness; 10 = greatest soreness possible). A survey on attitude toward NMES exercise (e.g., useful, pleasant, beneficial) was administered pre and post NMES on a 1-7 scale (e.g., 1 = useless; 7 = useful). Repeated measures analysis of variance (ANOVA) was used to test statistical differences between scores over time. Data are reported as mean ± SE. RESULTS: Attitude toward NMES exercise was high and did not change post-exercise (pre: 6.2 ± 0.1, post: 6.1 ± 0.2, p = 0.21). Reported pain during NMES was low and was not different across time points (0 min: 2.1 ± 0.4, 15 min: 2.7 ± 0.4, 30 min: 2.6 ± 0.4, 45 min: 2.9 ± 0.4, 55 min: 2.5 ± 0.4, p = 0.126). Muscle soreness remained elevated 48-hours post-NMES (3.5 ± 0.593, p < 0.001). CONCLUSION: Pain reported during NMES was low and did not increase as stimulation intensity increased. Attitudes toward NMES sessions were relatively high and were unchanged after exercise, indicating that any pain and soreness experienced did not change participants’ attitude regarding the benefits of NMES exercise.

Elevated anxiety and depressive symptoms, persistent fatigue, and pain are prevalent co-morbidities in Rheumatoid Arthritis (RA). Though the available evidence supports exercise effects on these outcomes, no quantitative synthesis of evidence from randomized controlled trials (RCTs) of exercise effects on these critically important symptoms in RA has been conducted. PURPOSE: To estimate the overall population effect of exercise on depressive and anxiety symptoms, fatigue, and pain derived from available RCTs. METHODS: Twelve articles published before September 2017 were located using Google Scholar, PsycINFO, PubMed, and Web of Science. Trials involved 1,031 participants and included both randomization to exercise and non-exercise control and validated measures of depression, anxiety, fatigue, and/or pain assessed at baseline and post-intervention. Hedges’ d effect sizes (95%CI) were computed and random effects models were used for all analyses. RESULTS: Participants were aged 49±9 years and 83±14% female. Exercise training consisted on average of 16±1 weeks lasting 60±17 minutes per session, and 11.5 weeks in duration. Mean reported adherence was 87±11%. For depression, 18 of 20 effects (90%) were >0. The mean effect size Δ was 0.20 (0.10-0.31; p < 0.001). No significant heterogeneity was observed (Q₁ = 26.72; p = 0.10), and consistency was low across effects (I² = 32.6%). For anxiety, seven of seven effects (100%) were >0. The mean effect size Δ was 0.50 (0.27-0.74; p < 0.001). No significant heterogeneity was observed (Q₁ = 26.72; p = 0.10), and consistency was low across effects (I² = 32.6%). For anxiety, seven of seven effects (100%) were >0. The mean effect size Δ was 0.50 (0.27-0.74; p < 0.001). No significant heterogeneity was observed (Q₁ = 26.72; p = 0.10), and consistency was low across effects (I² = 32.6%). For anxiety, seven of seven effects (100%) were >0. The mean effect size Δ was 0.50 (0.27-0.74; p < 0.001). No significant heterogeneity was observed (Q₁ = 26.72; p = 0.10), and consistency was low across effects (I² = 32.6%). For pain, seven of seven effects (100%) were >0. The mean effect size Δ was 0.40 (0.14-0.21; p = 0.06). The effect was heterogeneous (Q₁ = 32.82; p < 0.005) and consistency was moderate across effects (I² = 57.34%). For fatigue, six of 11 effects (54.5%) were >0. The mean effect size Δ was 0.01 (-0.20-0.21; p = 0.93). The effect was heterogeneous (Q₁ = 19.08; p = 0.04), and consistency was moderate across effects (I² = 52.83%). CONCLUSION: Exercise resulted in significant small-to-moderate reductions in depressive and anxiety symptoms. However, pain and fatigue were not significantly changed. Further investigation of sources of variability in the effects of exercise on pain and fatigue among adults with RA is warranted.
The cortisol awakening response (CAR) describes the initial rise in cortisol following waking, and has been suggested to be a potential biomarker for monitoring exercise training stress. However, it is currently unknown if CAR is sensitive enough to track changes in daily physical activity (PA). PURPOSE: Therefore, the purpose of this study was to assess the impact of daily PA on CAR and associated derived measures. METHODS: Male (n = 24) and female (n = 71) college-aged students (19.0±1.8y, 72.1±19.5kg) wore wrist-worn accelerometers (ActiGraph) for four consecutive days (24 hour protocol). Actigraph data were analyzed using six custom activity bands as totals (Bands) and percentage of total time (Bands%), since moderate-vigorous PA was minimal in this study cohort. Salivary samples were collected each morning, immediately after waking (C0) and 30 mins later (C1) and were analyzed for cortisol (ng/ml) using DELFIA. CAR and CAR% were calculated as the difference between C1 and C0 and the percentage increase from C0, respectively. Only subjects with two complete days of data were included in the current analysis. Analyses between PA and CAR variables between days were assessed via paired-sample t-tests. Multivariate multiple linear regression with univariate follow-up tests fit CAR variables by PA. Models were computed for each day individually, as well as ratio (Q) values between days (Day2/Day1). RESULTS: No differences were observed between days for CAR or derived measures, or activity bands (all p>0.05). Day 1 showed a significant model for CAR by Bands, (R² = .13, p = 0.04), while the Day 2 CAR, by Band model was significant (R² = .015, p = 0.02). Ratio models further elucidated these relations, with a significant model for CAR by QBand, (R² = .015, p = 0.02). CONCLUSION: These results suggest that CAR and its derived measures are relatively stable across days. Also, CAR does appear to be sensitive to the degree of PA or sedentary behaviors during the preceding day in college-aged persons, such that change in CAR is partially accounted for by changes in PA. Therefore, PA should be considered in future CAR research and interventions that specifically manipulate PA (i.e., exercise interventions) are needed to confirm the usefulness of CAR for tracking changes in exercise training stress.

Premenstrual Syndrome and Cortisol In Female Soccer Players Carriers Of PMS: Correlation Between Proinflammatory Cytokines And Cortisol In Female Soccer Players Carriers Of Premenstrual Syndrome

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(No relevant relationships reported)

PURPOSE: The aim of this study was to evaluate cytokines production and its relation with cortisol in female soccer players with premenstrual syndrome (PMS) and with no PMS (nPMS). Women in the PMS were carriers of premenstrual syndrome (PMS). In pMS, pregame regulation of the menstrual cycle: follicular and luteal. PMS causes physical and emotional discomfort to women, so that this study can be of great importance in female athletes training scheme. METHODS: Fifty-two eumenorreic soccer players were evaluated (age: 19.8 ± 4.7 years). The PMS and phases of the menstrual cycle were determined by monitoring for 3 consecutive months, using the Daily Symptom Report (DSR). Evaluation of cytokines was performed in serum samples of 40 soccer players, 20 PMS and 20 nPMS. The results of correlation between cortisol and the cytokines evaluated also showed positive correlations in the pregame phase of the menstrual cycle (p<0.05). CONCLUSIONS: Our results allow us to conclude that female soccer athletes PMS carriers of PMS: Correlation Between Proinflammatory Cytokines And Cortisol In Female Soccer Players Carriers Of Premenstrual Syndrome and cortisol in female soccer players with premenstrual syndrome (PMS) and with no PMS (nPMS), in pregame evaluating the two phases of the menstrual cycle: follicular and luteal. PMS causes physical and emotional discomfort to women, so that this study can be of great importance in female athletes training scheme.

The Coriolis Awakening Response is Associated With Activity Level on the Preceding Day

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(No relevant relationships reported)

PURPOSE: To examine hormonal, steroidal and inflammatory responses in collegiate male soccer players (M M) and female cross-country runners (F C) over the course of a competitive season. METHODS: 22 M (mean±SD; age: 20±1y; height, 181.2±6.5cm; body mass, 79.4±6.9kg; VO2max: 74.30±33.28 ng•ml-1; IL-1β: 21.19±13.16 pg•ml-1; IL-6: 74.59±33.18 ng•ml-1) compared to both PS and F C, which returned to baseline at the conclusion of the competitive seasons. Over time, regular season training allowed for sufficient recovery from exercise stress in both male soccer and female cross-country athletes. Future research is needed to examine the relationship between changes in training volume and training intensity on changes in the anabolic and catabolic response in male and female collegiate athletes.
Optimal T cell activation requires a two-signaling process. The first signal is engagement of the TCR-CD3 complex and the second, or costimulatory, signal is the classical binding of a T cell CD28 receptor with an APC-bound CD80 or CD86. A marker of senescent T cells is a lack of CD28 expression and it has been posited that CD28 expression may decrease following strenuous exercise. PURPOSE: To quantify exercise induced changes in CD28 expression on CD4+ cells obtained from human subjects. METHODS: Utilizing a cross over design, untrained subjects completed a control and exercise visit. The control visit consisted of 30 min of seated rest while the exercise session entailed 3 sets of 10 reps squat at 70% 1-RM, 3x10 leg press at 70% 1-RM, and 3x10 leg extensions at 70% 1-RM with 2 min rest between sets. Venous blood samples were obtained pre and post each visit. CD4+ T cell isolation from peripheral blood was completed through negative selection using a Human CD4+ T cell enrichment kit. CD4+ T cells were plated at 1.5 x 10⁶ cells/ml in 200 μl of ImmunoCult T-cell expansion media directly after isolation and costimulated through CD3/CD28 or no stimulation. Cells were incubated for 1 and 3 d at 37°C in a humidified incubator with 5% CO₂ and then analyzed by flow cytometry. Data were analyzed using two-way RMANOVA. RESULTS: There were no significant differences in CD28 expression between the exercise and control conditions in either the stimulated (p = 0.27) or non-stimulated (p = 0.62) samples. These data suggest that suppression of CD4+ T cell activation following strenuous exercise is likely not a result of dysfunction in CD28, a major costimulatory receptor. CONCLUSIONS: Changes in T cell activation following strenuous exercise are likely derived from a plurality of sources, but without direct assessment of discrete elements of the activation cascade we will be unable to understand how exercise changes immune function. Future work should focus on elements upstream of T cell clonal expansion in order to identify mechanisms for exercise induced changes in immunocompetence.

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## RESULTS

**CONCLUSIONS:**

ROS produce function than C group and ME group. **Conclusion:** An acute single bout of strenuous exercise increases NETs formation and cause hyper-function of innate immunity function. Mitochondrial antioxidants suppress strenuous exercise induced NETs formation and balance innate immunity cells function.

## Effects Of Exercise On The Expansion Of Myeloid-derived Suppressor Cells

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(No relevant relationships reported)

Myeloid-derived suppressor cells (MDSCs) are a heterogeneous population of immune cells that expand in response to cancer and various other pathological conditions. MDSCs are characterized by their suppression of T-cells and their involvement in metastasis. Aerobic exercise protects against tumor growth and metastasis, yet the mechanisms behind this protection are still largely unknown. **PURPOSE:** To examine the effects of exercise on the expansion of MDSCs and suppression of immune function in a murine breast cancer model. **METHODS:** Female mice, 8 weeks of age, were randomly assigned to one of the following groups: exercise tumor (EX+TUM), sedentary tumor (SED+TUM), exercise control (EX) or sedentary control (SED). Animals in both TUM groups were inoculated with 1x10⁴ 4T1 murine mammary carcinoma cells in the mammary fat pad. Both EX groups were given access to running wheels for 90 days, beginning on the day of inoculation, and SED groups were restricted to normal cage activity. Following completion of the 4-week training period, blood and spleen samples were collected for analysis via flow cytometry. MDSC expansion was measured as the percentage of CD11b+Ly6c+ and CD11b+Ly6c+ cells in the population. Spleen cytotoxic T-cells were measured as the number of CD8+ cells and expressed as a percentage of the total population. **RESULTS:** MDSCs in the blood of SED+TUM (15.3% ± 7.1%) were significantly higher (p = 0.05) than SED (0.8% ± 0.2%) indicating tumor-dependent expansion of MDSCs. EX+TUM (10.1% ± 0.7%) was not significantly different from EX (0.5% ± 0.1%) or SED (0.8% ± 0.2%) suggesting MDSC expansion did not occur to the same extent in the blood of exercised animals. The percentage of CD8+ T-cells in SED+TUM (5.6% ± 1.7%) was significantly lower (p < 0.05) than EX (13.1% ± 1.1%) and SED (13.4% ± 0.9%) indicating a tumor-induced suppression of immune function. In contrast, EX+TUM (7.7% ± 1.0%) was not significantly different from EX (13.1% ± 1.1%) or SED (13.4% ± 0.9%). **CONCLUSION:** These data suggest that exercise may have a protective effect against the immunosuppression that results from expansion of MDSCs in tumor bearing animals. MDSCs have been shown to create a premetastatic niche at the site of metastasis and exercise may protect against distant metastases by attenuating increased numbers of MDSCs in the blood.

## Acute Effects of Exhaustive Exercise and Cardio-Respiratory Fitness on Regulatory T Cell Homeostasis

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(No relevant relationships reported)

Regulatory T (Treg) cells are central anti-inflammatory regulators of the immune response and crucial for the maintenance of immune homeostasis. They exert anti-inflammatory effects and are central regulators of the immune responses to self- and foreign antigens. Increased Treg cell populations can result in a state of immunosuppression, as has been shown in tumor-induced immunosuppression, whereas dysfunction of Treg cells can result in autoimmune diseases. Acute physical exercise is known to have immune modulatory properties and has been previously described in professional athletes.

**Purpose:** The aim of this investigation was to examine the immune modulatory properties of acute exhaustive exercise on Treg cell homeostasis and to examine whether there is a direct link between cardiovascular fitness status (VO₂peak) and Treg cell population.

**Methods:** A total of 20 middle-aged healthy female subjects (age of 55, 2 ± 5, 7) were asked to perform a spiroergometry on a cycle ergometer. The spiroergometry protocol (1 minute rest measurement, 3 minutes warm-up with 50 Watts, increase of 25 Watts every 2 minutes) was performed until exhaustion of the subject. The evaluation of VO₂peak served as a parameter of the healthy subjects’ cardiovascular fitness. Before (TO) and after (T1) spiroergometry test, venous blood was collected. The Treg cell evaluation was assessed using antibodies against CD3, CD4, CD25 and CD127 through multicolor flow cytometry.

**Results:** The Treg cell population significantly decreased after single exercise load (TO vs T1, p<.001). There was a positive correlation found between VO₂peak and Treg cell frequency (p<.005).

## Acute Effects Of Exercise On The Expansion Of Myeloid-derived Suppressor Cells

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(No relevant relationships reported)
One of current sideline, post-injury assessment tools used for screening concussion include the King-Divick Test (K-D) which measures cognitive processing speed, rapid eye movement, and visual tracking. As a post-exercise test it is unclear if the K-D is truly sensitive enough to rule-out concussion in the presence of fatigue. PURPOSE: To examine the impact of whole-body fatigue on King-Divick test performance.

METHODS: The test was administered to 24 subjects (age = 23.2 ± 1.7 years, BMI = 24.9 ± 2.2 kg/m²) at baseline, after a fatigue protocol and on ensuing time at least 3 weeks later. The fatigue protocol was performed on a Concept 2 rower at an initial metronome pace of 60s/100s, with an increase of one heartbeat per minute as the subject reached fatigue. Fatigue was determined when three of four criteria were met: 90% or higher of predicted MaxHR, inability to maintain metronome pace for three consecutive pulls to the abdomen, 17/20 or higher on the RPE scale, and inability to maintain proper form. RESULTS: Post-fatigue, 41.7% of the subjects were positive on the K-D test. Among subjects that reported a history of diziness, 57.1 % were positive on the post-fatigue K-D test compared to 35.3% who did not report dizziness (P = 0.2). The time spent on the rower was not different (P = 0.2) between subjects that were positive on the K-D test (14.8 ± 12.0 minutes) and the ones that were negative (48.4 ± 23.2 minutes). A positive K-D test is determination when the time to complete the test increases on a posttest or an error is recorded. Follow-up testing (3 weeks) showed that 20.8% of subjects had K-D scores indicative of further evaluation (P = 0.09). Of these, 60% K-D scores were positive by less than 1 second (0.64 sec.).

If a positive K-D was defined as a score ≥1 second, only 8.3% of subjects will be positive on the K-D test (14.8 ± 12.0 minutes) and the ones that were negative (48.4 ± 23.2 minutes). T-test was used for the neurocognitive pre and post-test to assess differences in sequential memory, word memory, visual memory and rapid processing.

In the last decade, incidence of sport-related concussion has doubled. Optimal care requires an accurate diagnosis of symptoms and severity. Many student-athletes attempt to disguise symptoms and downplay severity to hasten their return to play. A subconcussive impact could lead to negative cognitive functions in youth soccer players. METHODS: A group of 30 youth soccer athletes (15 males, 15 females) between 9 to 11 years old wear a head accelerometer in a specialize headband. Each participant was encouraged to perform normally in the game. Descriptive statistics was used to assess subconcussive impacts. T-test was used for the neurocognitive pre and post-test to assess differences in sequential memory, word memory, visual memory and rapid processing.

RESULTS: Student/parent differences were found in atypiicality (p = 0.002), depression (p = 0.012), anger control (p = 0.006), and internalizing problems (p = 0.017); students reported lower scores in each category. Averaging all 7 categories, parents reported 6.7% higher scores (p = 0.031). Sex did not explain this difference (p = 0.184), but grade in school was a trending predictor: each additional grade associated with a 1.2-point reduction in parental overestimation (p = 0.064). CONCLUSIONS: Following a concussion, adolescents are likely to perceive the severity of emotional, social, and behavioral symptoms more intensely than their parents. The discrepancy was widest among elementary school students, it narrowed in middle and high school, and college students reported symptoms more severely than their parents.
1966

No Relationship Between Head Impact Kinematics and Concussion Clinical Assessment Performance

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Reported Relationships: T.A. Buckley: Salary; Applied Cognitive Engineering.

Repetitive head impacts (RHI), independent of concussions, are speculated to be associated with later life neurological impairments. While football has received the majority of the attention, RHIIs are commonplace in ice hockey. A multifaceted concussion clinical assessment battery assesses diverse neurological systems in clinically feasible manner.

PURPOSE: To examine relationship between head impact kinematics and performance on a multifaceted concussion assessment.

METHODS: Eleven male collegiate ice hockey players (age: 20.3 ± 0.8 years, Ht: 1.79 ± 0.06m, Wt: 80.9 ± 6.6 kg) wore a triaxial accelerometer (Triax Technologies, Norwalk, CT) for all home games and practices. Participants completed the clinical assessment battery twice: pre-season (PRE) and Post-season (POST). The battery included the Standard Assessment of Concussion (SAC), Balance Error Scoring System (BESS), Trails A and B, Tandem Gait (TG), and Dual Task Tandem Gait (DT-TG). Independent variables were the head impact outcome measures: number of impacts, mean peak linear acceleration (PLA), and mean peak rotational acceleration (PRA). Linear regression analyzed the effects of head impact kinematics on change scores (calculated as positive is improved performance) of clinical measures.

RESULTS: Participants experienced 107.6 ± 57.8 impacts over the course of the season with mean PLA of 38.9 ± 2.5 g's and PRA of 3.9 ± 0.5 krad/sec. There was no relationship between head impact kinematics and SAC (change: 0.7 ± 2.0, p=0.607), BESS (change: 4.9 ± 10.5 errors, p=0.607), Trails A (change: 9.2 ± 7.3 sec, p=0.981), Trails B (change: 13.7 ± 12.7 sec, p=0.370), TG (change: 2.0 ± 2.4 sec, p=0.996), and DT-TG (change: 3.1 ± 2.7 sec, p=0.990).

CONCLUSIONS: The results of this study suggest that ice hockey related RHI do not adversely affect neurological health on a multifaceted concussion assessment battery. Performance on all tests improved over the course of the season suggesting a learning effect secondary to repeated administration influenced the outcomes. While changes have been identified in neuroimaging studies, these results are consistent with previous studies in other collision sports which failed to identify differences on clinical measures of neurological health.

1967

Test Setting and ADHD Influence Baseline Concussion Testing Neurocognitive Performance in Collegiate Student-Athletes

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No relevant relationships reported

Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) is a widely used neurocognitive test for assessing and managing concussion injuries. There is inconclusive data on how test administration and environment influence baseline results for student-athletes. It has been well established that individuals with Attention Deficit Hyperactivity Disorder (ADHD) perform worse on the ImPACT, but little research has examined the effect of group test administration on neurocognitive performance and symptom reporting in student-athletes with ADHD.

PURPOSE: To compare baseline neurocognitive performance and symptom scores in group versus individual administration settings in NCAA division 1 collegiate student-athletes.

METHODS: 260 student-athletes completed two ImPACT baseline tests, test 1 was completed when they entered as first-year students or transfers and test 2 was completed this past summer. Of these participants, 205 athletes took test 1 individually and 55 participants took it in a group setting. All student-athletes took test 2 in a group setting. 21 of the 260 student-athletes had a diagnosis of ADHD. A 2 (time) x 2 (environment) x 2 (ADHD) Multivariate ANOVA was conducted. Time (test 1 and test 2) was within subjects and Environment at test 1 (individual and group) and ADHD (yes or no) were between subject variables.

RESULTS: There was a significant increase in total number of symptoms reported when participants went from individual testing to group testing (p<0.05). Time x Environment Interaction for visual memory (p=0.05) with scores increasing from test 1 to 2 if in the group setting for both, but staying the same if in the individual setting for test 1. A similar effect was found for visual motor processing speed (p<0.05). Participants with ADHD performed worse on all measures no matter the setting (p<0.05). Symptom scores significantly differed for ADHD participants depending on the setting (p<0.05). CONCLUSIONS: A group setting has inherent distractions and seems to influence performance on visual memory, visual motor processing speed and symptom scores. Student-athletes with ADHD may be more affected by these distractions. This should be considered in baseline concussion testing and interpreting post-injury neurocognitive performance.
vascular conductance (CVC) was calculated. Mean values were obtained over 60 s intervals. Data are expressed as the mean ± SD as a change from baseline. RESULTS: Baseline HR (CA: 54 ± 6; HC: 63 ± 10 bpm; P = 0.27), MAP (CA: 87 ± 5; HC: 90 ± 11 mmHg; P = 0.75), PETCO2 (CA: 44 ± 3; HC: 47 ± 1 mmHg; P = 0.20), and CVC (CA: 0.48 ± 0.13; HC: 0.69 ± 0.09 cm/sec/mmHg; P = 0.09) did not differ between groups. Baseline MACv was lower in CA (41 ± 11 vs. 61 ± 2.2 cm/sec; P = 0.04). HR did not change across time (P = 0.35) and was not different between groups (P = 0.51). MAP in CA did not differ from baseline (peak increase: 6 ± 2 mmHg; P = 0.16), whereas MACv increased in HC at the 4th (9 ± 9 mmHg; P = 0.02) and 5th min (10 ± 9 mmHg; P = 0.01) of LBPP. PETCO2 did not change across time (P = 0.57) and was not different between groups (P = 0.29). MACv was greater in CA throughout the entire LBPP protocol (peak difference at 5th min: 11 ± 3 vs. -13 ± 7 cm/sec; P < 0.01). CVC was greater in CA throughout the entire LBPP protocol (peak difference at 5th min: 0.09 ± 0.09 vs. -0.19 ± 0.04 cm/sec/mmHg; P < 0.01). CVC decreased in HC at the 3rd (0.17 ± 0.03 cm/sec/mmHg; P = 0.05) and 5th min (0.19 ± 0.04 cm/sec/mmHg; P = 0.02) of LBPP. CONCLUSIONS: Despite blunted MACv responses to LBPP, CA exhibited exaggerated increases in MACv and CVC during LBPP. These preliminary data indicate that CA who are symptomatic demonstrate abnormal cerebral blood flow regulation during central hypervolemia.

Concussion legislation has established education as the cornerstone of prevention. Georgia legislation requires guardian completion and acknowledgement of concussion education via a standardized concussion information sheet. However, the effectiveness of this standardized form has not been examined. Purpose: Examine the knowledge and understanding in guardians of Georgia High School Association (GHSA) student-athletes that completed the GHSA concussion awareness form versus additional concussion education. Methods: 102 GHSA guardians completed a 34 item paper-based survey that included demographic questions, concussion knowledge questions, and scenario questions to assess concussion understanding. Participants were divided into groups based upon concussion education (GHSA form only: n=54; Additional education: n=48). Independent sample t-tests were calculated to evaluate differences in concussion knowledge, understanding, and overall score. A Pearson correlation examined the correlation between knowledge and understanding score. All statistical analyses were conducted using SPSS 23.0. Significance levels were set a priori at P ≤ 0.05. Results: No statistically significant differences were found between groups on knowledge (t(100) = 1.74, P = 0.085), understanding (t(100)= 38, P= 0.41), and total scores (t(100)=1.88, P= 0.36). The Pearson correlation revealed a non-significant weak correlation between concussion knowledge and understanding (r = 0.35; P = 0.76). Conclusions: Guardians of high school student-athletes displayed moderate knowledge and understanding of concussion regardless of additional educational experiences. While a clinician’s desire for more comprehensive educational tools, the results of this study indicate that the state issued standardized form provides guardians with sufficient knowledge. This knowledge and understanding will help guardians in the recognition and management of a student-athlete with a concussion. Further, a multifaceted approach to concussion education could be utilized in order to most effectively reach every guardian regardless of education level.

While clinical assessments may aide to identify a concussion, there is no conclusive diagnosis via these assessments alone. Moreover, the progression and recovery of SRC is difficult to quantify. This is because the pathophysiological development of SRC injury occurs at the cellular processes level which clinical assessments may not be sensitive to nor can they be identified through standard structural imaging. fMRI-RTI scalars such as fiber tractography, Fractional Anisotropy (FA), and Mean Diffusivity (MD) analyses have shown promise in identifying concussion as they can quantify axonal microstructure integrity via disturbances in Brownian water diffusion. PURPOSE: The purpose of this study was to compare fMRI-RTI scalars of FA and MD taken serially between acute (<72 hrs.) concussed individuals with healthy controls. METHODS: Male athletes (n=6) between the ages of 14 and 23 who presented with a sports-related concussion received an fMRI studying specific regions of the brain using BOLD to assess FA and MD within 72 hours of injury and at 2 weeks post-injury. RESULTS: A significant difference (P<0.05) was observed in the right cingulum projecting to the hippocampus in the MD scan. No significant results were identified in the FA scan. CONCLUSION: While whole brain analysis showed significant differences between scan 1 and scan 2, only one identified region was significantly different. Objectively measuring concussion recovery through FA and MD may be possible, but further research is needed.

Purpose: In response to the rising awareness and concern over sports related concussions (SRCs) in high school soccer players, some athletes are choosing to wear protective headgear (HG) as a form of defense. One criticism of HG use is that it encourages more aggressive play, potentially increasing the incidence or severity of non-concussive injuries. The purpose of this study was to assess associations between use of HG and non-concussive injury in high school athletes.

Methods: In a randomized control study of n=1577 Wisconsin high school soccer players, athletes were assigned to a HG group (n=925), or a control group, without the use of HG (n=652) for the 2016-2017 interscholastic seasons. Each athlete provided an SRC history and baseline survey of their concussion symptoms. Athletic trainers at each school recorded the SRCs and non-concussive injuries weekly and recorded additional information about the injuries such as days lost to play. Chi-square tests and logistic regression methods were used to assess for potential associations using intention to treat analyses. RESULTS: 440 non-concussive injuries were reported, affecting 352 (22%) unique athletes. No difference in the likelihood of obtaining at least one non-concussive injury between the control group (21%) and the HG group (22.8%) was detected (P=0.157). Further, no difference was detected in the number of days lost between the control group (mean=11.46 days) and the HG group (14.83 days) (P=0.234). While girls were 2.53 (95% CI: 1.80, 3.55) times more likely to sustain a non-concussive injury than boys (p=0.001), after adjusting for HG use there was no significant interaction between the sex of the player and use of headgear on sustaining a non-concussive injury (p=0.421).

Conclusion: Wearing HG designed to prevent SRCs does not influence the likelihood of obtaining a non-concussive injury, or the severity of that injury as defined by number of days lost, both of which would be expected if players with HG were competing more aggressively.
Approximately 1.6 - 3.8 million sports related concussions (SRCs) occur annually in the United States. Current consensus statements recommend using a multifaceted assessment for sideline evaluation after SRC. Following systematic review of current research and expert panel review, the Sport Concussion Assessment Tool 5 (SCAT5) was developed from the Sport Concussion Assessment Tool 3 (SCAT3). The SCAT5 includes additional assessments and addresses limitations of the SCAT3. Given the updated edition, there is a need to examine baseline normative data for the SCAT5. PURPOSE: To examine preliminary normative baseline data for the SCAT5 in adolescent soccer players. METHODS: In this cross sectional study, adolescent soccer players were administered the SCAT5 prior to practice. The SCAT5 is a sport concussion sideline evaluation that contains observable signs, Maddocks questions, Glasgow Coma Scale, cervical spine assessment, background information, symptom evaluation, cognitive evaluation (Standardized Assessment of Concussion [SAC]), neurological screening and the modified balance error scoring system (mBESS). Means and standard deviations were calculated as total number of symptoms (out of 22), symptom severity (out of 132), orientation (out of 5), immediate memory (out of 30), concentration (out of 5), delayed recall (out of 10), total SAC score (out of 50) and mBESS (out of 30). RESULTS: The final sample consisted of 91 adolescent soccer players (23 males, 68 females; 13.78 ± 1.2 years old). The average total number of symptoms reported was 1.79 ± 2.9 and the average symptom severity score was 2.93 ± 6.4. The average scores of the individual components of the SAC included: an orientation score of 4.96 ± 0.2, immediate memory score of 19.97 ± 3.4, concentration score of 3.00 ± 1.2 and delayed recall score of 6.88 ± 1.7, equaling an average total SAC score of 34.80 ± 5.2. Finally, the average mBESS score was 3.21 ± 3.0 errors. CONCLUSIONS: Establishing normative baseline data for the SCAT5 may help sports medicine professionals better screen and evaluate athletes for SRC on the sideline. Future researchers should continue to collect baseline data to establish normative SCAT5 values. In addition, researchers should focus on age and sex baseline and post-injury data in high school and collegiate athletes for the SCAT5.

It is important to appreciate the enormous diversity in the presentation and prognosis of sport-related concussions (SRC) in athletes. Duration of recovery is highly variable and partly attributable to injury severity, but a comprehensive evaluation must also include age and sex. Research on the interaction of these variables among youth athletes is limited. PURPOSE: To evaluate ST and DT TG performance throughout concussion recovery. METHODS: Eighteen NCAA Division I student-athletes (Age: 20.3 ± 1.3 years; Height: 173.6 ± 8.9 cm; Weight: 70.1 ± 11.3 kg) participated in this study. All student-athletes were diagnosed with a concussion by an athletic trainer, and the diagnosis was confirmed by a team physician. Participants were instructed to walk heel-to-toe down a 3-meter line and back as quickly as possible. In accordance with the SCAT3, each participant completed four TG trials with the best time recorded. All participants were baseline tested prior to the season (BL), within 48 hours post-concussion (Acute), on the first symptom-free day (Asymp), and on the day he or she returned to full sports participation (RTP). A one-way ANOVA with repeated measures was utilized to examine both ST and DT TG at the four different post-concussion time points. The alpha level was set at p=0.05.

RESULTS: Both ST (p=0.001, F=5.402) and DT (p=0.001, F=8.995) TG were significant across the four time points following concussion. There were more pronounced changes in time to complete DT TG (BL: 12.9 ± 3.0 seconds; Acute: 15.4 ± 4.7 seconds; Asymp: 12.5 ± 2.8 seconds; RTP: 11.3 ± 2.0 seconds) compared to ST TG (BL: 10.3 ± 1.4 seconds; Acute: 10.9 ± 2.1 seconds; Asymp: 9.8 ± 1.9 seconds; RTP: 9.2 ± 1.4 seconds) across the four time points. CONCLUSION: There were significant changes in time to complete ST and DT TG from BL to RTP following concussion, with more dramatic changes seen during the DT condition. These results suggest that TG, particularly during DT, is a useful measure of post-concussion recovery.

Previous reports in the literature have identified that visual deficits are common yet often undetected after pediatric concussion. Few studies have evaluated tools available to detect visual dysfunction after concussion. PURPOSE: To investigate the association between patient-reported and physician-detected visual deficits after concussion. METHODS: We conducted a prospective cohort study of 69 subjects, ages 5-20 years old and 64% female, who reported both pre- and post-injury vision-specific symptoms on the Convergence Insufficiency Symptom Survey (CISS), a validated 15-question instrument used to assess for changes in visual symptoms in patients with convergence insufficiency, and underwent a comprehensive visio-vestibular examination in a pediatric sports medicine clinic a median of 34 days after injury (IQR 22-48). The relationship between patient-reported symptoms on the CISS and clinical findings were examined using chi-square analysis for categorical data and Mann-Whitney analysis for nonparametric data.

RESULTS: Forty-six (67%) subjects reported an abnormal CISS score of 16 or greater. However, only 31 (44%) reported the presence of visual problems when asked as one of 21 concussion-related symptoms on the Post-Concussion Symptom Inventory (PCI). Even fewer reported symptoms on the near point of convergence (NPC) (31%) and accommodation (15.3%) testing completed as part of the visio-vestibular exam. However, those with an abnormal CISS score were significantly more likely to have abnormal clinical measures of NPC (p=0.002) and accommodation (p=0.003). Females were significantly more likely to have abnormal CISS scores than males after injury.
CONCLUSIONS: Those with detectable vision deficits may not recognize that they have visual problems using standard concussion symptom scales, making physician identification even more essential. Visual symptoms may also be more prevalent and severe among females compared to males. The CISS may be a useful screening tool specific to visual symptoms that are not captured by symptom provocation on the visio-vestibular exam or commonly used concussion symptom scales.

A common side effect from a concussion is slowed reaction time. When returning to play, reaction time should be at preinjury levels to ensure a safe return to activity and to prevent further injury. The Dynavision D2 system may be utilized as an assessment and rehabilitation tool to aid in the determination of reaction time following concussion. Previous research has demonstrated good intersession reliability when assessed following a 24-48 hour test-retest window. Determining reliable test-retest intervals for novel reaction time protocols is necessary for future use as a diagnostic and rehabilitation tool. Purpose: To investigate the test-retest (intra- and intersession) reliability of a battery of five reaction time protocols. Methods: A total of 28 nonclinical participants completed a battery of five protocols increasing in difficulty in terms of reaction speed requirement and cognitive load. Prior to the initial testing, participants were instructed to stand approximately 30.5 cm from the board and allowed three familiarization opportunities. All protocols required participants to hit as many lights as quickly as possible in 60 seconds. After completing the initial testing session (Time 1), participants waited an hour before completing the second session (Time 2). Between 10-14 days later, the participant completed the same battery of tasks (Time 3). The intraclass correlation coefficient (ICC) and repeated measures ANOVA were calculated. Results: The ICC values for each of the five protocols illustrated good to excellent reliability between Time 1 and Time 2 (0.66-0.90) and between Time 2 and Time 3 (0.71-0.89). There were no significant differences across time points (F<0.105, p>0.05). Conclusion: The one hour and two-week test-retest intervals are reliable for clinical assessment, expanding the timeframe of when assessments can be completed reliably. Although these protocols have application both as an assessment and rehabilitation tool, it is important to identify optimal intervention windows to improve reaction time post-concussion. Future research should focus on identifying optimal intervention windows and how effective the Dynavision D2 system is for rehabilitation purposes.

Methods: This is a secondary analysis of CV parameters measured from a subset of patients participating in the HOPE trial (NCT01234441). This analysis includes data from 98 HD patients (54±12 yrs; 59% male) randomized either to usual care (CON) or intradialytic exercise training + protein supplementation (EX) for 12 months. Patients in the EX group performed supervised moderate intensity exercise (RPE = 12-14) on cycle ergometers for 30-45 minutes with a concomitant oral protein supplement (30g whey) during treatment. Ultrasound exams were performed to measure cardiac systolic function (ejection fraction), diastolic function (early diastolic filling pressure; E, early diastolic tissue velocity; E') and carotid arterial wall thickness (intima-media thickness, IMT). Outcomes were assessed at baseline, 6, and 12 months.

Results: There were no significant changes in any CV parameter between groups at 12-months (Group x Time interaction, p > 0.05 for all measures). However, there was a significant main effect of Time for E' in the overall study population, indicating a general worsening of left ventricular filling capacity at 12-months that was larger in CON compared to EX (p< 0.05). There was a similar trend for an increase in carotid IMT at 12-months in CON (p<0.05), that was not evident in EX.

Conclusion: These data indicates that declines in cardiac diastolic function and increases in carotid IMT that manifest over time in HD patients may be attenuated by intradialytic exercise training. Surprisingly few studies have investigated the effects of exercise on CV structure and function in HD patients, thus, these findings warrant further investigation.

Purpose: Determine which baseline assessments are most predictive of AT performance in non-alcoholic fatty liver disease (NAFLD) and hepatitis C (HCV) subjects. METHODS: At baseline prior to Modified Bruce cardiopulmonary exercise testing (CPET), clinical, laboratory, and questionnaire self-report data were collected for NAFLD, HCV and non-CLD subjects participating in prospective research measuring performance (CPET), activity level (HAP), and fatigue (FSS). Data were analyzed via ANOVA, t-test, Pearson correlation, and both linear and step-wise regression. RESULTS: 28 subject’s baseline clinical data and self-reports were analyzed (39.3% female, 57.1% Caucasian, 14.3% African American, 10.7% Hispanic, 14.3% Asian, 50.0% NAFLD, 25.0% HCV, 25.0% Non-CLD, age 40.9 ± 13.3, BMI 29.1 ± 5.9, 42.9% obese, 35.7% overweight, 14.3% diagnosed with hypertension (HTN), 28.6% hyperlipidemia (HLP), 7.1% diabetes mellitus, 7.1% metabolic syndrome, resting heart rate 70.0 ± 11.8, systolic blood pressure (SBP) 121.3 ± 11.5, diastolic blood pressure (DBP) 73.6 ± 10.1, liver enzymes: AST 35.1 ± 22.3 IU/L, 1
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ALT 46.7 ± 29.8 IU/L). Frequently at baseline, subjects had elevated SBP (57.1%), DBP (28.6%) or both SBP and DBP (14.3%). In the 14.3% of the cohort diagnosed with hypertension (systolic ≥ 140 mmHg, 1 HCV), 100% of the other diagnoses were outside of the normal range. The non-CLD group was significantly younger (p<0.001), had higher VO2 (p<0.019) and METs (p=0.020) at AT than NAFDL, scored higher on HAP submeasures (p=0.001-0.004), and had exercised longer at AT onset than both NAFDL (p=0.010) and HCV (p<0.027) cohorts. Per stepwise regression age (AT HR = 8.16, p=0.014, AT exercise duration (AT HR = 7.78, p=0.007), and handgrip test with elevated AST (AT HR = 9.01, p=0.001) was most predictive of AT performance in the NAFDL cohort. In the HCV cohort, HTN was most predictive of AT performance (AT VO2 = 857, p=0.029, AT metabolic equivalents (METs) = 864, p=0.027, and AT exercise duration r=900, p=0.014). CONCLUSION: Regardless of formal hypertension diagnosis, elevated blood pressures were common in the HCV and NAFDL cohorts. Hypertensive blood pressures at baseline are most indicative of poorer performance at AT in HCV subjects, while elevated liver enzymes (AST) were most indicative of performance at AT in NAFDL subjects.

1984 Board #245 May 31 3:30 PM - 5:00 PM Feasibility Of A Low Volume HIIT Intervention In HIV+ Hispanic Women With Neurocognitive Impairment Amarilys Romero-Reyes, Farah A. Ramirez-Marrero, FACSM, Marcos Alamil-Birriel, Annette Medina-Eencarnacion, Jorge Santana-Bagur, Walter Frontera, FACSM, Valerie Wojna. University of Puerto Rico, San Juan, Puerto Rico. (No relevant relationships reported)

High intensity interval training (HIIT) is safe and improves cardiorespiratory fitness and other health characteristics in people with HIV. However, the feasibility of such intervention among HIV+ women with neurocognitive impairment (NCI) have not been tested. PURPOSE: To determine feasibility (attendance and percent completion) of a low-volume HIIT (LV-HIIT) intervention among HIV+ Hispanic women with and without NCI. METHODS: 30 HIV+ with and without NCI (19 and 11, respectively), and 13 HIV- women volunteered for a 6-week, 3-days/week LV-HIIT intervention on a cycle ergometer. During the first 2-weeks, participants completed 8-intervals (1-min intense, 1-min active resting) of cycling at 80% of their HR reserve (HRR) determined in a maximal exercise test. During the last 4-weeks, they completed 10-intervals at 99% of their HRR. Workloads prescribed to reach target HR ranged from 60 to 115, and 40 to 135 W in HIV+ and HIV- participants, respectively (p=0.54). Each session began with a 5-min warm-up on a cycle ergometer with no resistance, and ended with a 5-10 min cool-down with stretching exercises. NCI was determined with a battery of neuro-psychological testing (7-domains). Kruksal-Wallis non-parametric test was used to determine between group differences. RESULTS: 14 HIV+ with NCI (74%), 5 HIV+ without NCI (45%), and 11 HIV- (85%) Hispanic women completed the intervention; all with 100% attendance. Mean workload and percent target HR achieved were not different between HIV+ and HIV- participants (94±20 vs. 92±27 W, P=0.34; 95±6 vs. 100±17, P=0.09). Mean HR during the first 2-weeks were: 117±21 bpm for the HIV+ with NCI, 120±9 bpm for the HIV+ without NCI, and 124±13 bpm for the HIV- (P=0.34). During the last 4-weeks, HR was: 129±21 bpm for the HIV+ with NCI, 132±8 bpm for the HIV+ without NCI, and 142±21 bpm for the HIV- (P=0.36). CONCLUSION: Attendance and percent completion suggest the feasibility of the LV-HIIT intervention among HIV+ Hispanic women with NCI. Similar HR response between HIV+ and HIV- participants with NCI compared with HIV- women. Also, to evaluate between group differences in HR response during the intervention. METHODS: 30 HIV+ with and without NCI (19 and 11, respectively), and 13 HIV- women volunteered for a 6-week, 3-days/week LV-HIIT intervention on a cycle ergometer. During the first 2-weeks, participants completed 8-intervals (1-min intense, 1-min active resting) of cycling at 80% of their HR reserve (HRR) determined in a maximal exercise test. During the last 4-weeks, they completed 10-intervals at 99% of their HRR. Workloads prescribed to reach target HR ranged from 60 to 115, and 40 to 135 W in HIV+ and HIV- participants, respectively (p=0.54). Each session began with a 5-min warm-up on a cycle ergometer with no resistance, and ended with a 5-10 min cool-down with stretching exercises. NCI was determined with a battery of neuro-psychological testing (7-domains). Kruksal-Wallis non-parametric test was used to determine between group differences. RESULTS: 14 HIV+ with NCI (74%), 5 HIV+ without NCI (45%), and 11 HIV- (85%) Hispanic women completed the intervention; all with 100% attendance. Mean workload and percent target HR achieved were not different between HIV+ and HIV- participants (94±20 vs. 92±27 W, P=0.34; 95±6 vs. 100±17, P=0.09). Mean HR during the first 2-weeks were: 117±21 bpm for the HIV+ with NCI, 120±9 bpm for the HIV+ without NCI, and 124±13 bpm for the HIV- (P=0.34). During the last 4-weeks, HR was: 129±21 bpm for the HIV+ with NCI, 132±8 bpm for the HIV+ without NCI, and 142±21 bpm for the HIV- (P=0.36). CONCLUSION: Attendance and percent completion suggest the feasibility of the LV-HIIT intervention among HIV+ Hispanic women with NCI. Similar HR response between HIV+ and HIV- participants with NCI compared with HIV- women. Also, to evaluate between group differences in HR response during the intervention. METHO
Mann Whitney-U tests. RESULTS: Nine individuals with ID (4 male, 32.3 ± 7.7 yrs, 23.0 ± 8.7 kg/m²) and nine age and sex matched controls (24.3 ± 2.9 kg/m²) were included. Individuals with ID demonstrated significantly lower values (p<0.05) in all outcomes compared to controls, except for VE/VCO₂ slope (p=0.06) and RERpeak (p=0.34). CONCLUSION: Even with similar effort (RERpeak) between groups, individuals with non-syndromic ID had lower heart rate related parameters and altered integration of cardiovascular, muscular and respiratory function. This likely partially explains the lower exercise capacity compared to matched controls. This project has received funding from the Marie Curie International Outgoing Fellowship within the 7th European Community Framework Program under grant agreement No 625455-1D Physiologic.

All data are presented as mean ± SD, unless otherwise noted. *median ± IQR * Mann Whitney U test

1986 Board #247 May 31 3:30 PM - 5:00 PM

Assoeations of Sleep Patterns with Physical Functioning and Physical Activity in Adults with Down syndrome

Stamatia Agiovolasitis, FACSM, Mallory Chapman, Benjamin Carlson, Jasmin S. Curtis,1 Marquell Johnson, 1Mississippi State University, Mississippi State, MS, 1University of Wisconsin-Eau Claire, Eau Claire, WI.

(No relevant relationships reported)

People with Down syndrome (DS) have low sleep quality, physical functioning, and physical activity, and high levels of sedentariness and body mass index (BMI). It is not known, however, if sleep patterns are associated with physical activity, sedentariness, physical functioning, and BMI in adults with DS. PURPOSE: To examine if sleep variables are associated with physical functioning, physical activity, sedentariness, and BMI in adults with DS. METHODS: Fifteen persons with DS (8 women and 7 men; age 29 ± 14 y; BMI 32.8 ± 8.7 kg/m²) participated in this study. Participants attended a session where they were measured. Participants then wore for 7 days on their right wrist an accelerometer time during the timed-up-and-go test and distance covered during the 6-min walk test. RESULTS: Fifteen persons with DS (8 women and 7 men; age 29 ± 14 y; BMI 32.8 ± 8.7 kg/m²) participated in this study. Participants attended a session where they were measured. Participants then wore for 7 days on their right wrist an accelerometer time during the timed-up-and-go test and distance covered during the 6-min walk test. All data are presented as mean ± SD, unless otherwise noted. *median ± IQR * Mann Whitney U test

1987 Board #248 May 31 3:30 PM - 5:00 PM

Metabolic And Cardiovascular Effects Of Body Weight Support Treadmill Walking In Healthy Adults

Robert S. Van Zant, Wink Colegachoff, Michael Kunish, Tamara Kunz, Mark Marshall, Sara McDermott, Trevor Myers, Byron Sunga. The University of Findlay, Findlay, OH.

(No relevant relationships reported)

PURPOSE: The use of body weight support treadmill (BWST) training for rehabilitation of patients with brain injuries, as well as musculoskeletal and neuromuscular impairments, is an emerging clinical treatment method. Because of the limited evidence of physiological stress of BWST training, the purpose of this study was to describe the metabolic and cardiovascular response to varying levels of BWST walking in healthy adult subjects.

METHODS: A total of 21 subjects (10 females, 34.6 ± 6.7 yr; 74.6 ± 14.3 kg; 170.8 ± 6.9 cm; 26.1 ± 3.5 kg/m²) provided their informed consent to participate in three 5-minute walking trials at a self-selected treadmill speed, with body weight support (BWS) of 0, 15, and 30%. Test order was randomized for each subject. Subjects rested for a minimum of 15 minutes between trials, and did not begin a subset until HR was verified to be< 5 bpm of HR rest. Mean HR (12-lead ECG), BP (auscultation), oxygen uptake (continuous indirect calorimetry), and RPE (Borg ratio scale) were determined from the last 3 minutes of each trial. Mean values for all variables were assessed for difference between trials using repeated measures analysis of variance (ANOVA, 2 x 3 x 20). RESULTS: At rest, HR was 78.2 ± 11.5 bp and BP was 121.2 ± 7.9 / 76.9 ± 8.0 mmHg. Mean walking speed of subjects was 64.2 m/min. HR and systolic BP significantly (p<0.05) increased from rest to exercise at all BWS levels, with no significant difference in diastolic BP seen from rest to exercise at all BWS levels. There was no significant difference among levels of BWS for HR, BP, RPE, oxygen uptake, respiratory exchange ratio, respiratory rate, tidal volume, and METs.

CONCLUSIONS: Metabolic and cardiovascular responses to treadmill walking at 3 levels of BWS (0, 15, 30%) were similar in apparently healthy adult subjects.

1988 Board #249 May 31 3:30 PM - 5:00 PM

Myotonic Dystrophy Alters Peripheral And Central Adaptations Involved With Movement Control

Aaron T. Buclow, Michael A. Petrie, Jinhyun Lee, Peg Nopoulous, Laurie Guttmann, Richard K. Shields. The University of Iowa, Iowa City, IA.

(No relevant relationships reported)

Myotonic dystrophy type 1 (DM1) is the most common inherited muscular dystrophy in adults. The clinical manifestations of myotonia, muscle weakness, and muscle wasting are characteristic symptoms of DM1. However, “upstream” effects of myopathy on spinal cord function and overall movement control is not well established. PURPOSE: To determine the effect of DM1 on peripheral muscle properties, spinal cord excitability, and neuromuscular movement control. METHODS: Sixteen DM1 and sixteen control subjects participated in this study. Subjects received a battery of 4 tests; 1) assessment of spinal cord excitability via suppression using paired H-reflexes (H2/H1), 2) soleus muscle single (S) and double pulse (D) twitches, 3) fatigue via a repetitive 3 Hz stimulation, and 4) a global motor accuracy movement score (coherence) during a novel weight bearing task. We used a split plot repeated measures analysis of variance to analyze test for differences within and between DM1 and control for each test. RESULTS: H-reflex suppression was not different between DM1 and control (40.4 ± 0.31; p=0.52). The soleus single twitch amplitude was less for DM1 compared to control (0.59 and 0.72; p<0.03). The double pulse to single pulse (D/S) ratio, a measurement of excitation-contraction coupling, trended higher for DM1 compared to control subjects (1.96 and 1.8; p=0.08). The weight bearing task error analysis (coherence) was less for DM1 group as compared to the control group (0.42 and 0.66; p<0.004). Coherence was correlated to the MIRS score (r=0.7; p<0.05). The reproducibility of all within session measurements were high (r>0.87). Conclusion: The reduced twitch amplitudes for DM1 group is consistent with the extensive atrophy and provides a reproducible measurement to monitor disease progression. The enhanced D/S ratio for the DM1 group is consistent with impaired excitation contraction coupling, suggesting that calcium release is functionally compromised in people with DM1. The human performance weight bearing task accuracy (coherence) was the most robust measurement and highly correlated to disease severity. These findings support that people with genetically identified myopathy also have significant upstream effects that may influence human performance. Supported by NIH Grant R01NS094387-03
The development of new SCI-specific prediction models demonstrated that the addition of anthropometric variables, without FFM, explained less of the variance in BMR (Model 4; \( r^2 = 0.57 \)). However, all the developed prediction models demonstrated acceptable mean absolute error ≤6%.

**CONCLUSIONS:** BMR can be more accurately estimated when DXA derived FFM is incorporated into prediction equations. Utilising anthropometric measurements provides a promising alternative to improve the prediction of BMR, beyond that achieved by existing equations in persons with SCI.

**METHODS:** To determine the impact of superimposed resistance training (RT) in aerobically trained coronary patients on systolic blood pressure (SBP), heart rate (HR), rating of perceived exertion (RPE; 6-20 scale), and rate pressure product (RPP) at fixed submaximal workloads following a 12-week RT intervention. Additionally, pre and post RT measures of brachial artery reactivity, an index of endothelial function, were obtained. **METHODS:** Fifteen low risk coronary patients (13 men, 2 women; mean ± SD age = 56.1 ± 5.1yrs) completed a progressive 12-week RT program that complemented their regular aerobic training regimen. Prior to training, SBP, HR, RPP, and RPE were obtained while subjects performed 1 set (10 repetitions) of 3 different exercises (bicep curl [BC], shoulder press [SP], leg press [LP]) at an intensity -60-80% of 1-repetition maximum. After the training period, testing was repeated while subjects lifted the identical pre-training loads for each exercise following a standardized protocol. Vascular function was assessed by flow-mediated vasodilation (FMD) testing prior to and immediately following the 12-week RT training intervention. **RESULTS:** Lifting the same pre-training loads evoked attenuated responses for all variables (HR, SBP, RPE, RPP). A statistically significant decrease was shown for RPP (HR by SBP/100) during BC (106 ± 27 to 91 ± 22, \( P < 0.007 \)) and SP (102 ± 24 to 86 ± 17, \( P < 0.007 \)) whereas the RPP decrease during LP (116.2 ± 22 to 109 ± 26) did not achieve statistical significance (\( P = 0.18 \)). RPE for all 3 exercises decreased significantly (\( P < 0.0001 \)) following the RT intervention: BC (14.3 ± 2.3 to 9.7 ± 1.6), SP (13.9 ± 1.6 to 9.2 ± 1.5), LP (14.3 ± 1.4 to 10.3 ± 1.6). Pre versus post RT measurements for resting HR and resting SBP were unchanged. Peak FMD responses for the 15 subjects were 12.8% and 10.3% dilation pre- and post-training, respectively (\( P < 0.332 \)). However, 5 of the 15 subjects showed modest improvements in their post-training time to achieve maximum dilation from a mean of 117 seconds to 81 seconds (\( P < 0.156 \)). **CONCLUSION:** Among aerobically trained coronary patients, a superimposed resistance training program resulted in decreased hemodynamic and RPE responses to lifting fixed submaximal workloads and improved FMD responses in 5 of the 15 participants.
medicated dilation (FMD) was used to assess endothelial function by ultrasound and (VO2max) in young men with T1D.

CONCLUSION: The 12-week multi-directional exercise training regimen utilizing half-ball balance devices improved lower limb strength, endurance, and balance compared with uni-directional conventional training in patients with chronic stroke. Therefore, this multi-directional exercise regimen may have therapeutic advantages in a clinical rehabilitation setting.

PURPOSE: Physical exercise and educational programs promote several benefits for patients with knee osteoarthritis (OA). However, little is known about their effects on blood pressure (BP) of this population. Our purpose was to assess the role of physical activity on BP of subjects under treatment for knee OA submitted to an interdisciplinary educational program.

METHODS: One hundred and thirty six sedentary subjects (25/111 men/women; age = 67.6 ± 9.6, BMI = 30.6 ± 4.4 kg/m²), under treatment for primary knee OA, were submitted to an interdisciplinary educational program emphasizing the recommendation for regular practice of physical exercise, and have their BP, six minute walking test (6MWT), body mass index (BMI) and daily living physical activity (IPAQ) short version assessed before (pre) and after 12 months of follow-up. Subjects were then classified, according to their physical activity status during follow-up, in sedentary-to-sedentary (SED-SED, sedentary/insufficiently active at pre and post follow-up), sedentary-to-active (SED-ACT, sedentary/insufficiently active at pre follow-up and active/very active at post follow-up), active-to-sedentary (ACT-SED, active/very active at pre follow-up and sedentary/insufficiently active at post follow-up) and active-to-active (ACT-ACT, active/very active at pre and post follow-up) groups and have their BP and physical 6MWT compared.

RESULTS: Systolic BP increase (11±3 mmHg, P < 0.01) and maintenance in diastolic BP were found in SED-SED, whereas trendiness toward increase in systolic BP (12±6 mmHg, P = 0.07) and increase in diastolic BP (5±1 mmHg, P < 0.01) were found in ACT-SED during follow-up. On the other hand, maintenance in systolic BP and reduction in diastolic BP (5±2 mmHg, P = 0.01) were found in SED-ACT, whereas maintenance in systolic BP and tendency toward reduction in diastolic BP (3±2 mmHg, P = 0.07) were found in ACT-ACT during follow-up. The positive effects on BP in SED-ACT and ACT-ACT were accompanied by improvements (P < 0.05) on 6MWT (SED-ACT = 8.5±2.7 %; ACT-ACT = 9.3±3.6 %) and BMI (SED-ACT = 2.9±0.9 %; ACT-ACT = 3.8±2.0 %), whereas no changes were found in SED-SED and ACT-SED.

CONCLUSIONS: This results suggest that high levels of physical activity may have a positive role on prevention /management of high BP in subjects under treatment for knee OA.

1994 Board #255 May 31 2:00 PM - 3:30 PM Endothelial Function Correlates With Aerobic Fitness In Adults With Fasting Hyperglycemia Plus Impaired Glucose Tolerance
Stephanie L. Miller, Natalie Z.M. Eichner, Nicole M. Gilbertson, Emily M. Heiston, Arthur Weltman, FACSM, Eugene J. Barrett, Steven K. Malin, FACSM, University of Virginia, Charlottesville, VA. (Sponsor: Steve Malin, FACSM) (No relevant relationships reported)

Background: Impaired glucose tolerance (IGT) elevates type 2 diabetes and cardiovascular disease (CVD) risk above and beyond impaired fasting glucose (IFG) alone. Endothelial dysfunction and arterial stiffness have been implicated in chronic disease and linked to reduced aerobic fitness. However, it is unknown if the presence of IGT attenuates vascular function in people with IFG. We tested the hypothesis that adults with IFG+IGT have endothelial dysfunction and arterial stiffness in relation to low aerobic fitness when compared with IFG counterparts. Methods: Middle-aged, obese adults with IFG (n=11, 58.3±10.3yrs; 34.0±7.4 kg/m²; FBG: 105.6±6.1mg/dl, 2-hr glc: 120.7±28.1mg/dl) and IFG+IGT (n=14, 61±8.1yrs; 33.1±3.3 kg/m²; FBG: 104.2±10.5mg/dl, 2 hour glc: 165.4±2mg/dl) were compared in this cross-sectional study following a 75g OGGT screening based on ADA criteria. Aerobic fitness (VO2peak) was assessed with a cycle ergometer via indirect calorimetry, and body fat was determined by BIA (inBody®). After an overnight fast, brachial artery flow mediated dilation (FMD) was used to assess endothelial function by ultrasound and arterial stiffness was determined via augmentation index (AI) and pulse wave velocity (PWV) by applanation tonometry. A 180-min OGGT was also performed to assess glucose tolerance. Results: Although there was no significant difference between IFG and IFG+IGT for body fat (P=0.94), VO2peak (P=0.46), FMD (P=0.42), AI (P=0.71), or PWV (P=0.95), elevated VO2peak was strongly correlated with a higher FMD in people with IFG+IGT (r=0.57, P=0.04), but not IFG (r=0.1, P=0.99). Moreover, elevated postprandial glucose blood at 180 min was associated with lower VO2peak (r=-0.51, P=0.06) and FMD (r=-0.52, P=0.05) in IFG+IGT, but not IFG (r=0.19, P=0.57, r=0.22, P=0.52, respectively). Conclusion: Endothelial function was significantly related to aerobic fitness in adults with IFG+IGT but not IFG. These data highlight that post-prandial hyperglycemia may modify vascular function and training adaptation uniquely between prediabetes phenotypes. Additional research is needed to determine the effect of training across exercise doses on skeletal muscle vascular glucose regulation to optimize diabetes and/or CVD prevention.

PURPOSE: Research from our laboratory indicates that six weeks of aerobic exercise alters the gut microbiota and microbial-derived short chain fatty acids (SCFAs) in both lean and obese humans. SCFAs directly modulate inflammation, insulin sensitivity and gut barrier function. Thus, the objectives of the present study were to (1) determine the effects of aerobic exercise training on circulating metabolic and inflammatory parameters indicative of inflammation, insulin sensitivity, and gut barrier function and (2) determine whether changes in these parameters paralleled shifts in the microbiota and its metabolites.

METHODS: Previously sedentary but otherwise healthy adults (n=16 lean; n=11 obese) underwent a six-week aerobic exercise intervention. Blood samples collected before and after the intervention were analyzed for C-reactive protein (CRP), lipopolysaccharide binding protein (LBP), and insulin resistance by the homeostatic model assessment (HOMA-IR). Fecal samples were analyzed for microbiota composition (16S rRNA gene sequencing) and SCFA concentrations (gas chromatography).

RESULTS: At baseline, obese individuals had significantly higher CRP, LBP, insulin, and HOMA-IR compared to lean individuals (p < 0.05). There were no changes in CRP as a result of exercise training. However, LBP and HOMA-IR were significantly reduced by exercise in the obese group (p < 0.05). Change in CRP over the 6-week intervention positively correlated with change in abundance of Erysipelotrichaceae (r = 0.160, p = 0.009), a microbe previously shown to be associated with metabolic syndrome. Change in abundance of Anaerostipes, a genus of known butyrate-producers, negatively correlated with change in LBP (r = -0.727, p = 0.007) and HOMA-IR (r = -0.471, p = 0.036). Both CRP and LBP levels after the intervention were negatively correlated with postecal acetate, butyrate, and propionate levels (p < 0.01).

CONCLUSIONS: Six weeks of aerobic exercise improved markers of insulin sensitivity and metabolic endotoxemia in obese individuals. These improvements may be related effects on the gut microbiota, as metabolic and inflammatory markers correlated with changes in several important microbial genera and post-intervention SCFAs.
The Influence of Physical Inactivity on Risk Of Type 2 Diabetes In University Staff

Ever Espino-González, María de Jesús Muñoz-Daw, Elsa Hirujo-Señez, José Luis Santisteban-Parra, José Buenaventura Pardo-Renteria. Autonomous University of Chihuahua, Chihuahua, Mexico. (No relevant relationships reported)

There is now comprehensive evidence that physical inactivity is a primary cause of most cardiovascular and metabolic diseases. The Finnish Diabetes Risk Score (FINDRISC) questionnaire has demonstrated to be an effective tool for predicting the development of cardio-metabolic disorders, such as type 2 diabetes mellitus (T2DM) and metabolic syndrome (MetS). Importantly, one FINDRISC question is related with physical activity. PURPOSE: Thus, the present study aimed to: (i) determine the influence of physical inactivity on the risk of developing type 2 diabetes in university staff; and (ii) to determine possible connections between health parameters and the questionnaire responses. METHODS: A cross-sectional, descriptive study was conducted with 252 professors and administrative staff (139 women: 42.1±11 yr; 113 men: 45±13 yr) from the Autonomous University of Chihuahua (UACH) who underwent a health check including anthropometric measurements (height, weight, and waist circumference), blood pressure, and the FINDRISC questionnaire. The association between physical activity and the risk of T2DM was measured by contingency tables. RESULTS: There was a significant association between physical inactivity and the risk of T2DM (p<0.000). Waist circumference and body mass index were also associated with physical inactivity (p=0.01 and 0.03, respectively). Cardiovascular risk measured by waist circumference was 33% for women and 31% for men. Around 42% of men and 40% of women did at least 30 minutes of physical activity daily. CONCLUSIONS: The FINDRISC questionnaire showed a robust association with the risk of development cardio-metabolic disorders, as well as with health parameters.

Subjects categorized to type 2 diabetes risks according to FINDRISC

<table>
<thead>
<tr>
<th>Category</th>
<th>Women</th>
<th>Men</th>
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<tr>
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Loss of physical functioning due to non-surgical lower extremity soft tissue pain (LESTP) is not well studied, but LESTP has been linked to difficultly completing activities of daily living. Obese patients have high incidences of musculoskeletal pain in the back, knee, ankle, and feet as barriers to a physically inactive lifestyle. The American College of Sports Medicine (ACSM) recently published simple methods to assess physical functioning for adults with a chronic disease or disability. PURPOSE: To see if the ACSM methods can be implemented in a medical practice, and to examine the relationships between lower-extremity extremal symptoms and BMI and biomechanical abnormalities with poor physical functioning. METHODS: 15 subjects (12 female, 3 male) completed informed consent and underwent a brief medical history and physical exam for symptoms and signs of LESTP. Weight and height were recorded; knee and ankle alignments were measured (Ingham’s knee mal-alignment and foot rotation instruments). Dynamic stability was assessed by Trendelenburg test, 2-legged half-squats and 1-legged squats. Functional performance was assessed by gait speed, sit-to-stand, and stair climb tests. Associations between LESTP, biomechanical burdens, and poor physical functioning were examined with Fisher’s Exact test and Spearman’s rank correlation. RESULTS: Fisher's Exact test revealed significant relationships between BMI vs abnormal gait (p=0.01), as well as BMI vs two-legged squat mechanics (p=0.05). There were strong associations between physical functioning measures: sit to stand vs stair time r= -0.64, p<0.05; gait speed vs sit to stand r= 0.60, p<0.05; gait speed vs stair climb time r=0.65, p<0.05. Strong associations were also seen between BMI and dynamic instability score r=0.71, p<0.005, as well as dynamic instability and poor physical functioning r=0.50, p<0.05. Significant correlation was found between BMI and biomechanical burdens (r=0.27, p<0.05). CONCLUSION: In this study, BMI was associated with dynamic instability, and dynamic instability was associated with poor physical functioning. The findings support the concept of sarcopenic obesity, wherein body mass outstrips musculoskeletal ability to provide normal biomechanical functioning and impairs independence and activities of daily living.

The combined effect of intermittent hypoxemia and sleep fragmentation induced by obstructive sleep apnea (OSA) is associated with high cardiometabolic risk. In contrast, high levels of physical activity (PA) decrease proinflammatory markers related to cardiovascular diseases, improve glycemic control and sleep quality. PURPOSE: To observe the association between PA levels with sleep parameters and a range of cardiometabolic profile in a population sample, and to assess the OSA effect on association between PA level and cardiometabolobic markers.

METHODS: A cross-sectional study, the Sao Paulo Epidemiologic Sleep Study, assessed 1042 individuals aged between 20 and 80 years of age through polysomnographic (PSG) and cardiometabolic profile such as C-reactive protein (CRP), homocysteine, folate acid, vitamin B12, tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), leptin, ghrelin, insulin and blood glucose. RESULTS: In the 993 individuals included in the analyses, PA level had a negative association with apnea and hypopnea index (B = -0.016, P<0.001). Compared to the non-PA group level was 20.3% higher in the moderate group vs. 39.9% lower in the moderate group (P<0.001), and 57.7% lower in the severe group (P<0.001). There was a negative association between PA level and CRP (B = -0.34, P=0.001) and insulin (B = -0.011, P=0.023) when analyzed whole sample. A negative association between PA level and homocysteine was only observed in non-apneic subjects (B = -0.327, P=0.002) There was no association between PA level, and CRP and insulin when apnic individuals only were analyzed.

CONCLUSIONS: A high PA level is negatively associated with OSA severity. Although PA level was negatively associated with CRP and insulin in the whole sample, this association was not found when only OSA individuals were considered. Supported by CEPID/SONO-FAPESP (09/12345-3), CAPES

Special rehabilitation treatment and exercises by INFINITY method® (IM) use active movement and passive therapy. The three-dimensional rehabilitation therapy and movements stabilize and centralize the posture and also lumbar region. The IM is used as a treatment of patients with low back pain (LBP) and also preventive exercise program. PURPOSE: To test efficacy of the rehabilitation method IM in patients with LBP. METHODS: This was a quasi-experimental and non-randomized study with repeated measures design in a rehabilitation clinic. The participants with LBP (n = 15, age 66.2 ± 18.8 yr) volunteered in the study. All patients received a 60-minute IM therapy per day for twenty days for four weeks. We measured the area of center of force (COF) (cm²), anterior-posterior (A-P) and medial-lateral (M-L) sway components of COF (cm) before and after the treatment. Patients were standing for 30 seconds with eyes closed.
Exercise training may reduce cardiovascular disease (CVD) risk among at-risk populations. Firefighters are a high-stress occupational group at increased risk for CVD. However, the effects of exercise training on risk factors of CVD among firefighters remain unclear. **Purposes:** To estimate the population effect size of exercise on health, fitness, and physiological/biological risk factors for CVD among firefighters. **Methods:** Eleven randomized controlled trials and seven experimental studies published before August 2017 were located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 1,428 (27 females) participants aged 36.7±8.5 years, included firefighters, aimed to improve physical activity and/or improve fitness/health, and included a validated measure of ≥1 biological CVD risk factor(s). Hedges’ g effect sizes were computed to quantify the magnitude of the effects of exercise compared to control conditions. Random effects models were used for all analyses. **Results:** Exercise interventions included aerobic exercise training, resistance exercise training, and combined training that varied in frequency (3±1 sessions/wk), intensity (moderate to intense), supervision (n=10), and duration (16±5 ± 10 weeks). Exercise resulted in significant, small-to-moderate effects on body weight (Δ=0.29, [0.02-0.56], p=0.05, k=12), body composition (Δ=0.34, [95% CI: 0.14-0.54], p=0.01, k=21), body fat percentage (Δ=0.53, [0.20-0.86], p=0.01, k=5), strength (Δ=0.50, [0.30-0.71], p=0.05, k=15), and occupational fitness (Δ=0.59, [0.20-0.99], p=0.05, k=8). Significant, large effects were found for fitness (Δ=0.85, [0.58-1.12], p<0.001, k=45), aerobic capacity (Δ=1.21, [0.47-1.95], p=0.001, k=8), and endurance (Δ=1.53, [0.79-2.38], p<0.001, k=11). Exercise training resulted in small-to-moderate non-significant effects on cholesterol, heart rate, psychological outcomes, BMI, flexibility, and systolic blood pressure. **Conclusions:** The available evidence supports positive effects of exercise interventions on risk factors of CVD, including health outcomes (i.e., body composition, weight, and body fat percentage), and relevant measures of fitness (i.e., aerobic capacity, endurance, strength, and occupational fitness).

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- Exercise training may reduce cardiovascular disease (CVD) risk among at-risk populations. Firefighters are a high-stress occupational group at increased risk for CVD. However, the effects of exercise training on risk factors of CVD among firefighters remain unclear. **Purposes:** To estimate the population effect size of exercise on health, fitness, and physiological/biological risk factors for CVD among firefighters. **Methods:** Eleven randomized controlled trials and seven experimental studies published before August 2017 were located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 1,428 (27 females) participants aged 36.7±8.5 years, included firefighters, aimed to improve physical activity and/or improve fitness/health, and included a validated measure of ≥1 biological CVD risk factor(s). Hedges’ g effect sizes were computed to quantify the magnitude of the effects of exercise compared to control conditions. Random effects models were used for all analyses. **Results:** Exercise interventions included aerobic exercise training, resistance exercise training, and combined training that varied in frequency (3±1 sessions/wk), intensity (moderate to intense), supervision (n=10), and duration (16±5 ± 10 weeks). Exercise resulted in significant, small-to-moderate effects on body weight (Δ=0.29, [0.02-0.56], p=0.05, k=12), body composition (Δ=0.34, [95% CI: 0.14-0.54], p=0.01, k=21), body fat percentage (Δ=0.53, [0.20-0.86], p=0.01, k=5), strength (Δ=0.50, [0.30-0.71], p=0.05, k=15), and occupational fitness (Δ=0.59, [0.20-0.99], p=0.05, k=8). Significant, large effects were found for fitness (Δ=0.85, [0.58-1.12], p<0.001, k=45), aerobic capacity (Δ=1.21, [0.47-1.95], p=0.001, k=8), and endurance (Δ=1.53, [0.79-2.38], p<0.001, k=11). Exercise training resulted in small-to-moderate non-significant effects on cholesterol, heart rate, psychological outcomes, BMI, flexibility, and systolic blood pressure. **Conclusions:** The available evidence supports positive effects of exercise interventions on risk factors of CVD, including health outcomes (i.e., body composition, weight, and body fat percentage), and relevant measures of fitness (i.e., aerobic capacity, endurance, strength, and occupational fitness).

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**References:**
**ABSTRACT**

The deadlift, back and front squat are common multi-joint lower body resistance exercises that are promoted to train similar musculature. To our knowledge, muscle activity measured via surface electromyography (EMG) has never been analyzed among these three exercises. Furthermore, most literature examining this topic uses all male participants creating a void in the literature for the female population. Knowledge of lower body muscle activation among these three exercises can aid coaches, trainers, and therapists for training and rehabilitative purposes. Therefore, the purpose of this study was to compare peak muscle activity of five lower body muscles among the back squat, front squat, and deadlift in trained women. Thirteen trained women completed two days of testing including a one repetition maximum (1RM) estimation, an actual 1RM, and 3 repetitions at 75% 1RM load for the deadlift, back and front squat. Muscle activity during the three repetitions at 75% 1RM load of each muscle during the total exercise period were averaged and normalized as a percentage of the peak signals obtained during the 1RM lifts. A repeated measures within subject analysis indicated greater muscle activity during the front squat (M = 94%, SD = 15%) compared to the back squat (M = 72%, SD = 16%; p < .05) in the GM. No significant differences were observed among the lifts in the vastus medialis, vastus lateralis, biceps femoris, and rectus femoris. These findings suggest that coaches and athletes may consider utilizing the front squat exercise for training focused on the GM involvement in female athletes.

**RESULTS**

Mechanical loading of differentiated myotubes mimics the loading pattern of mature skeletal muscle and alterations in signaling and gene expression responses have been reported upon mechanical loading applied on skeletal muscle myotubes. **PURPOSE:** This study investigated the effects of the mechanical loading of terminally differentiated myotubes (myotubes) on signaling and gene expression responses associated with the progression of their myogenic lineage. **METHODS:** C2C12 myotubes were cultured on elastic membranes up to the day 2 isoforms (IGF-1Ea: 2.1-fold, IGF-1Eb: 1.2-fold) and MRFs (MyoD: 5.8-fold, Myogenin: 3.3-fold, MRF4: 2.3-fold) increased significantly (p<0.05), while the apoptotic (p53: 0.09-fold, FAS: 0.7-fold) and atrophy factors (Atroglin: 0.09-fold, Myostatin: 0.7-fold, Murl1: 0.09-fold) decreased (p<0.05). On the contrary, an upregulation of the inflammatory factors (IL-1b: 4.6-fold, IL-6: 7.5-fold) was depicted (p<0.05), along with a downregulation of the (INF-γ: 0.5-fold) levels (p<0.05). **CONCLUSIONS:** It was demonstrated that mechanical loading of myotubes can further promote the progression of their myogenic lineage by upregulating myogenic and anabolic factors and signaling, and downregulating apoptotic and atrophy genes.

**2007 Board #268**

**May 31 2:00 PM - 3:30 PM**

**Glycogen Enhancement Augments Overload-Induced Protein Synthesis, Growth, and Myogenesis in Aged Skeletal Muscle.**

Marcus M. Lawrence¹, Josh R. Huot¹, Bailey Peck², Yuan Wen², Michael Shields³, Raahil Madhiwala¹, Alexander Skurat², Peter J. Rouhi¹, Eric Kane¹, Adam Reitze³, Benjamin F. Miller³, Karyn L. Hamilton⁴, Susan T. Arthur⁵, Scott E. Gordon, FACSM⁶. **UNC Charlotte, Charlotte, NC.** ¹University of Kentucky, Lexington, KY. ²National Heart, Lung, and Blood Institute, Bethesda, MD. ³Colorado State University, Fort Collins, CO. ⁴Kennesaw State University, Atlanta, GA. (Sponsor: Scott E. Gordon, PhD, FACSM)

Age-related skeletal muscle (SkM) wasting is associated with elevated 5′-AMP-Activated Protein Kinase (AMPK) activity, which inhibits overload-induced (OI) SkM protein synthesis (MPS) and growth. Glycogen, an inhibitor of AMPK, is reduced in aged SkM. **PURPOSE:** To examine the effects of manipulating glycogen on AMPK, MPS and related signaling, and OI-growth in aged SkM. **METHODS:** Mutant glycogen synthase (GS; designed to enhance SkM glycogen content [GCI]) or empty-vector plasmids were electrotroduced into fast-twitch plantaris muscles prior to 21-day synergist ablation-induced unilateral overload in young adult (8 mo; empty vector, YE; n=9) and old (33 mo); empty vector, OE; n=11; or mutant GS, OM, n=13) male FBN rats. Contralateral limbs underwent SkM ablations with no plasmid. **RESULTS:** As expected, mutant GS expression and GC were significantly higher in OM overloaded muscles (the only muscles receiving the mutant GS plasmid) vs SHAM OI muscles or vs OM muscles in control conditions. On the contrary, there were significant increases in OI-(all vs SHAM) MPS and hypertrophy in all groups and OM was greater than OE. Markers of AMPK activity and other signaling intermediates affecting MPS were largely unaltered by glycogen enhancement. However, there was a strong and significant effect of enhancing GC (via mutant GS vs empty vector plasmid) on myogenic regulatory factors MyoD and myogenin, embryonic myosin heavy chain-positive fibers, and total fiber number in aged muscle under conditions of overload. **CONCLUSIONS:** Thus, enhancing GC may lead to enhanced MPS and OI growth in aged SkM. This effect may be due, in part, to enhanced myogenesis.

**2008 Board #269**

**May 31 2:00 PM - 3:30 PM**

**High versus Low doses of Anti-inflammatory Drugs Do Not Differentially Affect Muscle Molecular Response to Acute Resistance Exercise**

Mats Lilja¹, Marcus Moberg², Mirko Mandič³, Thomas Gustafsson¹, Tommy R. Lundberg³. ¹Karolinska Institutet, Stockholm, Sweden. ²The Swedish School of Sport and Health Sciences, Stockholm, Sweden. **No relevant relationships reported**

**PURPOSE:** We recently reported that high doses of non-steroidal anti-inflammatory drugs (NSAIDs) attenuate resistance exercise-induced muscle hypertrophy in young adults. Yet, little is known about the molecular mechanisms behind this effect. The current study aimed to examine acute muscle molecular responses to resistance exercise during co-ingestion of high and low doses of anti-inflammatory drugs. **METHODS:** Thirty one young (age 18-35 years) healthy men and women were randomly assigned to daily consumption of high doses of ibuprofen (IBU; 1200 mg; n=15) or low doses of asacitsalicic acid (ASA; 75 mg; n=16) during an 8-week training intervention. During this period, subjects performed 20 supervised resistance training sessions (4 x 7-12 repetitions) involving the knee extensor muscles. Gene expression and protein signaling of key muscle growth regulators were analyzed from skeletal muscle biopsies obtained before training/treatment and 3 hours after an acute resistance exercise session during week 4 of the intervention. Real-time qPCR procedures were employed to determine mRNA expression. Protein signaling was assessed using western blots.

**RESULTS:** Gene expression of myostatin (0.4-fold; p=0.0005), MURF-1 (0.8-fold; p=0.015) and FoxO3 (0.6-fold; p=0.0005) decreased in response to the resistance exercise bout, with no difference across groups. Gene expression of IL-6 and STAT3 were
Autophagy is an anciently conserved pathway responsible for the degradation of long-lived proteins, protein aggregates, and organelles, thereby contributing to efficient protein homeostasis. Autophagy is stimulated by nutrient deprivation and is required for certain beneficial adaptations of exercise. Insufficient autophagy is a common feature of muscle diseases, obesity, type 2 diabetes, and aging. However, regulation of autophagy is incompletely understood at the molecular level. PURPOSE: Define the role of unc-51 like autophagy activating kinase 2 (ULK2), and contrast with that of its close homolog ULK1, in regulation of autophagy and contractile function in skeletal muscle. METHODS: 1) DNA plasmids encoding either Ulk1 or Ulk2 pre-micro RNAs (miR) were electroporated into the tibialis anterior (TA) muscle of one leg, and a control miR plasmid into the contralateral leg of wild type mice. Muscles were harvested 7-8 days afterwards, either at basal conditions or after 24h of starvation. 2) ULK2 differentiated primary mouse myotubes were infected with Ad-Cre-GFP or Ad-GFP (control) viruses, and harvested up to 96h afterwards. 3) Maximal force of hindlimb dorsiflexors was assessed in adult ULK2 skeletal muscle knockout mice (ULK2fl/fl), Myogenin-Cre+/-, and ULK2mKO via stimulation of the tibial nerve, and compared to control littermates (ULK2fl/fl, Cre-). RESULTS: ULK2 is expressed at ~2-fold higher levels than its close homolog ULK1 in skeletal muscle. ULK2 deficiency, but not ULK1, leads to ubiquitin and autophagy receptor protein accumulation (p62, NBR-1), suggesting impaired cargo recognition in adult skeletal muscle and primary myotubes, independent of lysosomal function. Preliminary findings indicate that maximal force is reduced in adult ULK2mKO. CONCLUSION: Here, we demonstrate a novel and fundamental role for ULK2 in regulating cargo recognition, an essential aspect of selective autophagy, which is commonly impaired in conditions of muscle dysfunction. These results reveal ULK2 as a potential therapeutic target for skeletal muscle contractile and metabolic dysfunction, and serve as basis for future studies dissecting the mechanisms of autophagic cargo recognition in skeletal muscle.

Supported by AHA (16SDG30360001) and Dept. of Health & Human Physiology, University of Iowa.

2011 Board #272 May 31 2:00 PM - 3:30 PM Mathematical Modeling of Mammalian Target of Rapamycin following Leucine Ingestion

Taylor J. McColl, David C. Clarke, Simon Fraser University, Burnaby, BC, Canada.

(No relevant relationships reported)

The mammalian target of rapamycin complex 1 (mTORC1) is a regulatory protein for several cell processes and is critical in the control of muscle protein synthesis and hence muscle size. Its activity is primarily regulated by nutrition (i.e., protein) and growth factors (i.e., insulin), however, how the whole-body dynamics of these factors translate into protein translational signaling in skeletal muscle cells is poorly understood.

Purpose: The purpose of this study was to develop and analyze a simple mathematical model of the signaling controlling protein translation in human skeletal muscle following leucine ingestion.

Methods: The model was expressed as a system of ordinary differential equations (ODEs) incorporating the signaling proteins involved in the control of protein translation (e.g., IR/P70S6K/mTOR axis). Intracellular biochemical reactions were mass-action kinetics. We constructed the model by modifying amalgamated published models of mTORC1 signaling [Pezze et al. (2012) Sci Signal], and skeletal-muscle leucine kinetics [Tessari et al. (1995) Am J Physiol]. The Pezze model was specific to HeLa cells, so we calibrated the kinetic parameters using signaling data from human skeletal muscle following leucine ingestion. The ODEs were solved using the ODE23s solver in MATLAB.

Results: The model outputs quantitatively agreed with published time-course data for plasma leucine, plasma insulin, and phosphorylation of Akt(Ser473), mTORC1(S2481) and p70S6K(S654) following the ingestion of a single leucine bolus or multiple, pulsatile leucine doses. Parameter sensitivity analysis determined that mTORC1 activity was most sensitive to total mTORC1 concentration and highly sensitive to the rate of leucine transamination to alpha-ketosooicaproate.

Conclusion: Our model represents a working quantitative hypothesis of the dynamics of protein translational control in skeletal muscle by nutritional and hormonal factors.

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D-75b Free Communication/Poster - Sports Medicine Fellow Research Abstracts

Thursday, May 31, 2018, 1:00 PM - 6:00 PM

Room: CC-Hall B

2012 Board #273 May 31 3:30 PM - 5:00 PM Short-term Effect Of Ultrasound-guided Iliospos Peritendinous Injection In Athletes With Iliospos Tendinitis

Julie Han, Dai Sugimoto, Maxwell McKee-Proctor, Andrea Straccioli, FACSM, Pierre d’Hemecourt, FACSM. Boston Children’s Hospital, Boston, MA. (Sponsor: Pierre d’Hemecourt, FACSM)

(No relevant relationships reported)

BACKGROUND: Iliospos injury is the second most common cause of groin pain in athletes. Treatment includes ultrasound (US)-guided iliopsoas peritendinous injection. Evidence regarding US-guided iliopsoas injection efficacy is lacking in athletes with intra-articular hip abnormalities. PURPOSE: To examine short-term efficacy of US-guided iliopsoas corticosteroid injection in athletes with and without intra-articular hip pathology. METHODS: Prospective study design to evaluate athletes 12-50 years with iliopsoas tendinitis. Participants completed a Hip Disability and Osteoarthritis Outcome Score (HOOS) questionnaire prior to US-guided iliopsoas injection and 6-weeks after injection. Outcome measures included change in HOOS subcategory scores. Independent variables included normal hips vs. hips with intra-articular pathology (labral tear, femoroacetabular impingement, osteoarthritis, and dysplasia).

Abstracts were prepared by the authors and printed as submitted.
Two-way repeated measures analysis of variance (ANOVA) with effect size ($\eta^2$) was used to determine effects of injection on HOOS scores of patients at baseline and 6-weeks following injection. RESULTS: 180 patients analyzed; 85.6% (N=154) female, mean age: females 20.5±7.5, males 21.5±7.6 years. Time effects were found for both normal and abnormal hips in all five HOOS score subcategories: symptoms (p=0.041, $\eta^2$=0.050), pain (p=0.001, $\eta^2$=0.184), activity of daily living (ADL) (p=0.011, $\eta^2$=0.076), sports/recreation (p=0.001, $\eta^2$=0.151), and quality of life (QOL) (p=0.001) (Table 1). Significant differences in all subcategories were found in sports/recreation (p=0.032, $\eta^2$=0.056) and QOL scores (p=0.001, $\eta^2$=0.135). Interaction was found for QOL scores only (p=0.031, $\eta^2$=0.056). CONCLUSIONS: US-guided iliopsoas injection appears to improve outcomes over the 6 week study period regardless of pre-existing intra-articular hip pathology. Athletes without intra-articular pathology showed greater improvement in sports/recreation and QOL when compared to athletes with abnormal hip pathology. QOL was significantly better in athletes with normal hips than those with hip pathology during 6 weeks. US-guided iliopsoas injections may serve to help patients with iliopsoas tendinosis to advance care and continue with non-surgical treatment regimes.

2013 Board #274 May 31 3:30 PM - 5:00 PM Pediatric and Adolescent Figure Skating Injuries: A 15-year Retrospective Chart Review Agnieszka Kowalczyk, Dal Sugimoto, Bridget Dahlberg, Lyle 5 (Gonik, HNSM, Ellen Geminiani. Boston Children’s Hospital, Boston, MA. (No relevant relationships reported)

BACKGROUND: According to our literature review, there is a paucity of studies published over the last four decades, examining figure skating injuries in the pediatric and adolescent populations. PURPOSE: To analyze the characteristics of injuries sustained by young figure skaters, who were evaluated at a regional pediatric sports medicine clinic. METHODS: Retrospective chart review was conducted over the study period from 2003 to 2017. Figure skaters were identified by entering key words ‘figure skating’ and ‘figure skater’ into search engine, HoundDog. Eligible figure skaters were between the ages of 9 and 19 years and had been evaluated at least once at the sports medicine clinic by a physician. All skating disciplines and both sexes were included. Injuries unrelated to figure skating were excluded. Descriptive statistics were used to report injured body areas, type of injury (acute or overuse), number of injuries and time to seek medical attention. Data were stratified by sex. RESULTS: Of 382 figure skaters identified during the preliminary search, 296 met eligibility criteria with a total of 822 injuries (273 female and 213 male, age: 14.2±3.0 years, height: 158±8.69 cm, weight: 52.2±10.7 kg, BMI: 20.6±3.0, BMI percentiles: 54.5±23.2%). Approximately 31.5% were acute and 67.5% were overuse injuries. Mean number of injuries sustained was 2.78 per female figure skater and 2.65 per male figure skater. Mean time to seek medical attention was 62.3±143 days (range, 0-1825 days) by female figure skaters and 23.4±28.5 days (range, 0-150 days) by male figure skaters. In female figure skaters, the most frequently injured body areas were, foot/ankle (30.1%), hip (21.2%), back (14.8%), knee (13.1%), ankle (13.1%), pelvis (6.6%), and lower limb (6.6%). In male figure skaters, they were foot/ankle (30.1%), knee (19.5%), back (17.8%), hip (10.5%) and wrist/hand (4.3%). In male figure skaters, they were foot/ankle (30.1%), knee (19.5%), back (17.8%), hip (10.5%) and wrist/hand (4.3%). In female figure skaters, the most frequently injured body areas were, foot/ankle (30.1%), hip (21.2%), back (14.8%), knee (13.1%), ankle (13.1%), pelvis (6.6%), and lower limb (6.6%). CONCLUSIONS: Pediatric figure skaters most commonly sustain foot/ankle (30.1%), knee (19.5%), back (14.8%), hip (13.1%) and wrist/hand (4.3%) injuries in both females and males. Approximately two-thirds of their injuries are overuse in nature while about one-third stem from acute mechanisms. This study indicates that not only are pediatric and adolescent figure skaters at risk of injuries, but that they also sustain multiple injuries requiring medical attention from sports medicine physicians.

2014 Board #275 May 31 3:30 PM - 5:00 PM Feasibility of a Novel Strategy for Cardiovascular Screening During the Preparticipation Physical Examination Roberta Dennison1, Deanna Kerkhof1, Trent Honda1, Renato Calatroni2, Giannimichel Cordaro1, 1 Boston Children’s Hospital, Boston, MA. 2 Northeastern University, Boston, MA. (No relevant relationships reported)

Sudden cardiac death (SCD) in athletes is a devastating event in which young, seemingly healthy individuals meet an untimely death, usually without warning. Best screening practices for SCD are highly debated; they vary around the globe and with level of play. PURPOSE: To determine the feasibility of simultaneously conducting history and physical (H&P), limb-lead ECG, and preparticipation echocardiography by frontline providers (PEFP) at one screening station. METHODS: A cross-sectional study design compared 2 preparticipation cardiovascular screening strategies. There were 31 participants screened in Year 1 and 53 screened in Year 2. Year 1 screening was conducted at three stations: screening H&P, 12-lead ECG, and limited PEFP. Time to complete each station was recorded and the total time for screening was the summation of times for each of the 3 stations. Year 2 screening was conducted at a single station by 2 frontline providers. Year 2 participants underwent screening H&P, limb-lead ECG, and limited PEFP in simultaneous fashion. Timing of the single station began when the patient entered the room and ended when all three components of screening were complete. A paired t-test was used to compare the mean time difference between Year 1 and Year 2 screening stations. RESULTS: The Year 1 screening time was significantly longer than the time to complete cardiac screening using the Year 2 protocol (10.27 minutes vs 3.96 minutes, respectively; p<0.01). Zero athletes screened positive in Year 1. Three athletes were referred to cardiology for further evaluation; all 3 were ultimately cleared to participate. CONCLUSIONS: A comprehensive preparticipation cardiac screening examination can be completed in a timely fashion using a single screening station and limited ECG to improve efficiency, while still allowing providers to gather information on personal and family history, physical exam, heart rhythm, and heart structure. This strategy may serve as a potential solution in the longstanding debate over best practices for preparticipation cardiovascular screening for athletes.

2015 Board #276 May 31 3:30 PM - 5:00 PM Medical Utilization Patterns Among Division I Collegiate Athletes Christopher Fox1, Emily Miller1, Joshua Goldman1, Peter Awad1, Nhiya Batta1, Montana Dunn1, Glenda Marshall1, Marissa Ogata1, Phil Sundin2, 1UCLA, Santa Monica, CA, 2UC, Westwood, CA. (Sponsor: Aurelia Nattiv, FACSM) (No relevant relationships reported)

PURPOSE: There are a multitude of medical care models for NCAA student athletes. At our Division I institution, student athletes have access to both primary care sports medicine physicians and sports medicine orthopedic surgeons on a daily basis. The purpose of our study was to determine athlete utilization patterns over the course of a single academic year.

METHODS: Using Presagia Sports, a web-based reporting system, medical visits from September 1, 2016 to August 31, 2017 were reviewed. Demographic information, team affiliation, physician type (primary care versus orthopedic surgery, fellow versus attending), and diagnosis were recorded. Encounter diagnoses were grouped into 12 categories ranging from chronic medical conditions to acute illness and operative orthopedic issues. Encounter diagnoses and categories were reviewed by two primary care sports medicine fellows and cross-referenced with athlete medical records. Poisson regression was used for statistical analysis.

RESULTS: A total of 2416 medical visits occurred during the study period, representing 517 of the 793 (65.2%) student athletes. Football (15%) of athletes represented 16.7% of total visits, followed by rowing (14.5%) of athletes with 10.9%, women’s track and field (10.7%) with 9.4%, women’s swim/dive (8.8%) with 8.9% and women’s gymnastics (3.8%) with 7.1%. Female athletes (53.7% of student athletes) composed 62% of all visits, male athletes 38% (p<0.001). 83.3% of all visits were with Primary Care Sports Medicine physicians versus 16.7% with Sports Surgery. When evaluating common diagnoses by sport the following trends were noted: football accounted for 38% of total concussion visits. Rowing had the highest percentage of mental health visits (48%), followed by swim/dive (11%) and women’s water polo (7%). Women’s cross country and track accounted for 58% of female athlete triad visits (amenorrhea, bone stress injuries or disordered eating) followed by gymnastics at 11% and rowing 10%.

CONCLUSIONS: A foundational understanding of current training room utilization and trends in the distribution of common sports medicine diagnoses, Sports Medicine physicians have the opportunity to prevent these diagnoses, mitigate their effects, and ensure athletes are receiving care designed to optimize their health and athletic performance.

2016 Board #277 May 31 3:30 PM - 5:00 PM Youth Multi-sport Participation Is Associated With Higher Bone Mineral Density In Female Collegiate Distance Runners Emily Miller1, Michael Fredericson, FACSM2, Andrea Kusman1, Emily Krauss2, Sonal Singh3, Megan Deanski-Roche4, Brian Kim1, Adam Tenforde5, Kristin Sainani2, Aurelia Nattiv1, FACSM2, 1University of California, Los Angeles, Los Angeles, CA, 2Stanford University, Stanford, CA, 3Stanford University, Los Angeles, CA, 4UCLA, Los Angeles, CA, 5University of California, Irvine, Irvine, CA. (Sponsor: Aurelia Nattiv, FACSM) (No relevant relationships reported)

PURPOSE: Youth sport participation is encouraged as a way to promote health and social interactions. But specialization in a single sport at an early age is becoming increasingly common. Distance runners have lower bone mineral density (BMD) compared to athletes in other weight-bearing sports and a higher risk of bone stress...
injuries (BSI). We sought to determine the effect of pre-college participation in sports other than cross country or track on BMD and BSI in collegiate middle and long-distance runners.

METHODS: As part of a prospective study on bone health in collegiate distance runners, baseline data were collected on 81 male and 79 female NCAA Division I distance runners at two institutions, including prior sports participation. Baseline BMD was recorded for 55 men and 54 women. We followed athletes for up to 4 years and recorded prospective BSIs. Data were analyzed using t-tests or regression models adjusted for age and school (linear regression for BMD, Poisson regression for BSI).

RESULTS: 62 male runners (76.5%) and 47 female runners (59.5%) had participated in at least one sport in addition to running track and field events prior to college. Soccer and basketball were the most common sports played in men and women. At baseline, women who participated in multiple sports had faster mile times (4:53 vs 5:11, p<.05), whereas male multi-sport athletes did not (4:12 vs. 4:14). All but 7 multi-sport athletes had participated in at least one high-intensity or multi-directional sport. For women, prior participation in high-intensity sports was associated with nearly a 10-standard deviation increase in total body BMD (Z= -7.8; p<.001); in contrast, the effect in men was small (Z= -2.6; p=.06). In terms of prospective BSI risk for women, prior participation in basketball was associated with a relative risk (RR) of 0.50 (0.28-0.91, p=0.023) whereas participation in gymnastics was associated with a RR of 1.99 (1.21-3.26, p=0.007). For men, cycling was significantly associated with an increased risk of prospective BSI with a RR of 4.33 (2.14-8.95, p=0.001) however the N was small (N=6 male cyclists).

CONCLUSIONS: For female collegiate distance runners, prior participation in non-running sports was associated with higher baseline BMD. Thus, encouraging youth to participate in multiple sports may have skeletal benefits.
and previously published data include, environment of screening, screening tool used, and level of collegiate play. More cross-sectional studies are needed to better elucidate rates of depression in our student-athlete population across all divisions.

**D-76 Clinical Poster/Reception - Clinical Poster Reception**

**Thursday, May 31, 2018, 5:45 PM - 6:45 PM**

Room: Hyatt-Lakeshore C

2021 Board #1

**Chest Pain and Palpitations - Lacrosse**


(No relevant relationships reported)

**HISTORY:** A 15-year-old female HS lacrosse player presented for episodes of chest pain and palpitations, initially at rest for minutes and then became exertional with SOB. She had been drinking water. Sent to the ER for IV hydration. On his way to the ER, he suddenly became unresponsive with stiffness, shaking, and frothing at the mouth.

**PHYSICAL EXAMINATION:** T 97.7°F, HR 56, BP 116/68, RR 20, SpO2 98%, RA, BMI 20.7

Well appearing with clear breath sounds. Cardiac exam: regular rhythm, normal S1 and S2, no S3 or S4, and a 2.6 low frequency systolic murmur best heard at the left upper sternal border. 2+ pulses. No peripheral edema, cyanosis, or hepatomegaly.

**DIFFERENTIAL DIAGNOSIS:**

1. arrhythmia - SVT, WPW, aflutter, atrial, PACs
2. pulmonary valve stenosis, tricuspid valve regurgitation
3. cardiomyopathy—hypertrophic cardiomyopathy, ARVD
4. ASD
5. anemia
6. hyperthyroidism

**FINAL WORKING DIAGNOSIS:** Coronary-cameral fistula

**TREATMENT AND OUTCOMES:**

1. The patient was cleared to play after symptoms spontaneously resolved and serial echocardiograms over a 5 year period demonstrated a stable coronary-cameral fistula.
2. Cardiology consultants recommended a rest/stress MRI to further determine the anatomical nature of the fistula given the symptom history. However, they believe that the fistula was an incidental finding and likely not the cause of her symptomatology.
3. Coronary-cameral fistula is a rare cause of congenital cardiac anomalies. Although most are small and asymptomatic, larger ones may cause MI or CHF, thus requiring intervention.
4. There are no published reports of this condition in athletes, highlighting provocative issues surrounding risks of incidental findings of unknown significance and return to play considerations.

**TEST AND RESULTS:**

- ECG- sinus bradycardia, no chamber enlargements or pre-excitation, normal QTc
- 28 day event monitor-two episodes of chest pain and rapid heart beat correlate with sar and sinus tachycardia
- Transthoracic echocardiogram- normal cardiac segmentation, valvular function, biventricular size, and systolic function. No effusion. There is a small coronary-cameral fistula entering the main pulmonary artery.
- Exercise stress with 2D echocardiogram performed showed normal EF with no wall motion abnormalities, ischemia, or arrhythmias

**NOTES:**

**HISTORY:**

A 21-year-old Division I cross-country runner presented to the athletic training room the day he was to leave for ACC championships, concerned about his intolerable dry mouth, leg heaviness and worsening fatigue. He had an unintended weight loss of 15 pounds despite working with Sports Nutrition over the summer due to a baseline BMI of 17.9 and a history of a sacral stress fracture the prior year. He endorsed normal eating pattern, but often felt full secondary to increased fluid intake from his dry mouth. Over the past few days, he also noted the onset of blurry vision. His only medication was an Omega-3 supplement and he denied a family history of autoimmune diseases, but did have an uncle with Type II diabetes mellitus.


**DIFFERENTIAL DIAGNOSIS:** Relative energy deficiency in sport Overtraining Osteoporosis Thyroid disease Anemia Viral illness/ Mononucleosis Diabetes Mellitus Type 1 Malignancy Diabetes Insipidus

**TREATMENT AND OUTCOMES:** Urgent transport to the emergency department for DKA management including insulin and intravenous fluids with several day admission. Endocrinology work-up in process. Plan to follow weekly x 6 weeks and held from sport of the remainder of the semester.

**2023 Board #3**

**Going the Distance Makes Me Tired: Seizure in a Cross Country Runner**

Caitlin G. Waters - (Sponsor: Pierre Rouzier, FACSM), James Broadhurst, John H. Stevenson. UMass Memorial Medical Center, TEWKSBURY, MA.

(No relevant relationships reported)

**HISTORY:** 21 y/o M collegiate cross country runner presents to team doctor with hand shaking and body cramping after a strenuous 12 mile run. Complained of generalized weakness, abdominal and leg cramping, nausea, diarrhea, slight shaking of his hands, and thirst. Felt well prior to the run. Endorsed increased thirst this week and had been drinking water. Sent to the ER for IV hydration. On his way to the ER, he suddenly became unresponsive with stiffness, shaking, and frothing at the mouth.

DIFFERENTIAL DIAGNOSIS: Metabolic Derangement, Hyponatremia, Hypocalcemia, Hypoglycemia; Rhabdomyolysis/Dehydration; Toxic Encephalopathy; Drug Withdrawal; Intracranial Mass; CNS Infection; Epilepsy

TEST AND RESULTS: Initial Na 118, Anion Gap 17, Bicarbonate 15, Magnesium 1.5, initial CPK 917, CK rose to greater than 60,000 despite IV hydration, Toxicology Negative, CT head: questionble hypodensities in the medial temporal lobe, MRI Brain: normal, EEG: negative

FINAL WORKING DIAGNOSIS: Seizure induced by Hyponatremia Secondary to Psychogenic Polydipsia; Hyponatremia Induced Myopathy

TREATMENT AND OUTCOMES: Sodium corrected in the ICU over a few days. Patient drank a total of 48 oz prior to his run, and 160 oz post-run. Despite hydration and gentle correction of sodium, CK continued to rise. Rhabdomyolysis thought initially due to seizure and muscle breakdown in the setting of aggressive exercise; however, the delayed clearance of CPK raised concerns for glycogen storage deficiency vs genetic dysfunction. Refurred to Genetics for a muscle biopsy to rule out glycogen storage deficiency. Biopsy pending. Returned to cross country running with strict instructions regarding hydration, runs 5-8 miles without any issues.

2024 Board #4

Different Strokes for Different Folks - Football

Tu Dan Nguyen1, Mark Chassay, FACSM1, Jocelyn Szeto1, Noor Alzarka2. 1University of Texas Health Science Center at Houston, Houston, TX. 2Memorial Family Medicine Residency, Sugar Land, TX.

(No relevant relationships reported)

History:
22-year-old DI University Football Long Snapper presents to the training room for migraines. He’s had migraines for 6-7 years and 4 concussions since HS. The night prior he had a migraine in the temporal region associated with transient left-sided vision loss & left arm numbness for 30-40 minutes. A diffuse headache lasting for 4-5 hours followed. Sumatriptan relieved the pain. He’s had increased migraine frequency for the past 6 months. Episodes were described to his neurologist. MRI of the Brain & Cervical Spine were ordered.

Physical Examination:
AF VSS, NAD, well appearing. PERRLA, EOMI, NCAT
Cranial nerves intact, no nystagmus, normal face symmetry, tongue & palate midline
Sensation intact
Strength/tone normal bilaterally
Reflexes 2+
Coordination and gait intact

Diff erential Diagnosis:
Migraine (hemiplegic/reital) with brainstem aura
Transient Ischemic Attack or Cerebrovascular Accident
Cerebral Aneurysm
Intracranial space-occupying lesion
Dissection Syndrome

Tests & Results:
MRI Brain w/o contrast: small subacute infarct in the right cerebellum. No mass effect or ICH.
MRI C-Spine: mild degenerative changes. No canal stenosis
Admitted to the hospital further work up. Lumbawork negative.
US LE w/ doppler - No DVT
CTA head/neck: Normal vessels. No dissection
MRA Neck: Common and internal carotid arteries w/ normal caliber and contour.
Normal vertebral arteries. Left vertebral a. is dominant. No flow-limiting stenosis.
TTE: Small right to left shunt on agitated saline contrast study suggestive of a patent foramen ovale.
Transcranial Doppler US Bubble Study: Right to left shunting, showering bubbles

Final / Working Diagnosis:
Cryptogenic subacute right cerebellar infarct secondary to a PFO

Treatment and Outcomes:
Aspirin & Clopidogrel started inpatient. Discharged after workup.
PFO closure and transspinal left heart catheterization completed with Cardiovascular Surgery.
Continue ASA and Clopidogrel for 6 months post-op; ASA lifelong.
Retired from the football team.
Repeat TTE: well seated closure device.
Cardiac rehabilitation for first 2 months post-op.
4 months post-op: running about 1 mile daily, 6 days/week. Endurance and circuit training with low weights.

He’s been migraine free since 2 months post-op. He takes Indomethacin as needed. Follow up schedule for 6 months post-operation.

2025 Board #5

Forearm Pain- Gymnastics

Melissa Faubert1, Holly Benjamin, FACSM2, Daniel Mass2. (1NorthShore University HealthSystem/University of Chicago, Chicago, IL. 2University of Chicago, Chicago, IL.

(No relevant relationships reported)

HISTORY: 14 year old right handed level 8 gymnast presents with complaints of progressive right greater than left elbow and forearm pain over the past four months. Despite bracing, activity modification and three months of physical therapy she still reported progressive worsening of pain and development of tingling in her hands and forearms. She notes she has a constant feeling of tightness over her anteromedial forearms and pain and tingling of her arm occurs the worst while writing in school or vauling. Pain and numbness resolve with a few minutes of rest and elbow extension. She does not have any nighttime pain.

PHYSICAL EXAMINATION: - Well appearing female adolescent - Full ROM of elbow, forearm, wrist and fingers - Sensation intact to light touch in the radial, medial and ulnar nerve distribution bilaterally - 5/5 strength in the radial, medial, ulnar, anterior interosseus and posterior interosseus nerves bilaterally - Mild TTP of proximal forearm and medial elbow bilaterally - Positive compression test at the proximal forearm - Positive Tinel’s test over the pronator teres - Positive Tinel’s test over cubital tunnel - Negative Tinel’s, Durkan’s and Phalen’s at the wrist bilaterally

DIFFERENTIAL DIAGNOSIS: Pronator syndrome - Cubital tunnel syndrome - Chronic exertional compartment syndrome of the forearm - Anterior interosseous nerve syndrome - Brachial plexus neuritis - Cervical radiculopathy

TEST AND RESULTS: MRI elbow Left: MRI findings normal but noted presence of accessory anconeous epicondyleus muscle. MRI elbow Right: Normal MRI. FINAL WORKING DIAGNOSIS: Pronator syndrome bilaterally. Left arm with accessory anconeous epicondyleus muscle also causing ulnar neuropathy.

TREATMENT AND OUTCOMES: Patient’s older sister previously had pronator syndrome as well as chronic exertional compartment syndrome for which she underwent median nerve release and fasciectomy. Patient and her parents elected to forgo compartment testing suspecting she also had both conditions. She underwent surgery on her left elbow with a median nerve release, ulnar nerve release and fasciectomy. She is due to have surgery on her right arm for median nerve release and fasciectomy this week after her left.

2026 Board #6

Low Back Pain - Recreational Soccer Player

Sean Matsuwaka, Brian Liem. University of Washington, Seattle, WA.

(No relevant relationships reported)

HISTORY: A 21-year-old female recreational soccer player presented with intermittent right-sided low back pain for two years. She denied any trauma or inciting event. Pain was localized to the right lumbosacral region without radiating leg pain and was described as dull and aching. It was rated on average 5/10 on a numerical rating scale and associated with nausea when pain worsened. Symptoms were worse with prolonged sitting, and several times in the last month she reported wakening up with a headache. She reported no history of typical pain with alcohol intake. She denied leg weakness, numbness, or bowel/bladder dysfunction. She participated in six weeks of physical therapy, which helped with nausea and pain with sitting, but she continued to have pain with alcohol consumption.


TESTS AND RESULTS: 1. Lumbar spine X-rays: -Normal alignment, normal vertebral body and disc space height -Partial lumbarization of S1 vertebral body -Five degrees of lumbar dextroscoliosis 2. MRU lumbar spine: -Lumbarization of S1 vertebral body -Normal disc heights and signal -Normal central canal and neural foramens size throughout lumbar spine -T1/T2 hypointensity within S2 vertebral body, likely lipoma -Increased T2 signal medial to right kidney suggestive of hydropnephrosis 3. Renal ultrasound -Moderate right hydropnephrosis with extrarenal pelvis. No nephrolithiasis. 4. Renogram with furosemide: -Right kidney with blunted flow and delayed clearance improved slightly with furosemide, consistent with partial obstruction at right ureteropelvic junction

FINAL/WORKING DIAGNOSIS: Ureteropelvic junction obstruction causing Dye’s crisis

TREATMENT AND OUTCOMES: 1. Referral to urology 2. Resolution of pain and improvement in renal function after pyeloplasty

Abstracts were prepared by the authors and printed as submitted.
2027 Board #7
Chronic Medial Knee Pain in a Collegiate Basketball Player and Marching Band Member
Nicholas E. Anastasio-(Sponsor: Robert Wilder, MD, FACSM), David Hryniak. University of Virginia, Charlottesville, VA.

History:
Patient 1:
A 17 year-old female collegiate basketball player presented with insidious onset right medial knee pain for the last 8 months. Pain waxed and waned with activity. No history of swelling, instability or locking. No numbness or weakness. Pain located diffusely over the medial knee and proximal medial tibia. Symptoms refractory to PT, patellofemoral kinesiotaping, medial support orthotics and NSAIDs. No relief following Medrol dose pack, intraarticular corticosteroid injection, or pes anserine bursa corticosteroid injection.

Patient 2:
A 19 year-old female collegiate marching band member presented with insidious onset right medial knee pain present for 4 years. Patient reported intermittent swelling but denied instability or locking. Symptoms were worse with walking and marching. Previous Rheumatologic consult unrevealing. Symptoms refractory to PT, knee sleeve, and patellar straps. No relief following right pes anserine bursa corticosteroid injection.

Physical Examination:
Patient 1: - Knee without effusion. Diffuse tenderness to palpation over the medial knee at and below mid medial joint line. ROM and strength normal. No laxity. Neurovascular intact.

Patient 2: - Knee without effusion. Tenderness to palpation over the medial joint line and distally over pes anserine. Tinel's sign positive over the medial femoral condyle. ROM and strength normal. No laxity. Neurovascular intact.

Differential Diagnosis:
1. Pes anserine bursitis
2. MCL bruising
3. Patellofemoral syndrome
4. Medial meniscal tear
5. Medial patellar plica
6. Saphenous neuralgia

Test and Results:
Patient 1:
XR Knee - No fracture or joint effusion.
MRI knee - No meniscus tear. No internal derangement. Mild increased T2 signal within the superior lateral aspect of Hoffa’s fat.
Diagnostic saphenous nerve block - 0.5% bupivacaine injected 2 inches cephalad to the medial joint line - 24 hours of relief.

Patient 2:
XR Knee - No fracture or malalignment.
MRI knee - Unremarkable MRI of the knee.
Labs: - ESR 8, TSH 1.7

Final/Working Diagnosis:
Saphenous Neuralgia

Treatment and Outcomes:
Patient 1:
Saphenous nerve injection - 40 mg triamcinolone/0.5% bupivacaine - 5 months of relief.

Patient 2:
US guided hydrodissection saphenous nerve - Full resolution for 1.5 years.

2028 Board #8
Are Subconcussive Impacts Harmless in Youth Soccer Players?
Luis R. Lopez-Roman1, Yarimar I. Diaz-Rodriguez2.
1Universidad del Sagrado Corazon, San Juan, PR. 2Universidad del Turabo, Gurabo, Puerto Rico.

In United States at least 3.5 million children play soccer yearly. Head Impact (concussive and subconcussive) in youth players have a growing concern throughout their short or long-term career. A subconcussive impact may induce a traumatic alteration of function of the cerebral without associated imaging abnormalities or loss of consciousness. Accelerometers can measure the magnitude and quantity of the subconcussive impacts in the field. The SIM-G™ accelerometer is a small portable device that measures change in velocity during an impact and provides estimates of magnitude (G) and angles. The ImPACT Pediatric® is a neurocognitive test that provide information of cognitive changes. PURPOSE: To evaluate if a subconcussive impact could lead to negative cognitive functions in youth soccer players. METHODS: A group of 30 youth soccer athletes (15 males, 15 females) between 9 to 11 years old wear a head accelerometer in a specialize headband. Each participant was encouraged to perform normally in the game. Descriptive statistics was used to assess subconcussive impacts. T-test was used for the neurocognitive pre and post-test to assess differences in sequential memory, word memory, visual memory and rapid processing. RESULTS: Mean age of female and male athletes (9.9 ± 0.6 years) was not different (P > 0.05). A total of 42 impacts were receive by both genders in three games. Range of acceleration was from 16g to 60g (Ave = 23.8 ± 9.1g). T-Test showed differences in sequential memory for female (p = 0.02) and rapid processing for males (p = 0.01). There were no differences between pre and post-test for visual memory for females and males (p = 0.97, p = 0.11; respectively) and visual memory (p = 0.30, p = 0.34; respectively). CONCLUSION: These results suggest that females that play soccer and receive a subconcussive impact can reflect changes in their education and social activities at short term in their word recognition, oral reading and reading comprehension (sequential memory) and males in their auditory processing and language skills (rapid processing). Parents, coaches, trainers, exercise physiologist, and speech-language pathologists (SLP) should receive education to take precautions after a game with children that received at least one sub concussive impact and do not perceived any notable changes.

2029 Board #9
Test Setting and ADHD Influence Baseline Concussion Testing Neurocognitive Performance in Collegiate Student-Athletes
Caroline A. Kelly, Caroline J. Ketcham, Kirtida Patel, Eric E. Hall, FACSM, Elon University, Elon, NC.

Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) is a widely used neurocognitive test for assessing and managing concussion injuries. There is inconclusive data on how test administration and environment influence baseline results for student-athletes. It has been well established that individuals with Attention Deficit Hyperactivity Disorder (ADHD) perform worse on the ImPACT, but little research has examined the effect of group test administration on neurocognitive performance and symptom reporting in student-athletes with ADHD. PURPOSE: To compare baseline neurocognitive performance and symptom scores in group versus individual administration settings in NCAA division 1 collegiate student-athletes. METHODS: 260 student-athletes completed two ImPACT baseline tests, test 1 was completed when they entered as first-year students or transfers and test 2 was completed this past summer. Of these participants, 205 athletes took test 1 individually and 55 participants took it in a group setting. All student-athletes took test 2 in a group setting. 21 of the 260 student-athletes had a diagnosis of ADHD. A 2 (time) x 2 (environment) x 2 (ADHD) Multivariate ANOVA was conducted. Time (test 1 and test 2) was within subjects and Environment at test 1 (individual and group) and ADHD (yes or no) were between subject variables. RESULTS: There was a significant increase in total number of symptoms reported when participants went from individual testing to group testing (p<0.05). Time x Environment Interaction for visual memory (p<0.05) with scores increasing from test 1 to 2 if in the group setting 1 vs staying the same if in the individual setting for test 1. A similar effect was found for visual motor processing speed (p<0.05). Participants with ADHD performed worse on all measures no matter the setting (p<0.05). Symptom scores significantly differed for ADHD participants depending on the setting (p<0.05). CONCLUSIONS: A group setting has inherent distractions and seems to influence performance on visual memory, visual motor processing speed and symptom scores. Student-athletes with ADHD may be more affected by these distractions. This should be considered in baseline concussion testing and interpreting post-injury neurocognitive performance.

2030 Board #10
Jump Training Improves Psychological Impairments and Facilitates Greater Sports Participation in Athletes with ACL Reconstruction
Ryan L. Mizner, Audrey R. Elias. University of Montana, Missoula, MT.

NO relation to previous report.

PURPOSE: About 35% of athletes with anterior cruciate ligament (ACL) reconstruction fail to return to their preinjury level of sports participation. Psychological factors, such as fear of reinjury, often prevent athletes who wish to return to their sport from achieving their goal. Limited evidence is available to direct patient care to target these psychological impairments. Most ACL injuries are not contact in nature and typically occur during a deceleration task such as jump landing. We propose that training focused on improving jump landing performance will improve psychological factors and facilitate increased sports participation. METHODS: Forty-eight athletes completed screening tests an average of 2 years after unilateral ACLR (Wk0). Testing included the ACL-Return to Sport after Injury (AACL- RSI) scale as measure of psychological readiness for sports participation. Athletes (n = 25, 9 men, age = 23 ± 5 yr) who scored below normative ACL-RSI recovery standards (~65%) completed 8 weeks of twice-weekly jump landing training. Retesting occurred at midtraining (Wk4), posttraining (Wk8), and 2 months after training (Wk16).
Athletes answered a survey measuring perceived changes in sports participation at the end of training. Changes observed during training were determined via repeated measures ANOVA.

RESULTS: ACL-RSI scores improved substantially throughout treatment (mean ± SD; Wk0: 53 ± 18%, Wk4: 67 ± 15%, Wk8: 76 ± 16%; p<0.001). Treatment benefits were maintained over the retention period (Wk16: 81 ± 15%; p=0.052). Four out of 5 athletes trained report that they were more likely to participate in their sports activities after training and two thirds of the cohort described at least a moderate increase in their sports participation.

CONCLUSIONS: Progressively dosed jump training that focuses on correcting aberrant landing movements is effective at addressing psychological factors in athletes who self-identified as having limited readiness for sport. The training was also effective at facilitating increased sports participation. Clinicians should consider implementing similar jump training interventions to help athletes who are struggling to return to their desired sports participation because of limited confidence or high fear of re-injury. Funded in part by the Foundation for Physical Therapy.

2030b Board #11

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

Jane Konidis1, Philippe Corbeil1, Antoine Cantin-Warren2, Sylvie Turmel3, Emile Cardinal-Soucy4, Remi Lacroix3, Etienne Belzile1, 1University Laval, Quebec City, QC, Canada. 2University Hospital Center of Quebec (CHUQ), Quebec City, QC, Canada. 3University Hospital Center of Quebec (CHUQ), Quebec City, QC, Canada.

(No relevant relationships reported)

INTRODUCTION: Degenerative hip osteoarthritis (OA) is a common progressive disorder causing disability. The injection of exogenous hyaluronic acid (HA), or viscosupplementation (VS), can potentially help restore the properties of synovial fluid. There is little literature available evaluating the long-term effects and the functional impact of VS in hip OA. PURPOSE: To determine if a single intra-articular injection of a high-molecular weight (HMW) VS would improve function and decrease pain in persons suffering from hip OA. METHODS: A double-blinded randomized control trial was conducted at a University Hospital Center in Canada. Patients were randomly allocated to either the treatment group, an ultrasound guided single intra-articular injection of a HMW HA, or the placebo group, a single extra-articular injection of local anesthetic. Participants underwent evaluations at 2 weeks prior to the injection (T0), and at 1 month (T1), 3 months (T2) and 6 months (T3) post injection. Patients completed two questionnaires; the Hip Disability and Osteoarthritis Outcome Score (HOOS) and the 36-Item Short Form Survey (SF-36). Gait biomechanics were evaluated in a lab. RESULTS: Between May 2014 and September 2017, 38 participants were evaluated in this study over the course of 6 months. In the treatment group, N = 19 and in the placebo group, N = 18. The mean age at the time of injection was 55.0. The HOOS symptom subscale, the placebo group worsened from T0 to T3 by 6.29% compared to the treatment group. The VS group improved their pain subtotal from T0 to T2 by 4.73%. The control group worsened by 1.22% during that same time and continued to deteriorate by 6.09% at T3. There were also improvements in the activities of daily living subscale from T0 to T3, with the treatment group improving by 5.29% while the placebo group worsened by 5.15%. The most important change occurred in the sports and recreational subscale of the HOOS. Between T0 and T3, the placebo group worsened by 7.611 points (-17.82%). The treatment group improved by 5.29% while the placebo group worsened by 5.15%. The most important change was greatest in former players aged 60+, with more than 50% of those individuals hypertensive at screening, over 20% of those 20-39 were hypertensive. White former players aged 40-59 had the lowest prevalence of hyper-tension. Hypertension prevalence was only significantly different between age-specific racial groups at age 40-59. The majority of former players had a BMI ≥ 30 kg/m2, regardless of age; those with normal BMI were least likely to be hypertensive. Over 30% of former players reported previous hypertension diagnosis, with approximately 75% of those diagnosed reporting treatment. Of those former players that reported treatment, most had poorly controlled blood pressure at the time of screening. Of former players that reported no hypertension diagnosis, 41% had elevated blood pressure at screening. Former players aged 30-39 had the highest prevalence of previously undiagnosed elevated blood pressure at screening. CONCLUSIONS: Hypertension is a serious concern for former professional football players, even those considered to be younger and at decreased risk. This may be related to the high BMI typically associated with these athletes. Blood pressure control in those reporting diagnosis is also a concern, as the majority of those had high blood pressure at screening.

2030c Board #12

Lisa S. Krivickas Clinician/Scholar Travel Award - The Prevalence of Hypertension in a Population of Former Professional Football Players

Jaime Kaplan, Genevieve E. Smith, Gregory W. Stewart, FACSM. Tulane University School of Medicine, New Orleans, LA.

(No relevant relationships reported)

OBJECTIVE: There is substantial data suggesting that former professional football players have considerable cardiovascular disease risk. The objective of this study was to better understand the prevalence of hypertension, a major risk factor for cardiovascular disease, in former professional football players. DESIGN: Data including blood pressure, height, and weight were collected from 981 former professional football players between April 2015 and May 2017 during cardiovascular screening events held throughout the U.S. Demographic information was collected from all subjects, including age, race, previous hypertension diagnosis, and treatment. Means were analyzed using one-way ANOVA, Chi square, or paired T-tests where appropriate.

RESULTS: Pre-hypertension was greatest for former players aged 20-59, with almost 50% of those aged 20-39 pre-hypertensive at screening. Hypertension was greatest in former players aged 60+, with more than 50% of those individuals hypertensive at screening, over 20% of those 20-39 were hypertensive. White former players aged 60+ had the lowest prevalence of pre-hypertension. Hypertension prevalence was only significantly different between age-specific racial groups at age 40-59. The majority of former players had a BMI ≥ 30 kg/m2, regardless of age; those with normal BMI were least likely to be hypertensive. Over 30% of former players reported previous hypertension diagnosis, with approximately 75% of those diagnosed reporting treatment. Of those former players that reported treatment, most had poorly controlled blood pressure at the time of screening. Of former players that reported no hypertension diagnosis, 41% had elevated blood pressure at screening. Former players aged 30-39 had the highest prevalence of previously undiagnosed elevated blood pressure at screening. CONCLUSIONS: Hypertension is a serious concern for former professional football players, even those considered to be younger and at decreased risk. This may be related to the high BMI typically associated with these athletes. Blood pressure control in those reporting diagnosis is also a concern, as the majority of those had high blood pressure at screening.