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D-07 Thematic Poster - Aging and Training

Thursday, May 31, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100C

1513 Chair: Loretta DiPietro, FACSM. *The George Washington University School of Public Health and Health Services, Washington, DC.*

(No relevant relationships reported)

1514 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)

(No relevant relationships reported)

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

Maximal aerobic capacity (VO_{2max}) 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 measured RE as the submaximal rate of oxygen consumption in $ml\ O_2 \cdot kg\ body\ mass^{-1} \cdot min^{-1}$ (VO_2), whereas it is more valid to express RE using allometric scaling of body mass ($alloVO_2$) or as the energy cost of running (EC), in $kcal \cdot kg\ body\ mass^{-1} \cdot min^{-1}$. The percent of VO_{2max} ($\%VO_{2max}$) at which a submaximal run occurs is also related to performance. **PURPOSE:** To evaluate VO_{2max} , $alloVO_2$, EC, and $\%VO_{2max}$ 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_{2max} test. $AlloVO_2$ was calculated using body mass^{0.66}. 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 $22.54 \pm 2.9\ kg \cdot m^{-2}$) had a mean VO_{2max} of $53.2 \pm 10\ ml\ O_2 \cdot kg^{-1} \cdot min^{-1}$ (range: 35.6-69.9). Age was not significantly correlated with VO_{2max} , $alloVO_2$, or $\%VO_{2max}$ (respectively: $r = -0.281$, $p = 0.205$; $r = -0.172$, $p = 0.470$; $r = -0.191$, $p = 0.42$). Age was highly correlated with EC ($r = 0.721$, $p = 0.001$). **CONCLUSIONS:** In this population, age was not related to maximal or submaximal oxygen consumption. The strong positive relationship between age and EC suggests that substrate use during submaximal running may change with age in trained distance runners.

1515 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.*

(No relevant relationships reported)

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 [BEG, $n = 15$ (men = 1), mean age = 71.1 ± 4.9 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. BEG performed balance exercise on a foam stability pad or soft balance beam. At a welfare center, all subjects participated in a 60-min supervised group exercise session once every 2 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 ($P = 0.031$) with EO. After the training session, HEG demonstrated a significantly increased path length in an enveloped area with EC (21.5 ± 7.9 vs. $26.3 \pm 13.0\ cm^2$, $P < 0.05$) and a significantly decreased path length (45.0 ± 17.4 vs. $37.6 \pm 12.5\ cm$, $P < 0.05$), enveloped area (2.71 ± 1.40 vs. $2.09 \pm 1.25\ cm^2$, $P < 0.05$), and sway velocity (2.25 ± 0.87 vs. $1.88 \pm 0.63\ cm/s$, $P < 0.05$) with EO. BEG 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.

1516 Board #3 May 31 1:00 PM - 3:00 PM
The Effects Of Tempo-adjusted Music On Gait Speed And Functionality In Middle-aged And Older Adults

Jeffrey M. Janot, Saori Braun, Nicole Cisewski, Anna Stover, Samantha Noetzelman, Lauren Grover. *University of Wisconsin-Eau Claire, Eau Claire, WI.*

(No relevant relationships reported)

PURPOSE: Tempo-based music is capable of impacting gait patterns and functionality, however, there is little knowledge on how technological applications (apps) that match music tempo to self-selected gait speed can impact gait patterns. The purpose of this study was to determine if functionality and self-selected gait speed in community-dwelling middle aged and older adults can be improved both acutely (in one bout) and over a three-week period by utilizing an app that changes music tempo to match pace. **METHODS:** Twenty-six (14 females, 12 males) participants, aged 56-80 years old were recruited for this study. All participants were previously involved in a regular exercise program. Participants were randomly assigned to control (CTL) or training (TRN) group. The CTL group walked with the music app for one bout to measure acute effects then adhered to a 3-wk walking program (2x's/week) without music. The TRN group used the music app for the full 3-wk walking program. Main outcome measures included a 10-m walk test (10mWT), a 15-min walk test (15MWT), and the timed up-and-go test (TUG). **RESULTS:** There were significant ($p < .05$) improvements seen during the acute session (1.58 ± 0.19 m/sec music app vs 1.49 ± 0.18 m/sec no music) across all participants and improvements in TUG (CTL: 9.53 ± 0.47 sec pre-study vs 8.83 ± 0.52 sec post-study; TRN: 8.70 ± 0.45 sec pre-study vs 7.92 ± 0.50 sec post-study), regardless of group assignment. Also, there were no significant ($p > .05$) differences in the 10mWT (CTL: 1.48 ± 0.09 sec pre-study vs 1.55 ± 0.07 sec post-study; TRN: 1.66 ± 0.09 sec pre-study vs 1.70 ± 0.07 sec post-study) or 15MWT (CTL: 1.49 ± 0.05 m/sec pre-study vs 1.55 ± 0.07 m/sec post-study; TRN: 1.49 ± 0.05 m/sec pre-study vs 1.56 ± 0.07 m/sec post-study) tests times for both groups over the 3-wk period. **CONCLUSIONS:** These results demonstrated that a music app that matches walking tempo may be an effective means to acutely improve speed and functionality as measured by the TUG test in middle aged and older adults. Future studies should explore longer intervention programs to improve self-selected walking speeds or employ a similar program with individuals who were previously inactive.

1517 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. Olmos¹, Garrett M. Hester¹, Zachary K. Pope², Mitchel A. Magrini², Ryan J. Colquhoun³, Alejandra Barrera-Curiel², Carlos A. Estrada², Jason M. DeFreitas⁴. ¹Kennesaw State University, Kennesaw, GA. ²Oklahoma State University, Stillwater, OK. ³Oklahoma State University, Stillwater, OK. ⁴Oklahoma State University, Stillwater, OK.

(No relevant relationships reported)

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 $45^\circ \cdot s^{-1}$ 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 impulse from contraction onset to 30 ms (RTD_{0-30} and IMP_{0-30} , respectively) and 100-200 ms ($RTD_{100-200}$ and $IMP_{100-200}$, respectively) were recorded for analysis. Three-way (age [young vs. old] \times group (training vs. control) \times 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_{0-30} , IMP_{0-30} , $RTD_{100-200}$, or $IMP_{100-200}$ ($p > 0.05$). However, a 2-way (group \times 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 \times time) interaction indicated that PT (+21.1%; $p < 0.001$) and IMP_{0-30} (+7.0%; $p = 0.038$) increased at POST similarly between the YTG and OTG compared to the control groups. Similarly, RTD_{0-30} demonstrated a nearly significant increase that was similar between the YTG and OTG

(+11.2%; $p = 0.051$). **CONCLUSION:** Cross-education of strength was unaffected by age, however, neither young nor older males demonstrated cross-education of rapid torque characteristics. Further, while rapid torque characteristics were improved in the trained leg, age was not influential on these adaptations.

1518 Board #5 May 31 1:00 PM - 3:00 PM
Copper - Zinc Serum Traces, Lipid Profile, Geriatric Depression, and Daily Living Activities in Older Adults

Jean C. Zambrano¹, Ramón A. Marquina², María V. Gómez¹, Edyleiba Rojas¹, Carlos E. Rondón¹, Thairy G. Reyes-Valero³, Rafael A. Reyes-Alvarez². ¹University of The Andes Mérida-Venezuela, Mérida, Venezuela, Bolivarian Republic of. ²University of The Andes Mérida-Venezuela, Mérida, Venezuela, Bolivarian Republic of. ³NOVA Southeastern University, Fort Lauderdale, FL.

(No relevant relationships reported)

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:** Thirteen 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/L) and Zn (PA: 0.29±0.01; NH: 0.31±0.011 mg/L), 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, NH: 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.

1519 Board #6 May 31 1:00 PM - 3:00 PM
Heavier, Stronger for Better Bone Mineral Density of Middle Age and Older Adults

Xiong Qin, Weimo Zhu, FACSM. University of Illinois at Urbana and Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

(No relevant relationships reported)

PURPOSE: Lost of bone mineral density (BMD) could lead to a serious health consequence for middle age and older adults. It is well known that BMD declines as a person becomes aging. It is also observed that heavier individuals tended to have a better bone mineral density, which led an assumption that stronger persons should have a more dense bone. This hypothesis, however, has not been examined using the large population data. This study was to fill this gap.

METHODS: Data from the 2013-2014 National Health and Nutrition Examination Survey (NHANES) were used for the study, in which a sample of 3127 (representing a weighted national sample of 126541108 US adults), with age from 40 to 80 yr. old, were examined for their BMD, age, sex, height, weight and hand grip strength. The correlations between total femur BMD (tBMD) and BMI (body mass index) and grip strength were examined by sex and by total.

RESULTS: Statistical findings of the study are summarized as in the table:

Correlation between total femur BMD and age, BMI and grip strength			
Correlation	Age	BMI	Grip Strength
Male	-0.171	0.434	0.285
Female	-0.449	0.496	0.414
Total	-0.291	0.411	0.475

CONCLUSIONS: As expected, age has a negative correlation with bone density and BMI and grip strength has a positive one and this is especially true for female adults and older adults. Since BMI is often associated with overweight or obesity, the best approach to improve body density is to engage in strength and conditional related exercises regularly. Future studies should focus more on dose-response issues of needed strength exercise for a better bone.

1520 Board #7 May 31 1:00 PM - 3:00 PM
Age-related Alterations In Functionality And Muscle Architecture Of The Lower Limbs In Women

Kevin C. Phillips, Byungjoo Noh, Michelle Burge, Matt Gage, Tejin Yoon. Michigan Technological University, Houghton, MI. (Sponsor: Sandra Hunter, FACSM)

(No relevant relationships reported)

The age-related declines in muscle mass and function are greater for women and the lower limb muscles, and these decrements accelerate during middle-age. However, it is less clear which lower limb muscles may be compromised more in middle-aged women. **PURPOSE:** To compare muscle function and architecture of the knee extensor and plantar flexor muscles in young and middle-aged women. **METHODS:** Twenty two middle-aged (years: 54 ± 6) and eight young women (years: 22 ± 2) volunteered to participate in this study. In vivo muscle architecture measurements such as muscle thickness and pennation angle of four muscles including vastus lateralis (VL), rectus femoris (RF), Gastrocnemius medialis (GM) and lateralis (GL) were measured using a B-mode real-time ultrasound scanner. Each participant performed maximal voluntary isometric contractions (MVIC) of knee extensor and plantar flexor muscles 3-4 times on the Biodex dynamometer. Interpolate twitch technique was used to assess voluntary activation (VA). Absolute and weight-normalized maximal strength and rate of torque development (RTD) were analyzed from MVIC torque data. Additionally 6 minute walk test and sit-to-stand task were performed. Age-related changes were tested using two-way ANOVA with repeated measures. **RESULTS:** Both absolute and normalized MVIC strength, RTD, and VA were similar ($p > 0.05$) between young and middle-aged women. There were no significant differences in muscular thickness between young and middle-aged women, however, VL thickness trended towards being larger in young women (2.31 ± 0.2 vs. 2.14 ± 0.22 cm, $p = 0.067$). GM pennation angle was significantly larger in young women (25.8 ± 2.5 vs. 23.6 ± 2.4 degrees, $p = 0.038$). Lastly, the young women performed significantly more repetitions during the sit to stand task (23.8 ± 5.7 vs. 18.3 ± 4.7, $p = 0.013$), whereas there were no differences in performance of the six minute walk test ($p = 0.139$). **CONCLUSION:** Isometric and explosive torque production was similar between young and middle-aged women. A greater decrease in GM pennation angle compared to other muscle groups suggest that the age-related alteration in muscle architecture may be more compromised for plantar flexor muscles than knee extensor muscles.

1521 Board #8 May 31 1:00 PM - 3:00 PM
Effects Of Linear Periodization Versus Concurrent Periodization Training On Adl's In An Elderly Population

Brian A. Zalma, Andrew NI Buskard, Craig Dent, Catherine Armitage, Joseph Signorile. University of Miami, Miami, FL.

(No relevant relationships reported)

Aging is commonly associated with a decline in muscle size, strength and power. As a result, daily physical function also declines. Recent studies have noted that declines in muscle power are the most significant cause for decreased functional performance for older persons. No previous studies have assessed the magnitude of improvements in functional movements (activities of daily living) by implementing different methods of periodization during training. **PURPOSE:** To analyze the effects of two different periodization styles on functional strength, power, and activities of daily living (ADL) in an elderly population over a 14-week (3x weekly) training period. **METHODS:** Pretest and post-test measurements included chest and leg press 1RM and pneumatic isoinertial peak power, as well as functional performance on 5 ADL measures (gallon-jug test, 8-foot up-and-go, floor rise, 6m walk, laundry transfer, 5x repeated chair stand). After a 2-week familiarization period participants were randomly assigned to either a linear periodization group ($n=16$, age = 69.31 ± 4.59 y) or a concurrent periodization group ($n = 14$, age = 68.93 ± 6.72 y). Each protocol consisted of 12 total strength (3 x 8 reps @ 70% 1RM), power (3 x 8 @ 50% 1RM), and translational training sessions. Linear periodization consisted of 4 wk strength training, 2 wk translational training, 4 wk power training, 2 wk translational training while the concurrent periodization group completed 12 weeks of day 1: strength, day 2, power, and day 3: translational. **RESULTS:** Both groups experienced significant improvement on all strength ($p<.0001$), power ($p<.0001$), and ADL measures relative to baseline ($p<.0001$), with no significant between-groups differences observed on any outcome variable. **CONCLUSION:** Linear and concurrent periodization were found to be equally effective at increasing muscular strength, power, and ADL performance over the course of a 14 week training study.

D-08 Thematic Poster - Exercise Training- Clinical Applications

Thursday, May 31, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100E

1522 **Chair:** Cemal Ozemek. *University of Illinois Chicago, Chicago, IL.*

(No relevant relationships reported)

1523 **Board #1** May 31 1:00 PM - 3:00 PM
Confirming Training-Related Aerobic Improvement Using Heart Rate Recovery in Older Adults with Chronic Disease

Ellie Rickman, Stacey Reading. *The University of Auckland, Auckland, New Zealand.*

(No relevant relationships reported)

PURPOSE: The efficacy of aerobic training in a rehabilitation setting is often determined by comparing changes in aerobic capacity ($\text{VO}_{2\text{peak}}$) using a cardiopulmonary maximal exercise test (CPX). In many studies, the reported pre- vs. post-training difference in $\text{VO}_{2\text{peak}}$ is $\leq 3\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ 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 $\text{VO}_{2\text{peak}}$; especially when those with chronic illness who are unaccustomed to maximal effort exercise are tested. In the present study we retrospectively examined data to test the hypothesis that only individuals with an improvement in $\text{VO}_{2\text{peak}}$ have an improvement in steady state heart rate recovery (HRR) after completing a CPX test. **METHODS:** Thirty-seven chronically ill participants ($57 \pm 15\text{yrs}$) completed a cycle CPX test to voluntary termination before and after a 12-week exercise rehabilitation program based on current guidelines for cardiac rehabilitation. $\text{VO}_{2\text{peak}}$ 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) ($n=18$; $\text{VO}_{2\text{peak}}$ increased $> 0.2\text{L}\cdot\text{min}^{-1}$) and non-responders (NRS) ($n=19$; $\text{VO}_{2\text{peak}}$ increased $< 0.2\text{L}\cdot\text{min}^{-1}$). 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: $\text{VO}_{2\text{peak}}$ significantly improved post program in RS (2.2 ± 0.6 vs. $2.6 \pm 0.5\text{L}\cdot\text{min}^{-1}$; $p<0.05$) but not NRS (1.9 ± 0.7 vs. $1.9 \pm 0.7\text{L}\cdot\text{min}^{-1}$). The RS pre-program $\text{VO}_{2\text{peak}}$ 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 $46 \pm 9\text{bpm}$; $p<0.05$ and NRS pre 37 ± 10 vs. post $39 \pm 11\text{bpm}$; 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 $\text{VO}_{2\text{peak}}$. In the present study, participants that improved $\text{VO}_{2\text{peak}}$ were more likely to have concurrent improvements in HRR after exercise-based rehabilitation.

1524 **Board #2** May 31 1:00 PM - 3:00 PM
Using the Heart Rate Index Equation to Estimate Peak METs in Physically Active Adults

Roger Sacks, Barry Franklin, FACSM, Jenna Brinks, Judy Boura, Shelby Potkin, Rima Rida, Harold Friedman, Abhay Bilolikar, Justin Trivax, Diedre Brunk. *William Beaumont Hospital, Royal Oak, MI.* (Sponsor: Dr. Barry Franklin, FACSM)

(No relevant relationships reported)

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 Cardiovascular Performance database and the Wicks equation (MSSE, 2011) to estimate maximal oxygen consumption ($\text{VO}_{2\text{max}}$), expressed as metabolic equivalents (METs), we examined directly measured $\text{VO}_{2\text{max}}$ data on clients who self-reported performing vigorous physical activity ≥ 2 days per week to establish a prediction equation for this escalating patient cohort. **METHODS:** Our study population ($n = 177$) was comprised of young, middle-aged and older adults (mean \pm SD age = 53.7 ± 11.0 years), including 101 men and 76 women who had completed a standard Bruce treadmill protocol to volitional fatigue. Estimated $\text{VO}_{2\text{max}}$, expressed as maximal METs, was derived using the formula: Maximal METs = 6 (heart rate [HR] index) - 5, where the HR index was calculated as the ratio between the maximal attained during cardiopulmonary exercise testing and the standing resting HR. These values were compared to the directly measured $\text{VO}_{2\text{max}}$ values using age, body mass index (BMI), and gender to further modify the Wicks equation so that it more accurately estimated CRF for this active population. **RESULTS:** For the entire study

population ($n = 177$), mean BMI was $25.6 \pm 3.8\text{kg}/\text{m}^2$. During exercise testing, resting HR increased nearly 2.4-fold (2.37 ± 0.39); directly measured $\text{VO}_{2\text{max}}$, expressed as mean \pm SD METs, was 10.2 ± 2.8 . Using a linear regression model and the original Wicks prediction equation, as well as gender, age, BMI, an r-squared value of 0.62 was obtained (P -value < 0.001). Two separate equations were developed using this model: Maximal METs = $20.8 + (-0.08 \times \text{age}) - (0.29 \times \text{BMI}) + 0.24 \times ([6 \times \text{heart rate index}] - 5)$ for men; and Maximal METs = $18.8 + (-0.08 \times \text{age}) - (0.29 \times \text{BMI}) + 0.24 \times ([6 \times \text{heart rate index}] - 5)$ 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.

1525 **Board #3** May 31 1:00 PM - 3:00 PM
Effects of 12-weeks of Aerobic Exercise Training on Insulin Sensitivity Under Energy Balanced Conditions in Women

Christian E. Behrens, Jr. *The University of Alabama at Birmingham, Birmingham, AL.* (Sponsor: Dr. Gordon Fisher FACSM, FACSM)

(No relevant relationships reported)

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 (MIC) 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 hyperinsulinemia 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 MIC 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.

1526 **Board #4** May 31 1:00 PM - 3:00 PM
Effect of Exercise Amount and Intensity on Change in Adipose Tissue and Skeletal Muscle Distribution

Andrea M. Brennan, Theresa E. Cowan, Paula J. Stotz, Gregory J. Clarke, Robert Ross, FACSM. *Queen's University, Kingston, ON, Canada.*

(No relevant relationships reported)

PURPOSE: Habitual exercise is associated with marked reduction 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 (LALI; 180 and 300 kcal/session for women and men, respectively, at 50% of $\text{VO}_{2\text{peak}}$, $n=24$); high amount low intensity (HALI; 360 and 600 kcal/session for women and men respectively at 50% $\text{VO}_{2\text{peak}}$, $n=31$); high amount high intensity (HAHI; 360 and 600 kcal/session for women and men, respectively, at 75% of $\text{VO}_{2\text{peak}}$, $n=30$). AT and SM mass were measured by magnetic resonance imaging at baseline and 24 weeks. **RESULTS:** Reductions in total AT (%; C, -0.2; LALI, -7.9; HALI, -10.8; HAHl, -11.5), abdominal subcutaneous AT (%; C, -0.3; LALI, -6.7; HALI, -10.1; HAHl, -12.9), visceral AT (%; C, -0.2; LALI, -15.5; HALI, -18.4; HAHl, -17.1), weight (%; C, -0.8; LALI, -4.7; HALI, -6.8; HAHl, -6.4) and waist circumference (%; C, -1.2; LALI, -4.5; HALI, -6.1; HAHl, -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 HAHl compared to LALI ($p=0.003$). SM mass did not change at 24 weeks in any exercise

group compared to control ($p>0.05$). **CONCLUSION:** Substantial reduction in visceral AT with a preservation of SM mass is observed independent of exercise amount and intensity; however, higher intensity (HAHI) may be more effective than guideline-recommended (LALI) exercise for reducing total and subcutaneous adiposity. Supported by Canadian Institutes of Health Research (grant OHN-63277)

1527 Board #5 May 31 1:00 PM - 3:00 PM
Interval Training In Cardiac Rehabilitation

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(No relevant relationships reported)

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Exercise training is a standard treatment for patients with coronary artery disease (CAD). Improvements in endurance capacity are an important aim of cardiac rehabilitation.

PURPOSE: We assessed the use of high intensity interval training (HIT) on cardiorespiratory fitness (CRF) and body mass index (BMI) compared to the isocaloric conventional endurance exercise training. **METHODS:** After initial exercise test, 50 patients were randomized into HIT and a control groups (CG). In both groups, patients exercised for 12 wks, 4 x per wk. Between inclusion and week 6, patients exercised 4 x per wk and from wk 6 to 12, patients exercised 2 x per wk, both sessions were supervised in cardiac rehabilitation center and additionally 2 x per wk on individual basis at home. Patients in CG exercised continuously only, while patients in the HIT group completed 2 interval and 2 continuous exercise training sessions per wk, in alternate sequence. After 6 wks and at the end of the training phase, exercise tests were repeated. Exercise protocol consisted of 5min of warm-up followed by 30min of continuous cycling at 60% of P_{max} . HIT exercise protocol consisted of 5min of warm-up, followed by 30min of interval training at: $P_{mean} = 60\%$, $P_{max} = 100\%$, $P_{rec} = 20\%$, $t_{peak} = 60s$; $t_{rec} = 60s$ where P_{mean} was the mean workload during the 30min of exercise, P_{peak} was the peak workload intensity, P_{rec} was the recovery workload, t_{peak} was the peak workload duration, and t_{rec} was the recovery duration. For weeks 7-12, power output for each training session was recalculated according to P_{max} achieved in the second exercise test. **RESULTS:** The type of exercise training had a significant effect on BMI but not on absolute VO_{2max} . The CG reduced the BMI (-0.95) compared to the HIT group after 6 weeks, and the BMI decreased even further (-1.2) after 12 wks. **CONCLUSION:** Our results suggest that despite equal energy expenditure, HIT may be more effective in increasing muscle mass than endurance capacity.

1528 Board #6 May 31 1:00 PM - 3:00 PM
Feasibility of Aerobic Interval Training in Non-Ambulant Persons after Stroke

Sarah R. Valkenborghs¹, Kirk I. Erickson², Michael Nilsson¹, Paulette van Vliet¹, Robin Callister¹. ¹University of Newcastle, Newcastle, Australia. ²University of Pittsburgh, Pittsburgh, PA.
(No relevant relationships reported)

PURPOSE: To investigate the feasibility of aerobic interval training in non-ambulant persons after stroke.

METHODS: Intervals of aerobic exercise were performed on a low entry upright (928G3, Monark) or semi-recumbent (RT2, Monark) cycle ergometer depending on individual ability and impairment. Participants were prescribed 4 x 4-minute intervals of exercise at 85%HRmax with a 3-minute active recovery at 70% HRmax between each interval per 30-minute session, 3 times per week for 10 weeks. Heart rate (T31, Polar), rating of perceived exertion (Borg 6-20), workload (W), cadence and duration of exercise achieved were recorded in the last 15 seconds of each interval. Workload was initially prescribed based on data from an incremental cycle ergometer test and, where tolerated, was progressively adjusted to maintain intensity.

RESULTS: 9 participants (aged 62±12; 5 male) unable to walk without assistance after stroke (2.9±3.9 years) were recruited. There were no adverse events and 1 drop out (due to Bronchitis). Attendance for the remaining 8 participants was 93±6%. The mean training %HRmax was 72±14% for the higher intensity interval and 57±21%HRmax for the recovery interval, with all participants bar one achieving ≥85%HRmax at least once and the mean number of times being 28±49 over the 120 intervals (30 sessions). The mean increase in training workload between weeks 1 and 10 was 11.2±11.6 W (26.9±27.7%) for the higher intensity interval and 4±7.7W (17.4±33.3%) for the recovery interval. Mean VO_{2peak} was 12.99±4.48mL/kg/min at baseline and 14.62±4.57 mL/kg/min after 10 weeks, showing a mean increase of 1.63±2.43 mL/kg/min (12.5±18.7%) over the 10 week intervention. The mean R-value was 1.09±0.17 at baseline and

1.19±0.19 at outcome while the mean peak HR was 79±16%HRmax at baseline and 79±15%HRmax at outcome. The mean workload was 59±23W at baseline and 78±35W at outcome, showing a mean increase of 17±23W (29±40%).

CONCLUSIONS: 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

1529 Board #7 May 31 1:00 PM - 3:00 PM
The Effects Of Hiit On Body Composition And Muscular Strength In Sedentary, Obese Women

Jamie DeRevere, Amy S. Clark, Annie B. De La Rosa, Todd A. Astorino. California State University San Marcos, San Diego, CA.

(No relevant relationships reported)

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 (MICT) 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 wk of 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=37.22±3.34 kg/m²) or periodized 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 assessed 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), ($p=0.03$), yet 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 ($p=0.36$) or flexion torque ($p=0.75$).

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.

1530 Board #8 May 31 1:00 PM - 3:00 PM
The Effects Of A High-volume And High-intensity Resistance Training Program On Arterial Stiffness

Tim Werner¹, Thomas K. Pellingier¹, Nabil E. Boutagy², Demetri Rosette¹, Austin T. Ortlip¹, Morgan M. Vance¹. ¹Salisbury University, Salisbury, MD. ²Yale University, New Haven, CT.
(No relevant relationships reported)

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 vascular impact of a high-volume (HV), moderate resistance training program and a high-intensity (HI), moderate repetition training program on arterial compliance. **METHODS:** 21 otherwise healthy, male university students with limited resistance training experience (< 6 months) were randomized into one of three groups: 7 control (CO) group (22±3 yrs), 6 HI resistance exercise group (23±3 yrs), and 8 HV resistance exercise group (21±3 yrs). All were subjected to a series of tests including anthropometry, ultrasonography of the carotid artery, applanation tonometry, blood pressure acquisition, and maximal strength assessment. Subjects were instructed to maintain normal dietary patterns throughout the study period. Food consumption was monitored. All subjects in the training groups performed the same 8-10 exercises on training days. Subjects in the HV group trained at 50-70% of 1-RM with 10-15 repetitions and 2-4 sets per exercise for 3-5 days a week for 12 weeks. Subjects in the HI group trained at 70-95% of 1-RM with 3-6 repetitions and 2-3 sets per exercise for 3-5 days a week for 12 weeks. Subjects randomized to the control group were instructed to refrain from both cardiovascular and resistance exercise during the study period. Arterial stiffness comparisons

were calculated with two-way ANOVA with repeated measures. **RESULTS:** 1-RM significantly increased for squat (52% vs. 25%, $p<0.05$), bench press (31% vs. 27%, $p<0.05$) and seated rows (22% vs. 13%, $p<0.05$) in the HV and HI groups respectively. Carotid femoral PWV did not change in the HI (7.6±2 vs. 8.1±2 m/s, $p>0.05$), HV (6.3±1 vs. 6.8±2 m/s, $p>0.05$), and CO (6.7±1 vs. 6.7±1 m/s, $p>0.05$) groups. Beta stiffness index did not change in the HI (5.9±3.5 vs. 5.7±2.6 U, $p>0.05$), HV (6.5±1.9 vs. 6.5±2.1 U, $p>0.05$), and CO (7.2±4.4 vs. 6.4±3.1 m/s, $p>0.05$) groups. **CONCLUSION:** 12 weeks of HI and HV training 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

1531 **Chair:** Christopher McGlory. *McMaster University, Hamilton, ON, Canada.*

(No relevant relationships reported)

1532 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 Patterson³. 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)

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 tolerance have not been 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 47.65±35.95 mmHg higher than the SP for the rapid-inflation and handheld cuffs ($p<0.01$) and 2.17±6.70 mmHg lower than the SP for the variable-contour cuff ($p>0.05$) across all exercise sets. Pain and exertion were significantly greater in sets 3 and 4 in the rapid-inflation and handheld cuffs compared to the variable-contour cuff ($p<0.05$). MAP was significantly higher in the rapid-inflation and hand-held cuffs compared to the variable-contour cuff at 1-min and 5 min post-exercise ($p<0.05$). **CONCLUSION:** BFR cuffs that apply higher pressures than prescribed amplify CV and perceptual responses. A variable-contour cuff that regulates pressure is the most safe and effective for rehabilitative purposes in clinical populations.

1533 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. Nischenko, W. Michael Southern, Alexandra Flemington, Bethany L. Graulich, Jarrod A. Call. *University of Georgia, Athens, GA.*

(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 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 proteins Beclin1 (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 littermate 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 ($p<0.0001$), independent of ovarian hormones. There was a large induction of autophagy as indicated by greater Beclin1 and LC3 expression at 7 and 14 days post-injury, independent of ovarian hormones ($p=0.001$, $p=0.014$ respectively). Interestingly, OVX-Ulk1-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-Ulk1 deficient mice suggests an interaction between ovarian hormones and autophagy during muscle regeneration.

1534 Board #3 May 31 1:00 PM - 3:00 PM
Effect Of Diet And Exercise On Skeletal Muscle Morphology Following Radiation Therapy

Donna D'souza¹, Russell Emmons², Diego Hernández-Saavedra², Sophia Roubos¹, Jillian Larkin¹, Jessica Lloyd¹, Hong Chen², Michael De Lisio¹. ¹University of Ottawa, Ottawa, ON, Canada. ²University of Illinois at Urbana-Champaign, Urbana, IL.

(No relevant relationships reported)

With an increase in long-term cancer survival, the late effects of radiation therapy, a common treatment option, is an area of clinical concern. Furthermore, while obesity and physical activity levels are known to be associated with the risk for cancer, little is known regarding the effect of these two physiological factors on health following radiation therapy. **PURPOSE:** The purpose of the current investigation was to evaluate the influence of obesity and physical activity on skeletal muscle morphology following a sub lethal dose of radiation (IR). **METHODS:** Four-week-old male CBA mice were divided into control (CON; $n=20$) and high fat groups (HF; 45% fat, $n=20$). At 9 weeks of age mice in each group were further divided into sedentary (SED, $n=10$) and exercise (EX, $n=10$) groups. EX mice completed 4 weeks of treadmill training. At 13 weeks of age all mice were administered a therapeutic IR dose (3 Gy), and subsequently continued their previous exercise and dietary protocol for an additional 4 weeks. **RESULTS:** At 10 weeks of age HF groups had a higher percentage of body fat and higher body weight compared to controls ($*p<0.05$, $n=9-10$). At 16 weeks of age HF groups had significantly higher lean body mass and gastrocnemius/soleus complex mass compared to controls ($p<0.05$, $n=9-10$). Myofibre cross-sectional area (MCSA) analysis revealed an increase in EX groups ($p<0.05$, $n=6-8$), with a trend for an increase in HF groups ($p=0.062$, $n=6-8$). Fibre distribution analysis identified a decrease in 500-999 μ m fibres ($p<0.05$, $n=6-8$), and a greater proportion of large fibres (≥ 2000 μ m, $p<0.05$, $n=6-8$) in EX groups. Myonuclei/fibre in HF-EX was 1.3-fold higher than CON-EX and HF-SED ($p<0.05$, $n=6-8$). **CONCLUSIONS:** Diet-induced obesity resulted in an increase in body weight, adiposity, lean mass, and muscle weight. However, exercise training, but not HF, increased MCSA, and the proportion of large fibres. The increase in myonuclei content in HF-EX mice may implicate a role for muscle stem cell populations in this adaptive response. Future evaluation of distinct muscle stem cell populations and muscle morphological characteristics will be completed to further characterize the effect of diet and physical activity on skeletal muscle morphology following radiation therapy.

1535 Board #4 May 31 1:00 PM - 3:00 PM
Plasticity Of Insulin Sensitivity And Muscle Mass In Healthy Older Adults Following Inactivity And Re-ambulation

Paul T. Reidy, Alec McKenzie, Ziad Mahmassani, Nikol Yonemura, Vincent Morrow, Robin Marcus, Paul Hopkins, Yu K. Lin, Micah Drummond. *University of Utah, Salt Lake City, UT.*

(No relevant relationships reported)

Many older adults undergo repeated cycles of inactivity as they encounter sickness or injury. It is unknown how readily the insulin sensitivity and muscle mass of healthy older men and women are affected by modest physical inactivity (step reduction) and if these outcomes recover following a return to habitual physical activity. **PURPOSE:** To determine the changes in insulin sensitivity and leg muscle mass and function following inactivity and recovery. **METHODS:** Healthy older adults (5F/7M, 70±2y, 26 kg/m² BMI, HbA1c 5.5±0.1%) were assessed before (PRE), after 2-weeks of step reduction (RA: <75% of normal

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, decreased ($p < 0.05$) to 12.5 ± 1.7 at RA which then rebounded above PRE ($p < 0.05$) to 16.6 ± 1.9 at REC. This response was largely driven by the men. After removal of an outlier (+4.5% increase after RA), leg lean mass decreased after RA ($p < 0.05$) $1.3 \pm 0.5\%$ and then returned to PRE values at REC. Calf muscle area (pQCT) decreased ($p < 0.05$) $2.4 \pm 0.9\%$ from PRE to RA and then returned to PRE values at REC. KE strength decreased ($p < 0.05$) $8.0 \pm 3.5\%$ after RA and remained depressed $7.4 \pm 1.4\%$ compared to PRE.

CONCLUSIONS: In healthy older men and women, insulin sensitivity as assessed via the gold standard (euglycemic hyperinsulinemic clamp) decreased ($15 \pm 6\%$) following 2-weeks of modest physical inactivity, but unexpectedly, was able to rebound ($39 \pm 8\%$) after re-ambulation such that it was $14 \pm 5\%$ 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, Elfego 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, S6K1, 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. In addition, 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/NCATS UL1 TR001439.

1537 Board #6 May 31 1:00 PM - 3:00 PM
Impact of Short-term Sedentariness on Week-to-Week Myofibrillar Protein Synthesis Rates in Physically Active Young Men

Brandon J. Shad¹, Andrew M. Holwerda², Yasir S. Elhassan¹, Luc J.C. van Loon², Janice L. Thompson, FACSM¹, Gareth A. Wallis¹. ¹University of Birmingham, Birmingham, United Kingdom. ²Maastricht University, Maastricht, Netherlands.
(No relevant relationships reported)

Sedentary behaviour has been linked to the development of cardiometabolic disease and insulin resistance but little is known about its impact on the regulation of skeletal muscle mass. **PURPOSE:** To determine the impact of short-term sedentariness on week-to-week myofibrillar protein synthesis rates. **METHODS:** Utilising a within-

subject design, eight physically active young men (22 ± 1 y) completed 7 days of habitual physical activity (HPA) followed by 7 days of increased sedentariness (SED) using a step reduction model. Two days prior to the study, participants ingested 400 mL of deuterium oxide ($^2\text{H}_2\text{O}$) with 50 mL $^2\text{H}_2\text{O}$ doses ingested daily thereafter for the remainder of the study. Daily saliva samples were collected throughout to assess body water deuterium (^2H) enrichments. Muscle biopsies were collected at the beginning of the study (D1), after 7 days of HPA (D8) and after 7 days of SED (D15) for assessment of week-to-week myofibrillar protein synthesis rates. **RESULTS:** Currently, eight participants have completed the intervention. Preliminary data indicate that step count was reduced by approximately 92% during SED (14052 ± 797 to 1185 ± 134 steps $\cdot \text{d}^{-1}$; $P < .001$) and this led to a substantial increase in the contribution of sedentary behaviour to daily activity (72 ± 3 to $90 \pm 1\%$; $P < .001$) and decrease in the contribution of standing (17 ± 2 to $8 \pm 1\%$; $P < .001$) and ambulation (10.0 ± 0.4 to $1.0 \pm 0.2\%$; $P < .01$) to daily activity. $^2\text{H}_2\text{O}$ ingestion resulted in mean body water ^2H enrichments of $0.64 \pm 0.04\%$ during HPA and $0.70 \pm 0.06\%$ during SED ($P < .05$). Week-to-week myofibrillar protein synthesis rates decreased by approximately 26% from $1.24 \pm 0.08\% \cdot \text{d}^{-1}$ during HPA to $0.92 \pm 0.14\% \cdot \text{d}^{-1}$ during SED ($P = .096$). **CONCLUSIONS:** Preliminary data show a trend for short-term sedentariness to reduce week-to-week myofibrillar protein synthesis rates in physically active young men.

1538 Board #7 May 31 1:00 PM - 3:00 PM
Utilizing Next Generation Sequencing to Describe Age-Related Skeletal Muscle Changes with Bed Rest

Ziad S. Mahmassani, Paul T. Reidy, Alec I. McKenzie, Chris Stubben, Robin Marcus, Paul LaStayo, Mark Supiano, Michael Howard, Micah J. Drummond. *University of Utah, Salt Lake City, UT.*

(No relevant relationships reported)

Short-term bed rest is used to simulate periods of disuse experienced during hospital visitation. In our previous reports, we found that 5d of bed rest induced a ~4% loss of skeletal muscle mass in OLD (60-79 y) but not YOUNG (18-28 y) subjects (Interaction: $P < 0.001$). Identifying muscle transcriptional events that underlie this consequence of bed rest will help identify therapeutic targets to offset muscle loss in vulnerable older adult populations. **Purpose:** To compare the gene transcriptome response between YOUNG and OLD skeletal muscle after bed rest and identify a transcriptional program that underlies rapid loss of muscle mass. **Methods:** RNA was isolated and sequenced (HiSeq, Illumina; DESeq, R) from muscle biopsies obtained from the vastus lateralis of YOUNG ($N=9$; 22.9 ± 1.1 y, 171.6 ± 2.0 cm, 65.6 ± 4.6 kg) and OLD ($N=18$; 67.6 ± 1.3 y, 173.7 ± 1.8 cm, 75.7 ± 2.2 kg) men and women before and after five days of bed rest (Tanner et al 2015; Reidy et al 2017). **Results:** After bed rest, 551 genes responded similarly and 61 genes were differentially regulated between YOUNG and OLD ($P \leq 0.05$). Ingenuity Pathway Analysis identified the top commonly regulated pathways to be related to Actin Cytoskeleton Signaling, ILK Signaling, Calcium Signaling, and Mitochondrial Dysfunction. Out of the differentially regulated genes, 51 were altered in YOUNG (42 increased, 9 decreased) but were unresponsive in OLD after bed rest ($P \leq 0.05$). On the other hand, 9 genes were altered only in OLD as a result of bed rest ($P \leq 0.05$) of which 5 are protein coding (MRPL49, HIST1H2BC: increased; PXDN, NEXN, MAGI2: decreased). These genes code for proteins related to mitochondrial function, DNA structure, oxidative stress, Z-disc stabilization, and actin signaling, respectively. **Conclusion:** Our preliminary results indicate that altered gene expression in YOUNG in response to bed rest may be indicative of a compensatory expression profile to combat muscle loss. Additional investigation of the differentially regulated gene responses in young and old adults are ongoing in efforts to further describe underlying molecular events that occur in response to bed rest. Supported by NIH Grant R01 AG050781.

D-10 Thematic Poster - Movement Training

Thursday, May 31, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100F

1539 **Chair:** Kevin R. Ford, FACSM. *High Point University, High Point, NC.*

(No relevant relationships reported)

1540 **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 sec to 10±4 sec, ($p = 0.006$). Interestingly, right hip ROM was significantly reduced post-intervention (94±13 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, which may imply enhanced functional independence, as TUG performance is contingent upon lower-body strength 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.

1541 **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

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(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 (4,942 ± 4,415 steps/day) to end of treatment (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, which indicates dual-task training is superior than single-task training at reducing falls in PD.

1542 **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 Shelburne¹, 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 ($p = .005$).

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; $F(1,21) = 59.618$, $p < .001$) and 37% (pre, .140 ± .004 m; post, .192 ± .007 m; $F(1,21) = 48.482$, $p < .001$) and movement quality increased by 20% (LESS: pre, 6.7 ± .4 errors; post, 5.3 ± .5 errors; $F(1,21) = 15.032$, $p = .001$; modified LESS: pre, 7.3 ± .4 errors; post, 5.8 ± .5 errors; $F(1,21) = 22.353$, $p < .001$).

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

1543 **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.

occur since it requires minimal time and resources. **References:** 1. Paterno AJSM 2010 2. Paterno CJSM 2007 3. Hewett AJSM 2005 4. Fox SM 2014 5. Munro PTS 2012 6. Sugimoto CPMRR 2015 7. Braakhuis JHSE 2015

1544 Board #5 May 31 1:00 PM - 3:00 PM
Long-term Tai Chi Exercise Lead to Enhanced Resistance Postural Perturbation Among Older Adults
 Jiahao Pan¹, Cuixian Liu², Li Li, FACSM³. ¹361° (CHINA) CO., LTD., Xiamen, China. ²Shanghai University of Sport, Shanghai, China. ³Georgia Southern University, Statesboro, GA.
 (No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the influences of performing precision fitting task on the dynamics of postural sway among older adults.
METHODS: Three groups (12 each) participants aged 65 to 75 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 term brisk walkers (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 asked to stand on a force plate (Kistler 9287C, Kistler Corporation, Switzerland) with their feet forming a 30° angle and their heels 8% body height apart. 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 1.3 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-to-contact (TTC) measures were used to examine the dynamic of posture sway during fitting task. Two 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: $F_{2,99} = 11.567, p < .00$; far: $F_{2,99} = 13.549, p < .00$) and size (close: $F_{2,99} = 49.228, p < .00$, far: $F_{2,99} = 36.296, p < .00$) for both distances. LSD 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 that of the 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.

1545 Board #6 May 31 1:00 PM - 3:00 PM
Feasibility and Effectiveness of Augmented Feedback on Landing Mechanics in Female Basketball Players Compared to Controls
 Erin H. Hartigan, Kelly Coleman, Jaclyn Brooks, Hailey Frisbee, Michael Lawrence, Katie Hawke, Gwenyth Breslen. *University of New England, Portland, ME.*
 (No relevant relationships reported)

PURPOSE: Improper landing biomechanics (dynamic limb valgus,¹ hard landing,^{2,3} and limb asymmetries⁴) influence risk of ACL injury in female athletes.⁵ An intervention to train women to land properly using minimal time and resources appears warranted.⁶ This study tested the feasibility and effectiveness of implementing video feedback and task cards (written and pictorial cues) into basketball practice. Effectiveness was defined as reducing dynamic limb valgus (greater hip abduction and external rotation angles), landing softer [lesser vertical ground reaction force (vGRF), greater hip and knee flexion angles], and decreasing limb differences. **METHODS:** 16 female high school basketball players were randomly assigned to a control (n=8) or intervention (n=8) group. The intervention (I) group utilized delayed video feedback and task cards at 6 practices while the control (C) group received typical coaching. Pre and post-season data collections included 5 double and 5 single limb drop jumps [dominant (D) and non-dominant (ND) limb] from a 31 cm box onto a force plate. Motion analysis equipment and software were used to calculate peak hip and knee angles and vGRF over the first 10% of landing.² A RM-ANOVA was used ($P < .05$). **RESULTS:** The feedback paradigm did not increase practice time and cost was minimal (\$8 for BaM video delay app, iPad® was borrowed). Significance for double limb landing include: a group*time interaction for hip flexion angles ($p = .04$); C group decreased hip flexion angles over time: Pre=55°; post=46°; main effect of time for hip abduction (ABD) angle ($p = .009$; pre=1.7°; post=3.2°); and a main effect of group for hip ABD angles ($p = .043$; I=4.6°; C=3°). Significance for single limb landing included a time*group interaction for vGRF ($p = 0.04$, I group decreased over time); and a time*limb interaction for hip external rotation angles [$p = .016$; limb differences at pre (D=5.8°; ND=.77) and not at post (D=1.5°; ND=4.3°)]. **CONCLUSION:** This intervention provided varied feedback for different learning styles⁷ and may improve landing mechanics in female athletes. High team compliance with the intervention may

1546 Board #7 May 31 1:00 PM - 3:00 PM
Effects of Gait Modification on Lower Extremity Sagittal Plane Biomechanics
 Oladipo Eddo¹, Bryndan Lindsey¹, Shane Caswell¹, David Hollinger¹, Jessica Pope¹, Matt Prebble¹, Ana M. Azevedo², Nelson Cortes¹. ¹George Mason University, Manassas, VA. ²University of Lisbon, Lisbon, Portugal.
 (No relevant relationships reported)

Gait modification (GM) via real-time biofeedback (RTB) is a conservative intervention that has shown positive outcomes in post stroke and diabetic patients. Results from a recent systematic review support the effectiveness of this approach for increasing peak internal knee extension moment (iPKEM). iPKEM is a resistive moment to peak external knee flexion moment (ePKFM), which is associated with altered joint loading. Scarce information exists on the comparative effectiveness of existing GM strategies. **PURPOSE:** To compare the effectiveness of trunk lean (TL), medial knee thrust (MKT), and foot progression (FP) on iPKEM. **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 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 using RTB so that joint angles fell within a determined range (1-5 SD) relative to baseline. Visual 3D (V3D) was used to project visual RTB as a line graph displaying real-time joint angle during stance. V3D was used to calculate joint angles (°) and internal moments (Nm/kgm). Participants modified their gait based on strategy so the line fell within a highlighted bandwidth representing target ranges. Repeated measures ANOVA was used to assess differences in iPKEM between strategies. Dependent t-tests were conducted to compare joint angles between baseline and modification strategy ($p < 0.05$). **RESULTS:** A significant difference between strategies was attained for iPKEM ($p = 0.001$). MKT (.53±.24) had higher iPKEM than all other strategies (Baseline: .31±.2, FP: .34±.12, TL: .31±.14). No other statistically significant difference was found ($p > 0.05$). **CONCLUSION:** MKT 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 ePKFM 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.

1547 Board #8 May 31 1:00 PM - 3:00 PM
Can the Newly Learnt Gait Pattern after Running Retraining be Translated to Untrained Conditions?
 Janet H. Zhang¹, Zoe Y.S. Chan¹, Ivan P.H. Au¹, Winko W. An², Roy T.H. Cheung¹. ¹The Hong Kong Polytechnic University, Kowloon, Hong Kong. ²Boston University, Boston, MA.
 (No relevant relationships reported)

Running retraining is reported to be effective in impact loading control and injury prevention. During running retraining, biomechanics metrics, such as tibial shock, from one side of the body is usually provided while the participant is running at a controlled test speed. Whether participants are able to translate the newly learnt gait pattern to untrained conditions (e.g., untrained side of the limb and untrained speeds) remains unanswered. **PURPOSE:** To compare the tibial shock of the participants' untrained limb and at untrained running speeds before and after a course of running retraining. **METHODS:** Ten runners underwent a running retraining program as described by Crowell & Davis (2011). Before and after the program, their tibial shock from both limbs were measured using wireless accelerometers when they were running at the training speed (TS), 110% of TS and 90% of TS. The peak tibial shock during the last 20 footfalls in each 3-minute trial were extracted for analyses. **RESULTS:** The effect of gait retraining did not interact with test speeds ($p = 0.699$) but it interacted with limb side ($p < 0.05$). We found a reduction in the tibial shock on the trained limb at all test speeds ($p = 0.001-0.008$; Figure 1). However, we only observed a trend of tibial shock reduction on the untrained side ($p = 0.074-0.098$; Figure 1). **CONCLUSIONS:** The current running retraining protocol may not be fully optimized as the newly learnt gait pattern may not be completely translated to untrained conditions.

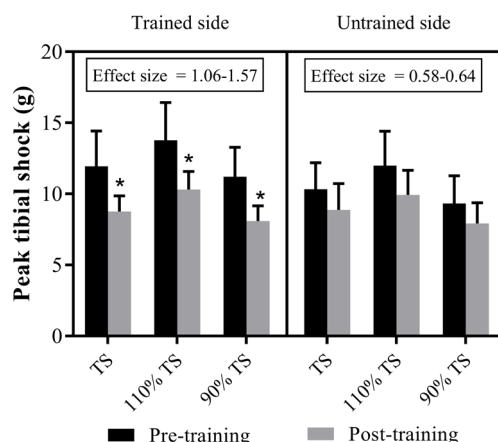


Figure 1. Peak tibial shock before and after running retraining at three speeds

TS: Training speed

* Significantly reduced compared to pre-training test

D-11 Thematic Poster - Physical Activity and Health Promotion in Cancer Survivors

Thursday, May 31, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100H

1548 **Chair:** Joachim Wiskemann, *Penn State College of Medicine, Hershey, PA.*

(No relevant relationships reported)

1549 **Board #1** May 31 1:00 PM - 3:00 PM
Rural-Urban Differences in Meeting Physical Activity Recommendations in Cancer Survivors in Central Pennsylvania

Scherezade K. Mama¹, Wayne Foo², Renate Winkels², Joachim Wiskemann², Shirley M. Bluethmann², William Calo², Joel E. Segel¹, Eugene J. Lengerich², Kathryn H. Schmitz, FACSM².

¹The Pennsylvania State University, University Park, PA. ²Penn State Cancer Institute, Hershey, PA. (Sponsor: Kathryn H. Schmitz, PhD, MPH, FACSM, FTOS, FACSM)

(No relevant relationships reported)

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 Survey (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 examine the association between rural-urban residence and meeting physical activity recommendations, adjusting for cancer site, age, BMI, education, and income.

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 ($\chi^2=1.8$, $p=.180$). 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; $p=.040$); however, this was only marginally significant after adjusting for covariates (OR=1.91; 95% CI: 0.98-3.76; $p=.057$). 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: 1.08-6.31, $p=0.03$).

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.

1550 **Board #2** May 31 1:00 PM - 3:00 PM

Breast Cancer Survivors' Psychosocial Beliefs, Physical Activity and Quality of Life

Zachary Pope¹, Nan Zeng¹, Jung E. Lee², Zan Gao, FACSM¹.

¹University of Minnesota-Twin Cities, Minneapolis, MN.

²University of Minnesota-Duluth, Duluth, MN. (Sponsor: Zan Gao, FACSM)

(No relevant relationships reported)

PURPOSE: Physical activity (PA) among breast cancer survivors (BCS) has been associated with quicker physiological and psychological recovery following cancer treatment. Yet, little study has examined the predictive utility of psychological beliefs on BCS's quality of life (QoL) and objectively-assessed PA. Therefore, this study examined whether BCS's psychosocial beliefs predicted QoL and daily PA, energy expenditure (EE), and steps/day, with an additional examination of whether QoL differed based upon whether BCS met PA recommendations.

METHODS: Forty BCS ($X_{age} = 51.2 \pm 10.0$ years; $X_{wt} = 80.1 \pm 19.7$ kg) participated in baseline testing of two larger parent intervention trials. Participants completed validated surveys regarding social cognitive beliefs (i.e., self-efficacy, social support, enjoyment, outcome expectancy, and barriers) and QoL outcomes (i.e., anxiety, physical functioning limitations, fatigue, depression, sleep disturbances, pain interference/intensity, and ability to participate in social roles/activities). One-week daily sedentary behavior (SB), light PA (LPA), moderate-to-vigorous PA (MVPA), EE, and steps/day were assessed via ActiGraph GT3X+ accelerometers.

RESULTS: BCS participated in a daily average of 556.2 min, 119.9 min, and 31.3 min of SB, LPA, and MVPA, respectively, with respective daily EE and steps/day being 385.5 kcal and 4,808 steps. Stepwise multiple regression indicated self-efficacy was the only belief observed predictive of overall QoL—explaining 34.9% of the variance for this variable ($F(1, 37) = 19.3$, $p < 0.01$). Further, only outcome expectancy was found predictive daily LPA ($F(1, 37) = 5.5$, $p = 0.03$)—explaining 13.2% of the variance. Notably, however, independent t-tests showed no differences in any QoL outcome between BCS who met or did not meet PA recommendations.

CONCLUSIONS: Findings suggest health professionals concentrate first on increasing BCS PA self-efficacy and outcome expectancy to increase PA participation and improve QoL. Larger sample sizes might allow for broader investigations of the predictive utility of psychosocial beliefs on QoL and daily PA behavior.

1551 **Board #3** May 31 1:00 PM - 3:00 PM

A Meta-analysis Of Tai Chi/qigong On Fatigue And Quality Of Life In Cancer Patients

Xiaoyue HU, Stanley Sai-chuen HUI, FACSM. *The Chinese University of Hong Kong, Hong Kong, China.* (Sponsor: Stanley Sai-chuen HUI, FACSM)

(No relevant relationships reported)

Due to the advances in cancer treatment, 64% of the person diagnosed with cancer can expected to be alive in 5 years. Long-term cancer-related health problems for these cancer survivors becoming a public health concern. Growing evidence suggests Tai chi or Qigong as a mind-body exercise become an option for cancer patients to improve QoL and reduce the cancer related fatigue symptom (CRF). **PURPOSE:** To investigate the effects of Tai Chi /Qigong versus non-Tai Chi/Qigong treatment on cancer patients' health related QoL and CRF. **METHODS:** Studies on randomized controlled trials (RCT) of Tai Chi /Qigong as an intervention were retrieved from Medline, CINAHL, SPORTDiscus, Cochrane Library, and PubMed. Meta-analyses were performed on changes in QoL and CRF. QoL was measured by SF-36 questionnaire and cancer-specific QoL was assessed by functional assessment of cancer treatment-general (FACT-G). CRF was assessed by brief fatigue inventory (BFI) or functional assessment of chronic illness therapy-fatigue (FACIT-F). Random effects model was used to calculate the pooled mean difference (MD) with 95% confidence interval (CI). **RESULTS:** A total of 14 RCTs (1,001 subjects) were included in this review. Nine RCTs (567 subjects) provided sufficient data to estimates the effect size for QoL and CRF. For QoL assessed by SF-36 questionnaire, significant differences were found in two subscales, mental health and vitality. The MD of mental health and vitality were 2.33 (95% CI: 1.71, 2.96; Z score = 7.31; $p < 0.01$), 1.50 (95% CI: 0.56, 2.44; Z score = 3.14; $p = 0.002$). QoL assessed by five subscales (PWB, SWB, FWB, total) FACT-G change scores were in support of Tai Chi/Qigong interventions and indicated a statistically significant effect. Their MD were 2.36 (95% CI: 1.32, 3.40), 2.91 (95% CI: 1.49, 4.32), 1.24 (95% CI: 0.03, 2.44), 2.70 (95% CI: 1.73, 3.68), and 7.74 (95% CI: 4.58, 10.91), respectively. For CRF, the standardized mean difference (SMD) was -0.51 (95% CI: -0.98, -0.04; Z score = 2.14, $p = 0.03$) indicating that Tai Chi /Qigong had

significant positive effects on cancer patients' CRF. **CONCLUSIONS:** This study concluded that Tai Chi/Qigong 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. Toohey, 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 (LVHIT) 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 LVHIT (n = 25), CLMIT (n = 25) or control group (n = 25). The LVHIT group performed 7 x 30s intervals ($\geq 85\%$ predicted maximal heart rate), the CLMIT group performed continuous aerobic training for 20 min ($\leq 55\%$ predicted maximal heart rate) on a stationary cycle, three times per week.

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

CONCLUSIONS: LVHIT elicited greater benefits in improving waist circumference and emotional well-being compared to the other groups in this study. Exercise positively impacted body composition, white 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, Tenbroeck Smith, Kassandra I. Alcaraz, J. Lee Westmaas, Alpa V. Patel. *American Cancer Society, Atlanta, GA.* (Sponsor: Melissa Bopp, FACSM)
(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 among cancer survivors.

METHODS: Self-report data from the American Cancer Society's Studies of Cancer Survivors I and II were merged. 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-36 Physical Functioning scale. Covariates included age, time since diagnosis, race/ethnicity, cancer type by gender, cancer stage, and number of comorbidities.

RESULTS: The sample (N = 10,255) was primarily white/Caucasian (80.8%), female breast (29.5%) or male prostate cancer survivors (21.4%), with in situ/localized cancer (69.2%), 4.8 years (SD = 3.3) from diagnosis, had 1-2 comorbidities (49.9%), and mean age of 64.1 years (SD = 12.4). Almost 27% of the sample reported no leisure-time LPA or MVPA. Both LPA [$F(3) = 19.93$, $p < 0.001$] and MVPA [$F(2) = 310.48$, $p < 0.001$] were independently, positively associated with physical functioning. The LPA by MVPA interaction [$F(6) = 31.34$, $p < 0.001$] showed that among those reporting no MVPA, there is a significant difference in physical functioning between those reporting no LPA and those reporting ≥ 120 min/week of LPA [mean difference = 5.65 (SE = 0.3), $t = 18.80$, $p < 0.001$]. A linear trend with increasing levels of LPA was evident [$t = 17.19$, $p < 0.001$]. Among those reporting 1-149 and 150+ min/week of MVPA, there was no association of LPA and physical functioning ($ps > .05$).

CONCLUSIONS: Among cancer survivors reporting no leisure-time MVPA, LPA was positively associated with physical functioning. The effect was clinically meaningful at the highest level of LPA (≥ 120 min/week). Randomized control trials are needed to determine the impact of LPA on physical functioning among cancer survivors healthy enough to begin LPA.

- 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, FACSM³, K.A. Rao, FACSM⁴, Laura Q. Rogers, FACSM¹.
¹The University of Alabama at Birmingham, Birmingham, AL.
²Southern Illinois University, Carbondale, IL. ³The University of Alberta, Edmonton, AB, Canada. ⁴Southern Illinois University, Springfield, IL. (Sponsor: Laura Rogers, FACSM)
(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 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 pain was reported by 43%, 35%, and 48%, respectively. The 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 ($r = 0.52$, $p = .02$) and PTN ($r = -0.48$, $p = 0.03$). Lean mass was positively correlated with total intake of CHO ($r = 0.46$, $p = .04$), fats ($r = 0.54$, $p = .01$), PTN ($r = 0.64$, $p > .01$) and kilocalories ($r = 0.56$, $p = .01$). No significant correlations were observed between macronutrients and strength or physical functioning. Fat intake was positively correlated with greater ability to swallow ($r = 0.66$, $p < .01$) and eat solid foods ($r = 0.60$, $p < .01$) while CHO were negatively correlated with ability to swallow ($r = -0.81$, $p < .01$) and eat solid foods ($r = -0.72$, $p < .01$). PTN intake was positively correlated with ability to swallow ($r = 0.47$, $p = .03$). **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 Smoak¹, Matthew Christensen¹, Nicholas Harman¹, Daniel Shackelford², Reid Hayward¹, Katie Kage¹, Jessica Brown², Laura Stewart¹. ¹University of Northern Colorado, Greeley, CO.
²Carroll 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 medicines supplement these conventional treatments while alternative 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 happy with the conventional medical treatments that they received, and 70% of respondents reported CAM use 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. Also, 45% of respondents used some form of CAM while undergoing cancer treatment. Almost half of respondents (48%) claimed that CAM was very 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, astragalus, 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
Exploring Racial/Ethnic Differences in Physical Activity and Behavioral Risk Factors among Cancer Survivors in Central Pennsylvania.

William A. Calo¹, Shirley Bluethmann¹, Wayne Foo¹, Eugene Lengerich¹, Scherezade Mama², Joel Segel², Renate Winkels¹, Joachim Wiskemann¹, Kathryn Schmitz, FACSM¹. ¹*Penn State College of Medicine, Hershey, PA.* ²*Penn State College of Health and Human Development, University Park, PA.*

(No relevant relationships reported)

PURPOSE: Racial/ethnic disparities in physical activity and behavioral risk factors are widely reported among the U.S. adult population. Little is known, however, about whether these racial/ethnic differences exist among cancer survivors. To address this gap, we examined the associations between race/ethnicity and meeting ACSM physical activity guidelines and behavioral risk factors among cancer survivors.

METHODS: We analyzed cross-sectional data from 585 cancer survivors who reside in central Pennsylvania. Survivors were identified using the Pennsylvania Cancer Registry and were mailed a survey using Behavioral Risk Factor Surveillance Survey-based items from May-September, 2017. We categorized race/ethnicity into: non-Hispanic whites (NHW; 89%), non-Hispanic blacks (NHB; 4%), Hispanics (4%), and others (3%). We classified respondents as participating in any physical activities/exercises, meeting aerobic guidelines (≥ 150 minutes/week), muscle-strengthening guidelines (≥ 2 times/week), or both guidelines. We also assessed whether participants were overweight/obese, current smokers, had multiple comorbid conditions, and perceived health status. Analyses were adjusted for sex, age, education, and income.

RESULTS: Sixty-seven percent reported participating in any physical activities in the past month. NHW reported higher levels of physical activity than NHB and Hispanics but these differences were not significant ($p > .05$). Neither race/ethnicity was associated ($p > .05$) with meeting aerobic guidelines, muscle-strengthening guidelines, or both. More NHB were overweight/obese than NHW or Hispanics but these differences were not significant ($p > .05$). Hispanics reported higher levels of smoking, however, race/ethnicity was not associated with smoking status ($p > .05$). All groups reported similar levels of comorbid conditions and perceived health status.

CONCLUSIONS: It was encouraging to find no evidence of racial/ethnic disparities in physical activity and behavioral risk factors in our sample. However, non-adherence to physical activity guidelines was high in all racial/ethnic groups. Future studies with more diverse samples are needed to further explore racial/ethnic differences in physical activity and their potential impact on cancer survivors' health.

D-12 Clinical Case Slide - Cervical and Thoracic Spine

Thursday, May 31, 2018, 1:00 PM - 2:40 PM
 Room: CC-200E

1557 **Chair:** John P. Batson, FACSM. *Lowcountry Spine & Sport, LLC, Hilton Head Island, SC.*
 (No relevant relationships reported)

1558 **Discussant:** Jeffrey M. Mjaanes, FACSM. *Northwestern University, Evanston, IL.*
 (No relevant relationships reported)

1559 **Discussant:** Sherrie L. Ballantine-Talmadge. *CU Sports Medicine and Performance Center, Boulder, CO.*
 (No relevant relationships reported)

1560 May 31 1:00 PM - 1:20 PM
Thoracic Pain in a Competitive Middle-Aged Tennis Player

Stacey Bennis¹, Daniel Blatz². ¹*McGaw Medical Center of Northwestern University/Shirley Ryan AbilityLab, Chicago, IL.* ²*Northwestern University/Shirley Ryan AbilityLab, Chicago, IL.* (Sponsor: Joseph Ihm, MD, FACSM)

(No relevant relationships reported)

HISTORY: A 47-year-old male competitive tennis player presented to a musculoskeletal clinic with nine day history of acute right-sided mid-thoracic back pain that started after serving a tennis ball. One week later, the patient developed a thoracic rash, treated as herpes zoster by his internist. Eight months later, he returned to the musculoskeletal clinic with one week history of acute bilateral thoracic back

pain and one day history of left thoracic rash. He described two prior episodes of herpes zoster (10 years prior, 8 months prior) and mild varicella zoster as a child. He denied neurologic complaints or immunocompromise.

PHYSICAL EXAMINATION: Initial examination revealed normal neurologic findings, negative lower limb dural tension tests, and right mid-thoracic paraspinal muscle tenderness exacerbated by left trunk rotation. At follow up, examination was stable except for a new erythematous vesicular rash with surrounding allodynia in dermatomal distribution at the left mid-thoracic spine.

DIFFERENTIAL DIAGNOSIS:

1. Acute recurrent herpes zoster
2. Thoracic radiculitis
3. Post-herpetic neuralgia
4. Thoracic paraspinal muscle strain

TEST AND RESULTS:

- MRI Thoracic Spine without Contrast: Multilevel degenerative changes. Moderate left foraminal stenosis at T7-8. Moderate to severe right foraminal stenosis at T9-10.
- HIV Ag/Ab: negative.
- Infectious Disease Consult: "heavy tennis playing may have resulted in re-activation of VZV."

FINAL WORKING DIAGNOSIS:

1. Acute left thoracic radiculitis due to recurrent herpes zoster reactivation from heavy tennis playing
2. Acute right thoracic radiculitis due to zoster sine herpette versus thoracic neural foraminal stenosis
3. Chronic right thoracic pain due to post-herpetic neuralgia versus thoracic radiculitis

TREATMENT AND OUTCOMES:

1. Valtrex 1000mg PO TID x7 days and 1000mg TID at onset of any future symptoms
2. Topical lidocaine patch versus capsaicin patch for treatment of post-herpetic neuralgia neuropathic pain
3. Discussed possibility of gabapentin as an alternative option for management of post-herpetic neuralgia
4. 2-3 weeks rest from tennis, and rest from tennis at onset of any future symptoms
5. Follow up after MRI (patient has not yet followed up in the office)

1561 May 31 1:20 PM - 1:40 PM

Cervical Spinal Injury: Presenting Issue —Decreased Range Of Motion Globally, Mild-to-moderate Stiffness With Chronic Pain

Zenon R. Jimenez. *Mercy College, Dobbs Ferry, NY.* (Sponsor: M. Allison Williams, FACSM)

(No relevant relationships reported)

Cervical Spinal Injury: Presenting Issue —decreased range of motion globally, mild-to-moderate stiffness with chronic pain
HISTORY: 36 y/o retired rugby player sustained multiple collisions during his professional career is now presenting with signs and symptoms indicative of cervical spinal trauma. He reports having many concussions, after which he wouldn't recall his own memories of finishing a game and regained awareness of self many hours post event. Also, he reports that "every Sunday while he played professionally felt as if he was in a car accident" at the high level of intensity he was expected to perform.
PHYSICAL EXAMINATION: Last seven years, individual has been waking up to both arms presenting completely numb through his hands. Last six months, symptoms have intensified; experiencing local burning into right latissimus dorsi during trunk flexion. Furthermore, right leg also experiences a local burning sensation whenever he's driving. Left arm and hand severely cramp whenever he performs any actions, which require a greater than usual amount of exertion and may limit many of his career functions. Chronic cervical pain at the base with stiffness. Occasional left drop foot that impedes ambulation.
DIFFERENTIAL DIAGNOSIS: Suspected herniated nucleus pulposusPossible cervical spinal stenosis
TEST AND RESULTS: Exaggerated deep tendon reflexes left of midline Clonus with multiple beats with quick stretch of left foot into dorsiflexion(+) Hoffman's & Babinski sign bilaterallyInverted brachioradialis reflex on left armDecreased ROM globally in all directionsMild tenderness to palpation locally near the spinous process of C6X-ray(+) MRI HNP
FINAL / WORKING DIAGNOSIS: Cervical spondylotic myelopathy from long standing protrusion of the C5/6 disc resulting in cord flattening.
TREATMENT AND OUTCOMES: Physical therapy with non-significant changes from the baseline. Underwent two courses of methyl-prednisone, which alleviated complications during the admission, but shortly after the medication was discontinued, complications presented to pre medication levels. Non-steroidal inflammatory drugs were unsuccessful at ameliorating signs and symptoms.Surgery for C4/5, C5/6 disc replacement with prestige LP prosthesis, via anterior cervical discectomy with replacement instead of fusion.

1562 May 31 1:40 PM - 2:00 PM

Spinal Trauma in a Division 1 Football Player

Arjun K. Ramprasad. *Crozer-Keystone Health System, Springfield, PA.* (Sponsor: Tom Kaminski, PhD, FACSM)
(No relevant relationships reported)

CLINICAL CASE SAMPLE

HISTORY: A division 1 football player developed acute onset shortness of breath after a tackle during game play. He made a proper form tackle but was struck in the sternum by an opposing player and the side by a teammate. On the field he initially complained of difficulty breathing but his airway remained patent. He then complained of rib and upper back pain but was able to walk off the field under his own power. A sideline evaluation demonstrated thoracic spine tenderness. He was then transported to the ER via EMS.

PHYSICAL EXAMINATION: Initial on-field examination revealed no sternal or laryngeal tenderness but did show right sided posterior rib tenderness. Additional sideline exam revealed midline thoracic tenderness around T6. He was neurovascularly 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:

CT scan of cervical spine:

— No acute cervical spine fracture

CT scan of thoracic spine:

— Acute burst type compression fracture of T6 with 4mm of retropulsion

MRI or thoracic spine

— Acute burst fracture of T6 vertebral body with approximate 25% height loss along with marrow 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

1563 May 31 2:00 PM - 2:20 PM

Thoracic Radiculopathy Case

Malia Cali, Jacques Courseault. *LSUHSC, New Orleans, LA.*
(No relevant relationships reported)

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 diagnosis.

PHYSICAL EXAM: Examination of the left upper abdomen near the insertion of the rectus on the rib cage exhibited severe active myofascial trigger points. Palpation of these trigger points induced nausea, abdominal, and chest pain. There was severe tenderness of the thoracic paraspinals from T6-T10. Reflexes and upper and lower extremity strength testing was normal. Sensation was normal.

DIFFERENTIAL DIAGNOSES:

1. Thoracic Radiculopathy with Active Myofascial Abdominal Trigger Points
2. Gastritis
3. Malignancy
4. Coronary Artery Disease

TEST AND RESULTS:

1. MRI of the thoracic spine:

• Scattered small perineural cysts, the largest measuring 0.7cm in diameter in the T10-T11 foramen, as well as slight central posterior protrusion of the T6-T7, T8-T9, and T9-T10 discs.

1. EMG and NCV:

• Findings consistent with inactive, subacute multilevel mid thoracic radiculopathy.

FINAL/WORKING DIAGNOSES:

Thoracic Radiculopathy due to Tarlov cysts and posterior protrusion of discs

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

1564 May 31 2:20 PM - 2:40 PM

Persistent Right Upper Limb Weakness: Football

Melissa Lau, Michael Baria. *Ohio State University, Columbus, OH.*

(No relevant relationships reported)

HISTORY:

Patient is a 15 year old previously healthy male linebacker presenting with the chief complaint of right upper limb weakness after tackling an opponent. He completed a form tackle, hitting his opponent with the right shoulder. Upon contact he experienced immediate right upper limb dysesthetic pain down to the hand with concomitant loss of strength of his entire right arm. Over the next 24 hours, his pain resolved but profound weakness persisted with complete inability to abduct the upper limb.

PHYSICAL EXAM:

-**Neurological:** Strength exam demonstrated 1/5 weakness in all shoulder movements including flexion, abduction, and external rotation. He has 3+/5 strength with elbow flexion, and 4/5 with wrist flexion and extension. Biceps reflex was depressed but present. Sensation was normal.

-**Musculoskeletal:** Full active range of motion in cervical spine, mild tenderness to palpation at approximately C5 but no step off appreciated. Shoulder examination demonstrated no deformity, tenderness, or range of motion impairment.

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
5. Suprascapular and/or axillary neuropathy
6. Rotator cuff tear
7. Shoulder fracture / dislocation

TESTS AND RESULTS:

-**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

-**MRI cervical spine:** Mild right foraminal disc protrusion at C5-C6 contributing to mild neural foraminal stenosis. Torg ratio 0.77

-**EMG:** Severe C5 and moderate C6 radiculopathy. Severe axonotmesis without neurotmesis

WORKING DIAGNOSIS:

C5 and C6 radiculopathy with axonotmesis

TREATMENT/OUTCOMES:

-**Initial:** C-spine precautions and R arm sling placement until cervical spine was cleared by MRI

-**2 weeks post injury:** Neuromuscular re-education and active assisted range of motion started

-**Return To Play:** No sporting activity until neurologic recovery completed. It remains controversial as to whether he should resume football or wrestling. Given the Torg ratio and the severity of his injury, there is an unquantifiable risk of recurrence if collision sports are resumed should he eventually regain full neurological function.

D-13 Clinical Case Slide - Knee III

Thursday, May 31, 2018, 1:00 PM - 3:00 PM
Room: CC-200F

1565 Chair: Scott A. Paluska, FACSM. *Christie Clinic Sports Medicine, Champaign, IL.*

(No relevant relationships reported)

1566 Discussant: Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.*

(No relevant relationships reported)

1567 Discussant: Dennis Khalili-Borna, FACSM. *Kaiser Permanente, Fontana, CA.*

(No relevant relationships reported)

**1568 May 31 1:00 PM - 1:20 PM
Knee Pain - Football, Basketball**

Alexandra Warrick, Julie Ingwersen, Brian Haus. *UC Davis, Sacramento, CA.* (Sponsor: Brian Davis, M.D., FACSM)

(No relevant relationships reported)

HISTORY: 16 year-old high school football and basketball athlete was referred to Sports Medicine. He could not recall a specific injury, but had 2 months of recurrent pain and swelling with high-impact activities. No neuropathic, mechanical, nor instability symptoms. No prior knee orthopedic history.

PHYSICAL EXAMINATION:

Inspection showed slight genu valgum and small right knee effusion. No pain with palpation of all bony and soft tissue landmarks of the knee. Active range of motion was pain free and symmetric for knee flexion and extension. Strength was intact at 5/5 hip flexion, knee extension and knee flexion. Provocative maneuvers showed no pain with bounce and McMurrays, firm 1+ endpoint with Lachmans, anterior drawer, and posterior drawer. He was stable and symmetric with no laxity or pain during varus and valgus stressing of the knee at 0 and 30 degrees of flexion. No pain with patellar compression and negative dial testing.

DIFFERENTIAL DIAGNOSIS: Includes meniscus pathology, plica syndrome, patellofemoral pain, osteochondritis dissecans (OCD), stress injury

TESTS AND RESULTS:

1. Standing knee xrays showed medial femoral condyle OCD with knee effusion and loose body in suprapatellar space.
2. MRI of right knee showed 1.7 x 1.3 cm osteochondral defect at the central weight-bearing surface of the medial femoral condyle with displaced osteochondral fragment in the suprapatellar bursa.

FINAL WORKING DIAGNOSIS:

Grade IV osteochondritis dissecans lesion

TREATMENT AND OUTCOMES:

1. Recommended non-weight bearing and medial unloader brace requested while physical therapy initiated.
2. Diagnostic arthroscopy for loose body removal and biopsy for matrix-induced chondrocyte implantation.
3. Low impact activities only, physical therapy and medial unloader brace with ambulation until harvested cells ready for implantation.
4. Matrix-induced autologous chondrocyte implantation was performed after 6 weeks of cell culturing.
5. Athlete treated with post-operative rehabilitation protocol.
6. MRI at 6 months demonstrated interval progression of healing medial femoral condyle OCD.
7. Athlete will continue post-operative rehabilitation protocol and will be assessed for readiness for sport progression at 12 and 18 months.

**1569 May 31 1:20 PM - 1:40 PM
Knee Pain And Instability - Soccer Player**

Allison N. Schroeder, Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.* (Sponsor: Thomas Best, FACSM)

(No relevant relationships reported)

HISTORY:

A 24-year-old male soccer player presented to an orthopedic sports medicine clinic with 7 years of left knee "looseness." He first noticed this following a soccer match. His main complaint was instability and his knee would buckle 3-4 times a week, but

it would never fully give-way or cause him to fall. He had a reported history of left "grade 1-2 PCL sprain." He has been avoiding aggravating activities, including playing soccer.

PHYSICAL EXAM:

No discoloration or swelling of the left posterior knee. Full active and passive range of motion without pain at end range of motion. McMurry's, Lachman's, and anterior drawer were negative. Posterior drawer was 1+. Posterior sag was 1+. Negative dial test.

DIFFERENTIAL DIAGNOSIS:

1. PCL sprain or tear
2. Posterior lateral corner injury
3. Posterior horn of medial or lateral meniscus injury
4. Meniscomfemoral ligament (ligament of Wrisberg or Humphrey) injury
5. Patellar subluxation/dislocation
6. Osteochondral defect
7. Cyst in the posterior knee

TEST AND RESULTS:

MRI revealed 8x7x6mm ganglion cyst adjacent to the posteromedial aspect of the PCL near the distal insertion on the tibia. Reverse KT1000 measurement revealed laxity of the left PCL that was 3mm greater than the right. Ultrasound of the insertional PCL visualized in long axis showed no pathology but appeared kinked at the proximal 1/3 when compared to the right. Cyst lying adjacent to the PCL in the posterior medial direction was visualized.

FINAL WORKING DIAGNOSIS:

PCL sprain and adjacent PCL ganglion cyst

TREATMENT AND OUTCOMES:

He was referred to our sports ultrasound clinic for sonographic evaluation and possible intervention. Sonographically guided intervention was performed from a distal to proximal approach with the patient supine. The cyst was fenestrated 10 times and 1mL of a 1:2:2 mixture of 50% dextrose, sterile water, and 1% lidocaine solution was injected into the cyst. An additional 2mL of the solution was injected peri-PCL. He had >50% improvement in instability at 1 month. Repeat sonographic exam showed decompression of the cyst. He reported 80% improvement in the feeling of "looseness" and KT1000 testing (completed by the same provider as the initial measurement) revealed a 1mm difference in laxity of the PCL on the left compared to the right 7 weeks after the injection. He had no limit in daily activity.

1570 May 31 1:40 PM - 2:00 PM

Keen Pain and a Moveable Mass in Basketball Player

James Wilcox, Robert Baker, FACSM, Keith Kenter. *Western Michigan University Homer Stryker M.D. School of Medicine, Kalamazoo, MI.* (Sponsor: Robert Baker, FACSM)

(No relevant relationships reported)

HISTORY:

A 16-year-old high school basketball player was evaluated for left knee pain and a moveable mass in his knee. He started having pain, swelling, and locking of his left knee when he played basketball. He would have to manually unlock his knee sometimes. He sat out the rest of the season, but now the pain and locking has returned, and he feels a moveable mass above his knee cap. He denied any specific injury or traumatic event. He was previously diagnosed with osteochondritis dissecans (OCD) in his right knee 2 years prior and was told to sit out of football that season, but now he is having trouble with his left knee. He denied any other joint complaints. He denied any constitutional complaints. Family history was significant only for osteoarthritis and rheumatologic disease in his mother.

PHYSICAL EXAMINATION:

Generally he is a well-nourished normal appearing 16 year old male. Examination of the left knee revealed lateral joint line tenderness and a moveable mass superior to his patella. McMurray's test was positive for clicking, and he had a trace knee joint effusion on exam. Small abrasion over the tibial tubercle. He had some general laxity of his joints, but sensation, strength, range of motion, and ligamentous testing were all normal. Normal gait, no antalgic limp. Examination of the right knee was normal.

DIFFERENTIAL DIAGNOSIS:

1. Loose chondral body
2. Lipoma arborescens
3. Bucket handle meniscal tear
4. Pigmented villonodular synovitis
5. Plica
6. Synovial osteochondromatosis
7. Juvenile Rheumatoid Arthritis
8. Synovial chondrosarcoma
9. Synovial sarcoma
10. Synovial metastases

TEST AND RESULTS:

Xray of left knee - lateral femoral condyle OCD, closed growth plates Xray of right knee - lateral femoral condyle OCD with sclerosis
MRI of left knee - small effusion with lateral femoral osteochondral defect about 2.5 cm

Arthroscopy of left knee - OCD with loose bodies and chondral defect

FINAL WORKING DIAGNOSIS:

Osteochondritis Dissecans with loose bodies

TREATMENT AND OUTCOMES:

He was treated with an arthroscopic procedure to remove the 2 loose chondral bodies. He had cartilage cobble stoning 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.

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

Anterior Knee Pain - Golf

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

(No relevant relationships reported)

HISTORY:

Athlete is a 71-year-old recreational golfer. Athlete's previous medical history includes bi-lateral Achilles tendon repairs, contralateral quadriceps tendon repair and Right supraspinatus tendon repair. Athlete is borderline diabetic with developing osteoarthritis.

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:

1. Anterior Knee Contusion 2. Posterior Cruciate Ligament Tear 3. Medial meniscus tear 4. Anterior Cruciate Ligament Tear 5. Quadriceps Tendon Rupture

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. Furthermore, it is imperative for clinicians to ensure both long and short axis views of the quadriceps tendon to ensure proper diagnosis.

1572 May 31 2:20 PM - 2:40 PM

Knee Swelling in a Football Player

Daniel Evering, Jr¹, David Webner¹, Kevin DuPrey¹, A.J. Duffy, III². ¹*Crozer Keystone Sports Medicine, Springfield, PA.* ²*Widener University, Chester, PA.* (Sponsor: Dr. Thomas Kaminski, FACS)

(No relevant relationships reported)

HISTORY: An 18-Year-Old Male Division III quarterback presented to the office with left knee swelling and pain. He was playing in a game 10 days prior in which he was sacked twice, each time landing on his left knee and medial thigh. Right after the game, he noted swelling over the superior aspect of the patella and pain with direct pressure and full flexion. He described the pain as sharp and fiery, non-radiating, 3/10, waxing and waning. He has been wearing a compression sleeve and icing his knee.

PHYSICAL EXAMINATION: Examination of the patient's Left knee revealed decreased ROM with flexion and extension to 120/0 degrees. Large, 4+, suprapatellar effusion. Strength intact. Negative patellar compression test for pain and crepitus. No patellar instability. No ligamentous laxity to anterior, posterior, varus and valgus (30°) stress testing. Negative Lachman's testing. Negative anterior and posterior drawer testing. No joint line tenderness. Negative McMurray's testing. No patellar tendon tenderness. No pes anserine bursa tenderness. The patient was otherwise neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: 1. Suprapatellar Bursitis 2. Prepatellar Bursitis 3. Patella Fracture 4. Intraarticular Injury with knee effusion 5. Morel-Lavallée lesion
TEST AND RESULTS: Ultrasound exam revealed large collection of fluid in the suprapatellar and medial thigh region. X-ray showed no fracture and moderate soft tissue swelling anterior to the left patella.

FINAL WORKING DIAGNOSIS: Morel-Lavallée lesion

TREATMENT AND OUTCOMES: 1. Under US guidance 75 cc of serosanguinous fluid was aspirated from the suprapatellar bursa on the left knee on the first visit.

Compression wrap applied. 2. 75 cc of serosanguinous fluid was aspirated 3 days later. Compression continued. 3. 50 cc of serosanguinous fluid was aspirated 4 day later, 7 days after the initial visit 4. 1 week later there was only mild accumulation of fluid. No aspiration was required. He had near full ROM and no pain with activity. He was cleared to return to football at that visit and successfully returned with no issues.

1573 May 31 2:40 PM - 3:00 PM

Knee Injury-soccer

Ankur Verma¹, Melody Hrubes², Terry Nicola, FACS².

¹*University of Chicago/Schwab Rehabilitation Hospital, Chicago, IL.* ²*University of Illinois-Chicago, Chicago, IL.*

(Sponsor: Terry Nicola MD, FACS)

(No relevant relationships reported)

HISTORY: A 17-year-old male high school varsity soccer player with a history of right knee patellar dislocation 6 months ago managed non-operatively with physical therapy and bracing with successful return to sport presented with right knee swelling, pain, and decreased range of motion after being struck on the lateral aspect of his right knee during a game yesterday. He felt a pop and had swelling. He is unable to bear weight, and is unable to fully extend or flex his knee. He has been icing. He denies numbness, tingling, or weakness.

PHYSICAL EXAMINATION: Examination revealed moderate effusion and tenderness to palpation over the medial aspect of his patella, as well as the MPFL. There was some tenderness over the MCL. He has a positive apprehension sign with positive ballottement. There was no tenderness over the LCL. There was a 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 20 degrees short of full extension and actively flex his knee to 90 degrees.

DIFFERENTIAL DIAGNOSIS: 1. Patellar dislocation 2. Osteochondral defect 3. MPFL tear

TEST AND RESULTS: XR Right Knee: Sunrise view demonstrated a medial patellar avulsion fracture

MRI Right Knee without Contrast: Acute lateral patellar tracking injury with medial patellar avulsion fracture, kissing contusion on the femoral condyle, and high-grade medial patellar retinaculum sprain

FINAL WORKING DIAGNOSIS: Medial patellar avulsion fracture

TREATMENT AND OUTCOMES:

Re-initiate the Lateral Patella Knee Brace for stabilization

Physical therapy for range of motion, quadriceps activation, gait biomechanics and modalities to decrease swelling

Orthopaedic Surgery referral. Surgery was recommended once swelling subsides

Plan is for surgery 3-4 months after injury

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

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

Room: CC-Mezzanine M100C

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. Pantan, FACS. *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 yrs) using dual-energy X-ray absorptiometry. Paired t-tests were used to compare arm BMD, LM, and FM. Significance was accepted at $p \leq 0.05$. **RESULTS:** BCS were 6.6 ± 7.3 yrs 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 ($0.674 \pm$

0.095 g/cm²) and FM (1.70 ± 0.60 kg) compared to the unaffected arm (BMD: 0.689 ± 0.104 g/cm²; FM: 1.89 ± 0.93 kg). There was no difference in LM. **CONCLUSION:** Our findings suggest that breast cancer treatments can result in accelerated changes in BMD and FM in the affected arm, which may place BCS at a higher risk for fractures on the affected side. These findings warrant the need for exercise interventions to improve BMD and body composition in the affected arm following cancer treatments. Research supported by the ACSM Doctoral Student Research Grant and the National Strength and Conditioning (NSCA) Graduate Research Grant

1644 Board #2 May 31 3:15 PM - 5:15 PM
Phase Angle and Body Composition in Breast Cancer Survivors Compared to Healthy Age-Matched Women

Caroline D. Deaterly, Elizabeth Evans, Takudzwa A. Madzima.
Elon University, Elon, NC. (Sponsor: Paul C. Miller, FACSM)
(No relevant relationships reported)

Breast cancer survivors (BCS) experience well documented treatment induced alterations in body composition, particularly the loss of lean mass (LM) and bone mineral density. Less is known about the treatment-related effects on phase angle, body cell mass (BCM), extracellular mass (ECM) and the ratio of ECM/BCM. Phase angle is an objective indicator of cellular health and integrity, and BCM is a measure of the actively metabolizing component of LM that also decreases with age. A phase angle less than 5° is indicative of poorer cellular health and nutritional status. An ECM/BCM ratio less than 1.0 is optimal. **PURPOSE:** To identify any differences in measures of body composition, phase angle, BCM, ECM and ECM/BCM in BCS compared to healthy age-matched women (HC). **METHODS:** Thirty post-menopausal BCS (stages 0-III) (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. Data 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 ± 8.3; HC: 25.7 ± 8.2 kg), body fat % (BCS: 34.0 ± 6.0; HC: 34.8 ± 5.7 %), BCM (BCS: 20.9 ± 3.0; HC: 21.3 ± 2.8 kg), ECM (BCS: 34.9 ± 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, 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.

1645 Board #3 May 31 3:15 PM - 5:15 PM
The Influence of Body Composition and Skinfold Thickness on Skin Temperature Changes after Resistance Exercise

Martin Weigert, Nico Nitzsche, Christiane Lösche, Lutz Baumgärtel, Henry Schulz. *Chemnitz University of Technology, Chemnitz, Germany.*
(No relevant relationships reported)

Resistance exercise leads to an increase in skin temperature (T) in the area of the exercised muscle. Non-contact infrared thermography seems to be applicable to identify these primary used functional muscles with measuring T changes. In previous studies, lean men showed homogenous T patterns after standardized exercise protocols.

Purpose

To examine the influence of body fat percentage (BF%) and skinfold thickness on T patterns 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 curl with 50 % of the individual one-repetition-maximum (two min rest between the sets). T of the exercised biceps was measured at rest (T_{rest}), immediately following set 1, 2 and 3 (T_{S1}, T_{S2}, T_{S3}) and up to 30 min post exercise (T_{-T₃₀}) with an infrared camera. For statistical analysis, Δ-values to T_{rest} for every measuring time point, as well as T_{max}, ΔT_{max} (=T_{max} - T_{rest}) and time to T_{max} (min after the final set) were calculated.

Results

One-way ANOVA detected a time effect on the T-values T_{rest} to T₃₀ (Eta²=0.64, p<0.001). Means (min-max) of T_{rest}, T_{max}, ΔT_{max} and time to T_{max} 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 T_{rest}, T_{max}, ΔT_{max} and time to T_{max} (r>-0.52, p<0.001). A negative correlation between BF% and skinfold thickness with the Δ-values to T_{rest} was found from T_{S2} to T₁₀ (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 T pattern in reaction to the exercise with a minimum ΔT_{max} of 1.3

°C and a time to T_{max} between 2 and 9 min. The T patterns 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 T.

Conclusion

A higher BF% and a higher skinfold thickness is associated with delayed and lower increases in T after resistance exercise. In contrast to lean subjects, identifying the primary used functional muscles by infrared thermography in obese subjects seems to be challenging.

1646 Board #4 May 31 3:15 PM - 5:15 PM
Body Composition of Collegiate Baseball and Softball Athletes, Consortium of College Athlete Research (C-CAR) Study

Madeline A. Czeck¹, Christiana J. Raymond-Pope¹, Tyler A. Bosch¹, Jack W. Ransone, FACSM², Jonathan M. Oliver³, Aaron Carbuhr⁴, Philip R. Stanforth⁵. ¹University of Minnesota, Minneapolis, MN. ²University of Nebraska, Lincoln, NE. ³Texas Christian University, Fort Worth, TX. ⁴University of Kansas, Lawrence, KS. ⁵University 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 baseball 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±0.1/20.0±0.1 yrs.; height = 1.8±0.02/1.7±0.03 m; weight = 88.6±2.4/73.1±3.03 kg; body mass index = 26.5±0.8/25.0±0.3 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 (14.4±3.1 kg) compared to P and C (16.7±4.5, 17.7±4.6 kg) but not compared to IF (16.5±6.3 kg; p=0.188). No significant (p>0.05) differences between male P, C, OF, and IF were observed for total BMD (1.47±0.1, 1.50±0.1, 1.50±0.08, 1.46±0.10 g/cm²) and VAT (0.28±0.22, 0.31±0.21, 0.33±0.14, 0.36±0.27 kg). Female OF had significantly (p=0.012) lower total FM (18.5±5.9 kg) compared to P (23.8±8.8 kg), but not compared to C and IF (20.8±4.0, 20.6±7.2 kg; p=0.544; 0.731). No significant (p>0.05) differences for female softball P, C, OF, and IF were observed for total LM (50.8±5.5, 49.7±4.8, 48.9±4.8, 49.3±5.8 kg), BMD (1.34±0.13, 1.34±0.10, 1.34±0.10 g/cm²), and VAT (0.22±0.33, 0.08±0.06, 0.12±0.16, 0.14±0.26 kg). **CONCLUSIONS:** We observed that there were more positional differences in baseball players than softball players. The greater differences within positions between sports may be related to the larger field dimensions and demands of the game. These values may be used for normative DXA data for collegiate baseball and softball players.

1647 Board #5 May 31 3:15 PM - 5:15 PM
Body Composition of Division I Collegiate Basketball Athletes, Consortium of College Athlete Research (C-CAR) Study

Anna L. Solfest¹, Christiana J. Raymond-Pope¹, Aaron Carbuhr², Philip R. Stanforth³, Jonathon M. Oliver⁴, Jack W. Ransone, FACSM⁵, Tyler A. Bosch¹, Donald R. Dengel, FACSM¹. ¹University 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 measures of total body composition using dual x-ray absorptiometry (DXA) in male and female NCAA Division I collegiate basketball athletes. **METHODS:** Two-hundred and eight male and female (88/120) collegiate basketball athletes (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; body mass index=25.0±2.4/24.2±2.9 kg/m²) received one whole body DXA scan. Athletes were classified into five positions: point guards (PG; M/F=27/32), shooting guards (SG; M/F=18/27), small forwards (SF; M/F=13/18), power forwards (PF; M/F=21/27), and centers (C; M/F=9/16). Total fat mass (FM), lean mass (LM), bone mineral density (BMD) and abdominal visceral adipose tissue (VAT) were measured by DXA. MANOVA and Tukey's HSD assessed total differences between positions for each sex (adjusted p=0.0125). **RESULTS:** Male C had significantly higher total FM, LM, and VAT compared to all other positions except PF. Male C and PF had significantly greater total FM (18.0±7.8; 15.6±5.6 kg) than SF

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 (0.44±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; all $p<0.001$). 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. Female SF, PF, and C had significantly ($p<0.001$) greater total LM (56.6±6.3; 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.

1648 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 Carbuhn², Philip R. Stanforth³, Jonathan M. Oliver⁴, Jack W. Ransone, FACSM⁵, Andreas Kreutzer⁴, Donald R. Dengel, FACSM¹. ¹University of Minnesota, Minneapolis, MN. ²University of Kansas, Lawrence, KS. ³University of Texas at Austin, Austin, TX. ⁴Texas Christian University, Fort Worth, TX. ⁵University 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=32), Setter (ST=9), and Libero (LB=18). Total fat mass (FM) and lean masses (LM) were measured by DXA, as well as abdominal visceral adipose tissue (VAT) and total and regional measures of bone mineral density (BMD). An ANOVA assessed the effect of position on body composition and BMD measurements. Tukey's HSD post-hoc analysis test identified significance between positions. **RESULTS:** As expected, height was statistically significant ($p<0.01$) between all positions: MB (185.8 ± 4.6 cm) > OH (181.7 ± 4.1 cm) > ST (174.7 ± 3.7 cm) > LB (167.8 ± 8.0 cm). Weight was significantly greater in MB and OH (80.1 ± 9.3 kg, 76.6 ± 7.8 kg) compared to LB (64.5 ± 7.6 kg, $p<0.001$), and MB compared to ST (69.7 ± 5.7 kg, $p=0.006$). Body percent fat was not statistically significant by position (mean = 25.3%). Total LM was greater in MB and OH (55.7 ± 4.6 kg, 54.1 ± 4.7 kg) compared to LB and ST (45.9 ± 4.9 kg, 48.3 ± 3.2 kg, $p<0.01$). Total FM was significantly greater in MB than LB (21.0 ± 6.9 kg, 16.1 ± 4.0 kg, $p=0.016$). VAT mass was not significantly ($p>0.05$) different between positions. After adjusting for weight, total BMD was significantly greater in MB (1.39 ± 0.1 g/cm³, $p<0.001$) and OH (1.41 ± 0.09 g/cm³, $p=0.002$) compared to LB (1.30 ± 0.08 g/cm³), but not ST (1.31 ± 0.07 g/cm³, $p>0.05$). Leg BMD was higher in MB and OH (1.54 ± 0.11 g/cm³, 1.53 ± 0.11 g/cm³) compared to LB and ST (1.39 ± 0.09 g/cm³, 1.4 ± 0.06 g/cm³, $p=0.001$ -0.008). Spine BMD was higher in MB and OH (1.32 ± 0.15 g/cm³, 1.33 ± 0.12 g/cm³) compared to LB (1.22 ± 0.09 g/cm³, $p=0.03$). **CONCLUSIONS:** Total body composition measures vary significantly by position; however, the similarities in percent body fat imply differences may be influenced primarily by height. Future studies should examine the distribution of mass. BMD differences may be influenced by repeated impacts of jumping during the attacking and blocking actions of front row players. These data provide some normative DXA data for collegiate volleyball players.

1649 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. Oliver³, Tyler A. Bosch², Donald R. Dengel, FACSM². ¹College 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/cm³, $p=0.92$) and VAT (0.13±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 ± 0.019 vs. 1.812 ± 0.030, $p=0.005$) 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/cm³, $p=0.46$). **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.

D-37 Thematic Poster - Exercise Training in Cancer Patients

Thursday, May 31, 2018, 3:15 PM - 5:15 PM
 Room: CC-Lower level L100E

1650 Chair: Karen M. Mustian. University of Rochester/James P. Wilmot Cancer Center, Rochester, NY.

(No relevant relationships reported)

1651 Board #1 May 31 3:15 PM - 5:15 PM
How Does a Supervised Exercise Program Improve Quality Of Life In Patients With Cancer?

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

(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 enrol. Eleven meetings with 3-10 patients were organized in which patients generated ideas in response to the statement: 'How has participating in a supervised exercise program contributed positively to your QoL'. Next, patients individually clustered (based on similarity) and rated (based on importance) the ideas online. The online assessments were combined and one concept map was created, visualizing clusters of ideas of how patients perceive that participating in a supervised exercise program improved their QoL. 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 fitness and influenced social, mental and cognitive factors, resulting in improvements in QoL. These results can be used to increase the awareness of the importance of supervised exercise programs for the QoL of patients with cancer.

1652 Board #2 May 31 3:15 PM - 5:15 PM
Exercise and The Cancer Patient: Function Improves Independent of Cardiovascular and Anthropometric Changes

Sarah R. McDowell¹, Cynthia Villalobos¹, Justin C. Brown², Paul D. Vosti³, Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²Harvard University, Cambridge, MA. ³St. Joseph's Medical Center, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)

(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 ($p<0.001$), timed up-and-go ($p<0.001$), 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.

1653 Board #3 May 31 3:15 PM - 5:15 PM
Piloting the Effect of Aerobic Exercise during Chemotherapy Infusion in Patients with Cancer

Kate M. Edwards¹, Vanessa Thomas¹, Catherine Seet-Lee¹, Birinder S. Cheema², Michael Boyer³, Michael Marthick³. ¹University of Sydney, Sydney, Australia. ²University of Western Sydney, Campbelltown, Australia. ³Chris O'Brien Lifehouse, Sydney, Australia. (Sponsor: Ollie Jay, FACSM)

(No relevant relationships reported)

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%HRR within 5-8 minutes and was steady during exercise, recovering to within 10 beats of resting rates in 4.7 ± 4.6 min. On average, systolic blood pressure rose 15% during exercise, with a maximum reading of 153mmHg, 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.

1654 Board #4 May 31 3:15 PM - 5:15 PM
Effect of Exercise on Chemotherapy-Induced Peripheral Neuropathy Symptoms in Women with Breast Cancer

Kelcey A. Bland¹, Amy A. Kirkham², Josh Bovard¹, Tamara Shenker³, David Zucker⁴, Margot K. Davis¹, Don C. McKenzie¹, Karen A. Gelmon³, Kristin L. Campbell¹. ¹University of British Columbia, Vancouver, BC, Canada. ²University of Alberta, Edmonton, AB, Canada. ³British Columbia Cancer Agency, Vancouver, BC, Canada. ⁴Swedish Cancer Institute, Seattle, WA.

(No relevant relationships reported)

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% HRR, 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 foot (vibration and pinprick). Assessments occurred at: 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 ($\Delta 16.3$, $p<0.01$) that progressed further by the end of chemotherapy ($\Delta 24.3$, $p<0.01$). At post-cycle 3, sensory symptoms were 38% lower in EX compared to UC but this was not statistically significant ($UC=26.3 \pm 4.7$, $EX=16.3 \pm 5.4$, $p=0.17$). The most frequently 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-model 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.

1655 Board #5 May 31 3:15 PM - 5:15 PM
Benefits of Immediate Versus Delayed Exercise in Men Initiating ADT for Prostate Cancer

Dennis R. Taaffe, FACSM¹, Robert U. Newton¹, Nigel Spry², David Joseph³, Suzanne K. Chambers⁴, Robert A. Gardiner⁵, Prue Cormie⁶, David HK Shum⁴, Daniel A. Galvao¹. ¹Edith Cowan University, Perth, Australia. ²Genesis CancerCare, Perth, Australia. ³Sir Charles Gairdner Hospital, Perth, Australia. ⁴Griffith University, Gold Coast, Australia. ⁵University of Queensland, Brisbane, Australia. ⁶Australian Catholic University, Melbourne, Australia.

(No relevant relationships 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 12 months. Similarly, physical performance improved ($p<0.001$) 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

at the onset or after 6 months ADT preserves/enhances muscle strength and physical function. However, to avoid any initial treatment-related adverse effects on strength and function, exercise should be prescribed and commenced at the onset of ADT. Supported by Cancer Australia (ID# 1029901).

- 1656 Board #6 May 31 3:15 PM - 5:15 PM
Effects of an Exercise Intervention on Lung Cancer Patients Who Have Undergone a Lobectomy
 Nicholas Harman¹, Jessica M. Brown², Daniel Shackelford², Reid Hayward¹. ¹University of Northern Colorado, Greeley, CO. ²Carroll University, Waukesha, WI.
 (No relevant relationships reported)

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 (VO_2peak), and spirometry, yielding forced vital capacity (FVC) and forced expiratory volume (FEV_1). Subjects were divided into two groups: surgical resection including lobectomy (LOB, $n = 9$), and all other cancers (AOC, $n = 205$). **Results:** There were significant improvements in VO_2peak in the LOB group (Pre: 15 ± 2 mL/kg/min, Post: 19 ± 5 mL/kg/min; $+20\%$; $p = 0.03$) and no significant changes in FVC and FEV_1 . There were significant improvements in VO_2peak (Pre: 21 ± 0.5 mL/kg/min, Post: 24 ± 0.6 mL/kg/min; $+13\%$; $p = 0.00$) and FEV_1 (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 VO_2peak 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.

D-38 Thematic Poster - Hydration

Thursday, May 31, 2018, 3:15 PM - 5:15 PM
 Room: CC-Lower level L100C

- 1657 **Chair:** Samuel N. Cheuvront, FACSM. *USARIEM, Natick, MA.*
 (No relevant relationships reported)

- 1658 Board #1 May 31 3:15 PM - 5:15 PM
Ad Libitum Fluid Consumption off-sets Thermal and Cardiovascular Strain Exacerbated by Dehydration during Heat Waves
 Connor Graham, Nathan B. Morris, Ollie Jay, FACSM.
 University of Sydney, Sydney, Australia. (Sponsor: Ollie Jay, FACSM)
 (No relevant relationships reported)

Purpose: We compared the impact of different fluid replacement practices on the development of dehydration and the associated changes in thermal and cardiovascular strain throughout 3 hours of light exercise in peak heat wave conditions (40°C , 40%RH). **Methods:** Seven participants completed four separate 180-min trials, exercising at 3 METs in 40°C , 40%RH. In each trial a different hydration plan was employed; i) *ad libitum* consumption of 20°C water (ALTAP); ii) *ad libitum* consumption of 4°C water (ALCHILL); iii) no fluid replacement (NOFR); iv) full replacement of sweat loss (FULLFR). Fluid consumption (FC), resultant dehydration (%DEH), rectal temperature (T_{re}), mean skin temperature (T_{sk}), heart rate (HR), whole body sweat rate (WBSR), and local sweat rate (LSR) were measured. **Results:** Compared to NOFR, FC was greater in FULLFR (1.39 ± 0.27 L; $P < 0.001$), ALTAP (1.36 ± 0.46 L; $P < 0.001$) and ALCHILL (1.04 ± 0.39 L; $P = 0.002$). FC was greater in ALTAP than ALCHILL ($P = 0.01$). %DEH was greater in NOFR ($1.79 \pm 0.18\%$)

compared to FULLFR ($0.03 \pm 0.14\%$; $P < 0.001$), ALTAP ($0.08 \pm 0.65\%$; $P = 0.002$) and ALCHILL ($0.46 \pm 0.59\%$; $P = 0.004$). The rise in T_{re} from rest was greater in NOFR ($1.13 \pm 0.34^\circ\text{C}$) compared to ALTAP ($0.68 \pm 0.32^\circ\text{C}$; $P < 0.001$), ALCHILL ($0.72 \pm 0.34^\circ\text{C}$; $P < 0.001$) and FULLFR ($0.72 \pm 0.35^\circ\text{C}$; $P < 0.001$). HR was higher after 180 min in NOFR (100 ± 11 beats $\cdot \text{min}^{-1}$) compared to ALTAP (86 ± 12 beats $\cdot \text{min}^{-1}$; $P < 0.001$), ALCHILL (87 ± 15 beats $\cdot \text{min}^{-1}$; $P < 0.001$), and FULLFR (91 ± 11 beats $\cdot \text{min}^{-1}$; $P = 0.003$). No differences in T_{sk} , LSR or WBSR were observed between trials. **Conclusions:** No fluid consumption throughout a 3-h heat wave exposure with light physical activity exacerbated both thermal and cardiovascular strain, although differences in T_{re} were not due to difference in sweating. *Ad libitum* consumption of 4°C or 20°C water was sufficient to prevent levels of dehydration that exacerbate physiological heat strain. Preliminary findings show 4°C water seems to blunt thirst, and hence fluid intake relative to 20°C water.

- 1659 Board #2 May 31 3:15 PM - 5:15 PM
Energy Drink Consumption and Running Performance in a Hot Environment
 Emma L. Reed¹, Lindsey N. Russo¹, Zachary J. Schlader¹, Jennifer L. Temple¹, David Hostler, FACSM². ¹University at Buffalo, BUFFALO, NY. ²University at Buffalo, Buffalo, NY.
 (Sponsor: Dave Hostler, FACSM)
 (No relevant relationships reported)

Energy drinks have been reported to have an ergogenic effect on exercise performance but there are few objective reports about the interaction of energy drinks and exercise in the heat in healthy, young adults. **PURPOSE:** To determine if energy drink consumption prior to a 5-km trial improves performance or alters thermoregulation when running in a hot environment.

METHODS: Experienced runners (4 males and 1 female; age: 22 ± 2.9 y; $\text{VO}_{2\text{max}}$: 51.16 ± 7.55 mL/kg/min) completed two 5-km trials in a double-blinded, randomized, crossover design 45 minutes after consuming a 500mL solution of a commercially available energy drink (ED) (~215 mg caffeine, ~480 mg taurine) or an equal volume of similarly flavored placebo (P). Both trials were completed on a treadmill in an environmental chamber set to 34°C and 40% relative humidity. Subjects were instructed to complete the 5-km run as fast as possible but were blinded to time, speed, and distance. Subjects were told the distance completed every 500 m. Physiological and perceptual variables were collected during the trials. **RESULTS:** There was no difference in time to complete the 5-km trial (1447 ± 296 (ED) vs. 1440 ± 264 sec (P)). Core temperature ($39.27^\circ\text{C} \pm 0.33^\circ\text{C}$ (ED) vs. $39.14^\circ\text{C} \pm 0.53^\circ\text{C}$ (P)), skin temperature ($36.2^\circ\text{C} \pm 0.4^\circ\text{C}$ (ED) vs. $35.3^\circ\text{C} \pm 1.2^\circ\text{C}$ (P)), rate of perceived exertion (both 9.4 ± 0.5), and heart rate (193 ± 9 bpm (ED) vs. 193 ± 12 bpm (P)) at the end of exercise did not differ. **CONCLUSIONS:** Consuming an energy drink before running a 5-km trial in the heat did not affect thermoregulation or improve performance.

- 1660 Board #3 May 31 3:15 PM - 5:15 PM
100% Orange Juice Consumption on Hydration, Electrolyte, and Cardiovascular Measures Following Exercise In The Heat
 Melani R. Kelly, Dawn M. Emerson, Evan J. Landes, Evan R. Barnes, Philip M. Gallagher. University of Kansas, Lawrence, KS.
 (No relevant relationships reported)

Compared to commonly consumed carbohydrate electrolyte beverages (CEB), 100% orange juice (OJ) has a similar carbohydrate content, less sodium, and an increased amount of potassium, vitamins, and minerals, making it a possible fluid replacement option. **PURPOSE:** To investigate OJ, water (W), and CEB on hydration, electrolyte, and cardiovascular measures following exercise in the heat. **METHODS:** We used a randomized, controlled, single-blind design to determine the effects of OJ, a commercially available flavored W, and a commercially available CEB on plasma osmolality (Posm); plasma sodium (PNa^+), potassium (PK^+), calcium (PCa^+), and chloride (PCl^-); urine volume (Uvol); fluid volume (Fvol); heart rate (HR); and blood pressure (BP). Participants ($n = 26$, 20 male, 6 female, age: 22.1 ± 3.3 yrs; weight: 72.9 ± 10.0 kg; height: 174.3 ± 7.9 cm; $\text{VO}_{2\text{max}}$: 48.8 ± 7.3 mL/kg/min) cycled 80 min at 70% $\text{VO}_{2\text{max}}$ in a hot, humid environment ($30.1 \pm 0.2^\circ\text{C}$, $51.6 \pm 4.0\%$ relative humidity) on 5 consecutive days. After exercise, participants consumed 237 mL (8 oz) of assigned beverage then rested 1 hr in an ambient environment. Dependent measures were taken pre-, during, post-, and 1 hr post-cycling. **RESULTS:** There were no significant differences between conditions at any time point for Posm, PNa^+ , PCa^+ , PCl^- , Fvol, Uvol, HR, or BP. Participants began exercise euhydrated (Posm = 266.9 ± 16.6 mOsm/L) and maintained hydration to post- (266.3 ± 19.5 mOsm/L) and 1 hr post-cycling (261.9 ± 12.8 mOsm/L). PK^+ post-cycling was significantly greater in OJ (4.3 ± 0.2) than CEB (4.0 ± 0.1 , $P = .04$). PK^+ 1 hr post-cycling was significantly lower in CEB (3.9 ± 0.1) than W (4.3 ± 0.2 , $P = .003$) and OJ (4.2 ± 0.3 , $P = .01$). Overall, pre- PK^+ (3.9 ± 1.9 mmol/L) was significantly lower than post- (4.2 ± 0.2 mmol/L, $P < .001$) and 1 hr post-cycling (4.1 ± 0.3 mmol/L, $P < .001$). **CONCLUSION:** Consuming 8 oz of OJ on multiple days after moderately intense cycling in the heat

maintained fluid, electrolyte, and cardiovascular measures similar to W and CEB. Only PK^+ was significantly affected by OJ, with post-cycling measures being higher, but within normal limits. 100% OJ is a viable rehydration option after exercise. Funded by the Florida Department of Citrus (#STE0075600).

- 1661 Board #4 May 31 3:15 PM - 5:15 PM
Rehydrating Efficacy of Maple Water After Exercise-Induced Dehydration: Potential Sex
 Alexs A. Matias, Monique D. Dudar, Josip Kauzlaric, Kimberley A. Frederick, Stephen J. Ives. *Skidmore College, Saratoga Springs, NY*. (Sponsor: Paul J. Arciero, FACSM)
 (No relevant relationships reported)

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:** 26 healthy college-aged (24 ± 1 kg/m², 22 ± 1 yrs) males ($n=13$) and females ($n=13$) participated in a single blind, counterbalanced, crossover design study investigating the rehydrating efficacy of MW vs. maple flavored bottled water after exercise-induced dehydration ($\sim 2.0\%$ Δ Body Weight [BW]) in an environmental chamber (30°C, 50% RH). Post-exercise, participants consumed either: 1L of MW or control. Assessments of hydration (BW, salivary and urine osmolality [S_{osm}/U_{osm}]), urine specific gravity (USG), urine output (UO), urine color (UC), thirst, fatigue, heart rate (HR), and HR variability (HRV) were taken at baseline, immediately post-exercise, and 0.5, 1, and 2h post-consumption. **RESULTS:** Following dehydration ($p<0.05$), MW had no differential ($p>0.05$) impact on rehydration. Thirst sensation was 12% higher in the MW condition ($p<0.05$). When analyzed by sex, females had lower UO (30%, $p<0.05$), higher Δ BW (25%, $p<0.05$), USG ($p<0.05$), and U_{osm} (23%, $p<0.05$), but similar S_{osm} ($p>0.05$). Analysis of MW revealed higher electrolyte content (Ca^{2+} , K^+ , Mg^{2+} , Mn^{2+} , CO_3^{2-} , PO_4^{3-} , SO_4^{2-} , Cl^- , but not Na^+), osmolality (81 vs. 11 mOsm/kg), and antioxidant potential (AP; FRAP assay, 3.9 ± 0.0 vs. 1.0 ± 0.1), which tended to increase urine AP following MW consumption (9.4 ± 0.7 vs. 7.6 ± 1.0 mmol; MW vs. control). **CONCLUSION:** MW is an equally effective rehydrating beverage to water, but has higher electrolyte concentration and osmolality which might better trigger thirst mechanisms when rehydration is performed ad libitum. Further, MW has a superior antioxidant capacity, which tended to increase urinary antioxidant capacity and might reduce free radicals associated with exercise. There are apparent sex differences in urinary (UO, Δ BW, USG, U_{osm}), but not salivary, based measures of rehydration and warrants further study.

- 1662 Board #5 May 31 3:15 PM - 5:15 PM
Commercial Hydration Beverages Effectively Prolong Positive Fluid Balance in Older Adults Compared to Water
 Megan M. Clarke, Anna E. Stanhewicz, W. Larry Kenney, FACSM. *The Pennsylvania State University, University Park, PA*. (Sponsor: W. Larry Kenney, FACSM)
 (No relevant relationships reported)

Glucose-based beverages are often prescribed when mild-to-moderate dehydration is suspected because glucose-sodium cotransporters in the small intestine facilitate active transport of Na^+ and resultant water diffusion. Alternatively, amino acid (AA)-based beverages use AA-sodium cotransporters to facilitate increases in vascular volume in the short-term with potentially fewer negative GI issues. **PURPOSE:** To compare effects of commercially available hydration solutions on short term fluid balance after an overnight fast. We hypothesized that (1) older subjects would stay in positive fluid balance longer after fluid ingestion due to decreased renal excretion rates, and (2) consumption of commercially-available hydration products would further delay negative fluid balance compared to water. **METHODS:** On five separate visits following an overnight fast, 12 young (Y, 23 ± 3 yr; 7M/5F) and 12 older (O, 67 ± 6 yr; 5M/7F) subjects consumed 1 L of distilled water, Gatorade (6% glu, 20 mmol/L Na^+), Pedialyte (2.5% glu, 45 mmol/L Na^+), Enterade (5 AA, 30 mmol/L Na^+), or Enterade-AD (anti-diarrheal; 8 AA, 60 mmol/L Na^+) over a 30-minute period. Urine samples were collected before ingestion and at 0, 60, 120, 180, and 240 min post-ingestion. Net fluid balance was calculated at each time point and time spent in positive fluid balance (g urine < g fluid consumed) was determined for each beverage by non-linear exponential decay modeling. **RESULTS:** GFR was lower in O compared to Y (71 ± 3 vs. 94 ± 6 mL/min, $P<0.01$). There was no difference among beverages for Y in time spent in positive fluid balance. Time in positive fluid balance was significantly longer for O compared to Y following ingestion of 1L of Pedialyte (234 ± 34 vs. 140 ± 18 min; $P<0.01$), Enterade (291 ± 49 vs. 152 ± 18 min; $P<0.01$), and Enterade-AD (228 ± 27 vs. 161 ± 25 min; $P=0.04$) and was significantly increased in O with Enterade compared to water (291 ± 49 vs. 204 ± 35 min, $P=0.02$). **CONCLUSIONS:** After a bolus fluid load, healthy older adults exhibit a prolonged time course for urine excretion due to

decreased GFR. Ingestion of commercially-available hydration solutions prolongs positive fluid balance compared to water ingestion in healthy older -- but not young -- adults. An AA based hydration product was the most effective short-term (0-4 h) oral hydration strategy for older adults.

- 1663 Board #6 May 31 3:15 PM - 5:15 PM
Consumption of a Caffeinated Soft Drink during Exercise in the Heat Worsens Dehydration
 Christopher L. Chapman, Blair D. Johnson, James R. Sackett, Mark D. Parker, Zachary J. Schlader. *University at Buffalo, Buffalo, NY*. (Sponsor: Dave Hostler, FACSM)
 (No relevant relationships reported)

Chronic dehydration is linked to kidney dysfunction in workers regularly exposed to hot environments. Sugar-rich beverages, such as soft drinks, are regularly consumed on work sites. Such hypertonic drinks decrease plasma and extracellular fluid volumes during rest. Consuming a soft drink-like beverage after resting heat exposure worsens dehydration in rats. It is unknown if drinking a caffeinated soft drink exacerbates dehydration during exercise in the heat.

PURPOSE: Test the hypothesis 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 (Mtn Dew, Soda) and water control (Water) trials. Subjects completed four 1 h work-rest cycles (45 min exercise, 15 min seated rest) in a 35°C, 65% RH environment. During rest, subjects drank 500 mL of the assigned rehydration beverage ($\sim 11^\circ\text{C}$). Physiological variables, and venous blood and urine samples were taken pre- (PRE), 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 (mean \pm SD).

RESULTS: Increases in core temperature (Soda: 0.8 ± 0.3 , Water: $0.8 \pm 0.3^\circ\text{C}$, $p=0.46$) and changes in nude body weight (Soda: -0.3 ± 0.8 , Water: $0.0 \pm 0.7\%$, $p=0.20$) were not different between trials. Urine specific gravity was higher at POST ($p<0.05$), but there were no differences between trials (Soda: 0.006 ± 0.013 , Water: 0.007 ± 0.009 , $p=0.89$). At POST, plasma osmolality was elevated in Soda (2 ± 3 mOsm/kg) and reduced in Water (-6 ± 3 mOsm/kg, $p<0.01$). Urine osmolality was higher at POST ($p<0.01$), but there were no differences between trials (Soda: 69 ± 368 , Water: 185 ± 311 mOsm/kg, $p=0.12$). Plasma volume was lower in Soda at POST ($p<0.02$), but there were no differences between trials (Soda: -5 ± 6 , Water: $-2 \pm 7\%$, $p=0.15$). Elevations in heart rate were higher in Soda at POST (Soda: 20 ± 12 , Water: 12 ± 12 bpm, $p<0.03$). Mean arterial pressure was elevated in Soda ($p<0.01$) at POST, but was not different between trials (Soda: 5 ± 8 , Water: 2 ± 5 mmHg, $p=0.33$).

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

- 1664 Board #7 May 31 3:15 PM - 5:15 PM
Effects of Different Water and Sodium Consumption Volumes on Fluid Retention and Hyperhydration.
 David M. Morris, Elizaveta Roslanova. *University of Texas - Permian Basin, Odessa, TX*.
 (No relevant relationships reported)

Previous research has shown that co-consumption of sodium and water prior to exercise is effective in promoting hyperhydration. However, optimum fluid and sodium consumption volumes for attaining hyperhydration have not been systematically studied. While consumption of larger volumes of fluid may seem to be advantageous, overconsumption of fluid may trigger excess diuresis and, thus, not provide advantages over smaller fluid doses. **PURPOSE:** To compare the effects of different water and sodium dose volumes on fluid retention.

METHODS: Urine excretion was measured during four separate 2-hr hyperhydration protocols in 13 well hydrated male subjects (24 ± 4 yr, 177.0 ± 8.9 cm, 75.2 ± 9.5 kg) who were free from known renal, digestive, and cardiovascular disease. Each protocol began with a complete bladder void and assessment of urine specific gravity (USG). Subjects then consumed water and NaCl in an isotonic mixture in four different dosing strategies: 20 mL $\text{H}_2\text{O} \cdot \text{kg} \text{bm}^{-1}$ with 94 mg $\text{NaCl} \cdot \text{kg} \text{bm}^{-1}$ (20), 15 mL $\text{H}_2\text{O} \cdot \text{kg} \text{bm}^{-1}$ with 70.5 mg $\text{NaCl} \cdot \text{kg} \text{bm}^{-1}$ (15), 10 mL $\text{H}_2\text{O} \cdot \text{kg} \text{bm}^{-1}$ with 47 mg $\text{NaCl} \cdot \text{kg} \text{bm}^{-1}$ (10), or 5 mL $\text{H}_2\text{O} \cdot \text{kg} \text{bm}^{-1}$ with 23.5 mg $\text{NaCl} \cdot \text{kg} \text{bm}^{-1}$ (5). Protocols were applied in a randomized, crossover fashion. Each treatment was divided into three equal portions and consumed at 0, 45, and 90-min of the 2 hr hyperhydration period. Total urine excretion for the two hour period was subtracted from the fluid consumed to determine total fluid retention (TFR). USG and TFR, expressed in mL $\cdot \text{kg} \text{bm}^{-1}$, were compared using separate, one-way repeated-measures ANOVAs and Sidak *post hoc* analyses.

RESULTS: USGs were 1.009 ± 0.005 (20), 1.016 ± 0.028 (15), 1.010 ± 0.003 (10) and 1.009 ± 0.005 (5) ($P = 0.93 - 1.00$) indicating that subjects were well and similarly hydrated for each trial. TFR, expressed in mL $\cdot \text{kg} \text{bm}^{-1}$, were 10.8 ± 2.7 (20), 7.5 ± 2.3 (15), 5.0 ± 2.5 (10) and 2.6 ± 1.4 (5) ($P = 0.001 - 0.039$).

CONCLUSIONS: The data suggest that, when consuming a water and NaCl mixture in volumes ranging from 5 - 20 mL H₂O · kg bm⁻¹, fluid retention rates are approximately 50% regardless of the volume of fluid consumed. Thus, to achieve maximum hyperhydration, at least 20 mL H₂O · kg bm⁻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

1665 **Chair:** Max R. Paquette. *University of Memphis, Memphis, TN.*

(No relevant relationships reported)

1666 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. Ciszewski², David W. McGehee², Jessica N. Schindler², Sarah J. Ingraham³, William W. Newhouse⁴, Daniel D. Hanson⁵, Jane R. Yank². ¹Crown College, St. Bonifacius, MN. ²Bethel University, St. Paul, MN. ³Norwich University, Northfield, VT. ⁴University of Minnesota, Minneapolis, MN. ⁵Wheaton College, Wheaton, IL.

(No relevant relationships reported)

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 and varsity), as observed through high-speed photography. In addition, the data was gathered to explore if the difference of dynamic hyperextension noted between men and women was similar to the differences 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 ($p=.456$) or team level ($p=.064$). 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 observed hyperextension showed no significant differences by sex of the players ($p=.702$) or by team level ($p=.191$). Results of categorical data analysis showed no significant differences among six player groups consisting of freshman, junior varsity, and varsity levels for both boys and girls (chi-square=3.928, $p=.560$). Interestingly, there was a marginal increased incidence of hyperextension in freshman high school athletes ($p=.099$). 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 of hyperextension 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, recoil and ACL injury.

1667 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

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(No relevant relationships reported)

Hop testing after an Anterior Cruciate Ligament reconstruction (ACL) 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 objectified using inertial sensors. These sensors have been used previously to objectify hop tests and showed differences in knee kinematics in ACL patients.

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

METHODS: 5 ACL 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 ± 14.3 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 straights 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.

Table 1: Peak knee flexion (degrees) of the reconstructed and healthy leg during stance phase of the individual ACLR subjects (ACLR#) and ACLR group and for the left and right leg for the HLTH group. An asterisk denotes the statistical significant difference.

	ACLR1	ACLR2	ACLR3	ACLR4	ACLR5	ACLR (n=5)	HLTH (n=10)
ACLR side	Right	Right	Right	Left	Right		
Reconstructed leg	27.9 ± 5.2	26.8 ± 3.1	47.5 ± 2.4	28.4 ± 5.1	44.0 ± 5.6	34.9 ± 11.4	46.3 ± 8.4
Non-injured leg	48.3 ± 5.0	48.6 ± 3.4	48.3 ± 1.7	37.4 ± 3.0	43.2 ± 3.3	45.2 ± 5.5	48.2 ± 9.5
ADPK	22.9 ± 4.9	21.8 ± 3.8	1.9 ± 1.9	9.1 ± 6.8	2.3 ± 2.5	12.0 ± 5.2	4.9 ± 5.2

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

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(No relevant relationships reported)

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 (1-5 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 ranges. 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 (.18±0.09) 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 LTL 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.

1669 Board #4 May 31 3:15 PM - 5:15 PM
Lack of Association Between Clinical Measures of Symmetry and Knee Loading Mechanics After ACL Reconstruction

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(No relevant relationships reported)

Distance hopped in the anterior cruciate ligament reconstructed limb (ACLR) limb relative to the contralateral limb (i.e. limb symmetry index [LSI]) has been used

as a clinical criterion to help guide safe return to sport. However, it is unclear if laboratory measures of knee kinematic and kinetic loading symmetry are related to clinical symmetry. Ongoing asymmetry in knee loading mechanics may predispose the individual to recurrent injury. Identifying whether clinical symmetry is related to knee loading symmetry is important to fully understand readiness to return to sport. **PURPOSE:** To evaluate whether clinical limb symmetry, measured by distance hopped during the single leg hop for distance (SLHD) test, is associated with landing mechanics symmetry in participants with a history of ACLR. **METHODS:** Motion analysis data were collected on participants with a history of ACLR ($n=10$, 6f/4m, 22.4 ± 1.1 yrs, 1.6 ± 0.8 m, 65.6 ± 12.1 kg, time from surgery to test 5.8 ± 1.9 yrs). The LSI [(ACLR limb/contralateral limb) $\times 100$] was calculated for the following parameters collected during the loading phase of the SLHD: distance hopped, peak knee flexion angle at initial contact, peak knee flexion angle, peak knee extensor moment, and the area under the curve (AUC) for knee flexion angle and knee extensor moment. Spearman correlations were used to determine if symmetry in distance hopped was associated with symmetrical landing mechanics. **RESULTS:** Distance hopped symmetry ($99.5\pm 5.1\%$) was not associated with peak knee flexion angle at initial contact ($72.8\pm 26.9\%$, $\rho=-0.164$, $P=0.651$), peak knee flexion angle ($90.1\pm 10.7\%$, $\rho=0.103$, $P=0.777$), AUC knee flexion angle ($88.3\pm 14.8\%$, $\rho=-0.006$, $P=0.987$), peak knee extensor moment ($89.9\pm 19.2\%$, $\rho=0.576$, $P=0.082$) or AUC knee extensor moment ($87.0\pm 23.5\%$, $\rho=0.188$, $P=0.603$) symmetry. **CONCLUSION:** Clinical symmetry was not associated with any laboratory measures of knee kinematic or kinetic loading symmetry. The lack of association between clinical symmetry and knee loading mechanics suggests that individuals with a history of ACLR use altered inter-limb biomechanical strategies to achieve the same functional outcomes. This finding suggests that additional assessment of loading mechanics may be warranted to help guide safe return to sport after ACLR.

1670 Board #5 May 31 3:15 PM - 5:15 PM
The Effects of Wearing Knee Wraps on Total Concentric Work Performed During the Back Squat Exercise.

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 (No relevant relationships reported)

PURPOSE: To investigate the effects of using knee wraps on vertical displacement, lifting duration, and work performed during the concentric phase of the back squat exercise. **METHODS:** Resistance-trained men performed a back squat protocol over three testing sessions, along with two training days, over a 2-week period. Each testing session involved performing six single repetition sets of the back squat with 5-min of rest. During each testing session, participants underwent 2 different treatments such that the first three sets were performed unassisted (U) and the second three sets were performed with knee wraps (W). The two training days occurred between the second and third testing sessions. On these training days, participants were randomly assigned to a back squat training group; one that trained with knee wraps (TW; $n=7$) (mean \pm SD; Age: 26 ± 4 yrs, Height: 1.81 ± 0.06 m, Mass: 88.4 ± 13.7 kg, 1RM: 144 ± 23 kg) and one that trained without knee wraps (TU; $n=7$) (Age: 24 ± 5 yrs, Height: 1.78 ± 0.4 m, Mass: 81.4 ± 3.8 kg, 1RM: 143 ± 25 kg). A linear position transducer was used to measure concentric vertical displacement, lifting duration, and work [Force \times distance]. Repeated measures ANOVAs were used to determine differences in back squat across time (testing days 1(D_1), 2(D_2), and 3(D_3)), treatment (U vs. W), and training group (TW vs. TU). **RESULTS:** A significant main effect of time ($p<0.001$) was observed such that during the third back squat testing session concentric vertical displacement (D_3 : 0.46 ± 0.06 m) was greater than the first two sessions (D_1 : 0.43 ± 0.08 m, D_2 : 0.44 ± 0.06 m) regardless of treatment or training group. Lifting duration significantly decreased ($p<0.001$) during the third session (D_3 : 0.99 ± 0.16 s) that was also significantly different from the first two sessions (D_1 : 1.06 ± 0.23 s, D_2 : 1.05 ± 0.19 s) regardless of treatment or training group. Concentric work was also significantly greater ($p<0.001$) during the third session (D_3 : 911 ± 135 Nm) compared to the first two sessions (D_1 : 844 ± 176 Nm, D_2 : 861 ± 144 Nm), independent of treatment or training group. **CONCLUSION:** Our data suggest that knee wraps didn't significantly alter concentric vertical displacement, duration, or work of the back squat exercise for single repetition sets.

*Supported by the Louisiana State University Graduate Research Stipend.

1671 Board #6 May 31 3:15 PM - 5:15 PM
Acute Effects of Two Hip Flexor Stretching Techniques on Knee Joint Position Sense and Balance

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 (No relevant relationships reported)

Tightness of hip flexor (THF) muscles has been recognized as a risk factor for various musculoskeletal injuries in the lower extremities. Abnormal knee joint position sense (JPS) has also been linked to several orthopedic and musculoskeletal conditions in

the knee joint. **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 THF 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 acute improvement in hip extension ROM and DB measures. However, knee JPS replication error results showed nonsignificant improvement over time in either stretching group.

1672 Board #7 May 31 3:15 PM - 5:15 PM
Movement Efficiency Profile Affects Knee Loading Responses to a Controlled Acute Exposure to High Metabolic and Mechanical Training Load

Barnett Frank, Troy Blackburn, Steve Marshall, Claudio Battaglini, FACSM, Anthony Hackney, FACSM, Darin Padua. The University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Claudio Battaglini, PhD, FACSM)
 (No relevant relationships reported)

Exposure to acute high training loads (HTL) induces biomechanics associated with knee joint injury. **Purpose:** Determine if individuals with high-risk (HR) and low-risk (LR) biomechanics exhibit different changes in tri-planar knee loading in response to a controlled HTL exposure. **Methods:** 43 physically active, healthy, college-aged field or court sport female athletes ($n=43$; age= 20.5 ± 1.6 yrs, height= 167.7 ± 7.0 cm, mass= 62.8 ± 7.1 kg) were assigned to a LR ($n=21$) or HR ($n=22$) movement profile group defined by the landing error scoring system. Peak anterior tibial shear force (ATSF ($N\cdot N_{bw}^{-1}$)), internal knee varus (IKVRM) and internal knee external rotation (IKERM) moments ($Nm\cdot N_{bw}^{-1}\cdot m_{ht}^{-1}$) were measured during a jump-landing task prior to and after a metabolically and mechanically controlled HTL exposure. Participants completed five sets of treadmill running at a speed (LR: 11.1 ± 1.2 km \cdot h $^{-1}$, HR: 11.3 ± 1.0 km \cdot h $^{-1}$, $t_{41}=0.702$, $p>0.05$) coincident with 110-120% of their ventilatory threshold (LR: 37.1 ± 3.6 ml \cdot kg $^{-1}\cdot$ min $^{-1}$, HR: 37.1 ± 3.6 ml \cdot kg $^{-1}\cdot$ min $^{-1}$, $t_{41}=0.072$, $p>0.05$) for five minutes and 10 jump-landings from a 30 cm box half their height from a landing target line. **Results:** A significant group-by-time interaction was observed for ATSF ($F_{1,41}=5.000$, $p<0.05$) The HR group experienced increases in ATSF (HR-Pre-HTL: 0.86 ± 0.10 [0.82, 0.90], HR-Post-HTL: 0.90 ± 0.08 [0.86, 0.93]), whereas the LR group experienced decreases in ATSF (LR-Pre-HTL: 0.82 ± 0.17 [0.76, 0.90], LR-Post-HTL: 0.79 ± 0.13 [0.74, 0.85]) from pre-to-post HTL exposure. No significant group-by-time interactions were observed for IKVRM ($F_{1,41}=0.648$, $p>0.05$; HR-Pre-HTL: 0.41 ± 0.23 [0.31, 0.51], HR-Post-HTL: 0.42 ± 0.22 [0.33, 0.52] & LR-Pre-HTL: 0.28 ± 0.14 [0.22, 0.34], LR-Post-HTL: 0.25 ± 0.11 [0.21, 0.30]) or IKERM ($F_{1,41}=0.083$, $p>0.05$; HR-Pre-HTL: 0.21 ± 0.09 [0.25, 0.17], HR-Post-HTL: 0.17 ± 0.11 [0.22, 0.12] & LR-Pre-HTL: 0.21 ± 0.09 [0.24, 0.17], LR-Post-HTL: 0.16 ± 0.08 [0.19, 0.12]).

Conclusion: Movement profile has a large effect ($d=0.98$) on HTL-induced sagittal plane knee loading responses linked to knee joint injury. Individuals with greater movement efficiency appear to be more biomechanically resilient to acute HTL exposure compared to individuals with high-risk biomechanics.

1673 Board #8 May 31 3:15 PM - 5:15 PM
Effects Of Load Carriage and Step Length Manipulation on Knee Loads During Walking

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 (No relevant relationships reported)

PURPOSE: Effects of load carriage on medial tibiofemoral joint (mTFJ) and patellofemoral joint (PFJ) contact forces were evaluated using preffered, 7.5% shorter

and 7.5% longer step lengths. **METHODS:** Sixteen male Army ROTC Cadets (20.1 \pm 2.5 years, 77.4 \pm 13.4 kg) completed walking treadmill trials (1.3 m/s) with and without 20-kg load carriage. Trials were then collected with altered step lengths (\pm 7.5%) with load carriage. 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% ($p < 0.001$, $d = 1.33$) and mTFJ impulse per 1-km by 22% or 89 additional BW*s per km ($p < 0.001$, $d = 1.49$). 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 ($p < 0.001$, $d = 0.69$). 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 carriage, a short step with load carriage 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 impulse per km ($p = 0.001$, $d = 0.48$) compared with preferred step length with load carriage. A long step with load carriage 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.

D-40 Thematic Poster - Step it Up! Walking Toward Health

Thursday, May 31, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100H

1674 **Chair:** David R. Bassett, FACSM. *University of Tennessee, Knoxville, TN.*

(No relevant relationships reported)

1675 Board #1 May 31 3:15 PM - 5:15 PM Trends In The Prevalence And Volume Of Transportation And Leisure Walking Among U.S. Adults, 2005-2015

Emily N. Ussery¹, Susan A. Carlson¹, Geoffrey P. Whitfield¹, Kathleen B. Watson¹, David Berrigan², Janet E. Fulton, FACSM¹. ¹*Centers for Disease Control and Prevention, Atlanta, GA.* ²*National Cancer Institute, Bethesda, MD.* (Sponsor: Janet Fulton, FACSM)

(No relevant relationships reported)

Promotion of walking is an important strategy for increasing physical activity levels in the US, as highlighted in *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities*. Public health monitoring of walking behaviors can guide future efforts to promote walking. The proportion of adults who walk for transportation or leisure has increased in recent years, but trend data on walking for specific purposes is limited.

PURPOSE: To examine trends in the prevalence and volume of self-reported walking for transportation and leisure among US adults from 2005 to 2015.

METHODS: The 2005, 2010, and 2015 National Health Interview Survey assessed participation in and time spent walking for transportation and leisure in the past week among adults ($n = 83,933$). For each year, the prevalence and mean volume (minutes/week) of walking were calculated for those reporting any transportation walking, any leisure walking, and both transportation and leisure walking. Trends were evaluated using logistic (prevalence) and linear (volume) regression.

RESULTS: The prevalence of transportation walking increased steadily from 2005 to 2015 (linear: $p < 0.05$). Leisure walking prevalence increased overall, but slowed between 2010 and 2015 (linear and quadratic: $p < 0.05$). Reported transportation and leisure walking volume decreased from 2005 to 2015, with no change between 2010 and 2015 (linear and quadratic: $p < 0.05$). The prevalence of walking for both transportation and leisure increased steadily from 2005 to 2015 (linear: $p < 0.05$); walking volume also decreased in this group, with no change between 2010 and 2015 (linear and quadratic: $p < 0.05$).

CONCLUSION: Transportation and leisure walking prevalence increased over the last decade, but time spent walking decreased. Encouraging walking for multiple purposes may increase participation in and time spent walking. Promotion efforts could benefit from a better understanding of factors explaining these trends.

	2005			2010			2015		
Measure	n	Estimate	(95% CI)	n	Estimate	(95% CI)	n	Estimate	(95% CI)
Prevalence of walking (%)									
Any transportation	8,302	28.4	(27.5-29.3)	7,582	29.2	(28.4-30.1)	9,895	31.7	(30.8-32.5) ^b
Any leisure	11,775	42.1	(41.2-42.9)	12,059	49.9	(49.0-50.8)	15,744	52.2	(51.2-53.1) ^{b,c}
Both transportation and leisure	4,506	15.5	(14.9-16.2)	4,516	17.6	(17.0-18.3)	6,353	20.6	(19.9-21.3) ^b
Mean volume of walking (minutes/week) ^a									
Any transportation	8,302	75.3	(73.3-77.4)	7,582	58.3	(56.4-60.2)	9,895	59.1	(57.5-60.9) ^{b,c}
Any leisure	11,775	90.2	(88.3-92.1)	12,059	79.8	(78.3-81.5)	15,744	79.3	(77.6-81.0) ^{b,c}
Both transportation and leisure	4,506	199.2	(193.5-205.2)	4,516	164.0	(159.1-169.0)	6,353	165.0	(160.4-169.7) ^{b,c}
Estimates are weighted and age-standardized to the 2000 US standard population.									
^a Walking 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.									
^b Significant linear trend from 2005 to 2015 ($p < 0.05$).									
^c Significant quadratic trend from 2005 to 2015 ($p < 0.05$).									

1676 Board #2

May 31 3:15 PM - 5:15 PM

Association Between Walkable Community Design Features and Walking Among U.S. Adults — 2015

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(No relevant relationships reported)

Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities calls for community design that makes it safe and easy to walk for people of all ages and abilities. Determining which community design features are associated with walking at the national level can inform strategies to improve and monitor walkability in the U.S.

PURPOSE: To document the associations between walking and walkable supports and destination types among U.S. adults.

METHODS: Adult respondents ($n = 29,925$) to the 2015 National Health Interview Survey reported the presence of two near-home walkable supports (roads, sidewalks, paths, or trails; sidewalks on most streets) and four destination types (shops, stores, or markets; bus or transit stops; movies, libraries, or churches; places that help one relax, clear one's mind, and reduce stress). Stepwise logistic regression was used to identify features significantly associated with self-reported walking for leisure or transportation in the past week. From the resulting model, the prevalence of walking was calculated for each combination of features.

RESULTS: When combined in a single model, one support and three destination types were associated with walking: roads, sidewalks, paths, or trails (prevalence ratio [PR], present vs. absent [95% confidence interval]: 1.11 [1.07-1.16]); transit (1.07 [1.04-1.10]); movies, libraries, or churches (1.07 [1.04-1.11]); and places to relax (1.39 [1.34-1.44]). For specific combinations of the four, 7.4% reported absence of all features, 36.5% of whom reported any walking. In comparison, 32.5% reported presence of all features, 73.7% of whom reported any walking (PR: 2.02 [1.82-2.22]). The prevalence of walking was generally higher among adults who reported a greater number of features ($p < 0.001$ for linear trend).

CONCLUSIONS: Among U.S. adults, one near home walkable support (roads, sidewalks, paths, or trails) and three walkable destination types (transit; movies, libraries, churches; places to relax) were associated with walking. Walking was two times more common among adults who reported all four features versus no features. These results support the idea that multiple built environment features may combine to influence walking and designing communities with these features may help improve walkability in the U.S.

1677 Board #3 May 31 3:15 PM - 5:15 PM
Walkability, Health Behaviors, And Body Mass Index In Twins

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(No relevant relationships reported)

Built environments (BE) may influence health behaviors and subsequently obesity. However, most research in the BE literature has been fraught by 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 twin pairs, and how these relationships differ when considering walkability of the home neighborhood and each twins' 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 twins' 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 833 and 1,666m 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 1,666m home neighborhood buffer between-pairs (both $r = -0.23$; 95% CI: -0.38, -0.06), but not within-pairs. However, BMI was not related to DED levels either between or within-pairs. **CONCLUSIONS:** Twin studies 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.

1678 Board #4 May 31 3:15 PM - 5:15 PM
Physical Activity and Biological Aging: Is Walking Enough? An NHANES Investigation

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(No relevant relationships reported)

PURPOSE: Research indicates that high levels of total physical activity are predictive of lower levels of biologic aging. However, research has never studied the extent to which walking alone contributes to reduced cellular aging. The principal objective of the present study was to determine the extent to which walking accounts for differences in leukocyte telomere length (LTL) in a large random sample of U.S. men and women. Another purpose was to assess the extent to which multiple demographic and lifestyle covariates affect the relationship between walking and LTL. **METHODS:** A total of 5,823 adults from the National Health and Nutrition Examination Survey (NHANES) were studied cross-sectionally. The quantitative polymerase chain reaction method was employed to compare LTL to standard reference DNA. Adults were divided into three walking groups based on self-reported minutes of walking per week: No Walking (< 10 minutes of walking per wk), Some Walking (10-149 min. of walking per wk) and Achieved Guidelines (≥ 150 min. of walking per wk). Participation in 61 physical activities other than walking was also measured and total MET-minutes of activity other than walking was calculated based on the frequency, duration, and intensity of each activity. Non-walking activity (i.e., other activity) was controlled statistically, with the other covariates. **RESULTS:** Telomeres were 15.5 base pairs shorter for each year of chronological age ($F=723.2$, $P < 0.0001$). After adjusting for age, sex, race, marital status, and income ($F=4.9$, $P=0.0153$), adults who met the PA Guidelines by walking ≥ 150 min per week had significantly longer telomeres than those reporting No Walking and also those reporting Some Walking. Differences in LTL remained significant after controlling for smoking, BMI, and other physical activity along with the demographic covariates ($F=3.6$, $P=0.0406$). Adults with ≥ 150 min of walking per week were estimated to have a biologic aging advantage of 6.6 years (102.8 base pairs $\div 15.5$) over Non-Walkers. **CONCLUSIONS:** Evidently, adults who engage regularly in ≥ 150 min per week of walking tend to have longer telomeres, accounting for years of reduced cellular aging, compared to adults who do not walk regularly and also those who accumulate less than 150 minutes per week of walking.

1679 Board #5 May 31 3:15 PM - 5:15 PM
Daily Step Counts in Service Members with Lower Limb Amputation

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(No relevant relationships reported)

Lower limb amputation can be a life-altering event given the critical role the lower limb plays in transferring, standing, and walking. The physical impairments an individual may experience can decrease his or her ability to function in the free-living environment. It has been reported that, on average, civilians with lower limb amputations of all levels walk only 2,000-3,000 steps per day. Although potentially not surprising that they are less active than able-bodied individuals, the magnitude of the activity gap is remarkable. **PURPOSE:** To quantify physical activity in Service Members with lower limb loss in the months following amputation. **METHODS:** Activity data were collected on 27 Service Members who received amputations during the recent military conflicts (N=16 unilateral transtibial, N=7 unilateral transfemoral, N=1 bilateral transtibial, N=3 bilateral transfemoral) using a StepWatch3 (Orthocare Innovations, Oklahoma City, OK) secured to the prosthesis and worn for one week. **RESULTS:** Service Members with lower limb amputations fell substantially below the recommended 10,000 steps per day to maintain an active lifestyle and averaged only $3,142 \pm 1,308$ steps per day. The individuals included in this data set were tested during their rehabilitation at the Center for the Intrepid and Walter Reed Military Medical Center and had been walking with a prosthetic limb for an average of 7.3 ± 3.6 months (range 2 to 12 months). There were no indications that individuals farther along in the rehabilitative process walked more steps per day than those in the earlier stages of rehabilitation ($R^2=0.008$). **CONCLUSION:** Although these young and previously highly active Service Members have extensive access to rehabilitative care and prosthetic technology, these data raise considerable concern about activity levels after amputation. These low activity levels indicate high risk for progressive declines in overall physical health. One limitation of this study was that these individuals may have been engaging in strength training or other exercises without a prosthetic limb as part of physical therapy, or recovering when not in therapy. It is unknown if their step counts are representative of activity once discharged from rehabilitation. Funding: Military Amputee Research Program W81XWH-06-2-0073

1680 Board #6 May 31 3:15 PM - 5:15 PM
Leisure-time Physical Activity, Work-related Walking and Incidence of Kidney Stones In Japanese Workers: The Niigata Wellness Study

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(No relevant relationships reported)

Limited data are available on the relationship of physical activity (PA) with the incidence of kidney stones. **PURPOSE:** The purpose of this study is to investigate the independent and joint effects of leisure-time PA (LTPA) and work-related walking (WRW) on the incidence of kidney stones among Japanese workers in the Niigata Wellness Study. **METHODS:** A cohort of 16,458 Japanese men [median (IQR) age 49 (43-53) years] and 7,140 women [median (IQR) age 48 (43-52) years] free of kidney stones completed a medical examination, and reported on LTPA and WRW in 2001. The participants were divided into three categories (0 min/week; LTPA-none, 1-119 min/week; LTPA-M₁, ≥ 120 min/week; LTPA-M₂) based on LTPA, and also divided into two categories based on existence of WRW (no; WRW-no, yes; WRW=yes). The development of kidney stones during follow-up from 2002 to 2006 was based on self-reports from questionnaires at another medical examination in 2006. Odds ratios and 95% confidence intervals (95%CI) for the incidence of kidney stones were obtained using logistic regression models while adjusting for sex, age, body mass index, cigarette smoking (5 categories), and alcohol intake (3 categories). **RESULTS:** During the 5 year follow-up period, 169 participants developed kidney stones. In regards to the independent effects of LTPA and WRW. Using LTPA-none as reference, odds ratios and 95% CIs for LTPA-M₁ and LTPA-M₂ were 0.72 (0.44-1.17) and 0.64 (0.40-1.02) (P for trend=0.034). Also, using WRW-no as reference, odds ratios and 95% CIs for WRW=yes was 0.85 (0.62-1.17). With regards to the joint effects of LTPA and WRW, using the LTPA-none and WRW-no group as reference, odds ratios and 95% CIs were 0.72 (0.42-1.24) for the LTPA-M₂ and WRW-no group, 0.39 (0.16-0.97) for LTPA-M₂ and WRW=yes group, respectively. **CONCLUSIONS:** These results suggest that there

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.

1681 Board #7 May 31 3:15 PM - 5:15 PM

HealthSteps Lifestyle Prescription Program Can Increase Physical Activity and Decrease Blood Pressure in At Risk Adults

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(No relevant relationships reported)

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 min/wk; sit ≥ 3 hr/d; eat <8 servings of fruit and vegetables/d) 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); p-value for difference – 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): -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.

1682 Board #8 May 31 3:15 PM - 5:15 PM

The Effect of 2 Walking Programs on HbA1c in Sedentary Employees During a 10 Week Intervention

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(No relevant relationships reported)

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 , BMI = 30.33 ± 5.79 kg/m²), continuous walking (Age = 48 ± 9 , BMI = 30.53 ± 6.17 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. A1cNOW[®] 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 $F(1,64)=4.229$, $p=.044$ with a medium size effect of $\eta^2=0.62$. Bonferroni Post-Hoc test shows that the continuous walking group was significantly affected, $F=8.463$, $p=.009$, with a large size effect $\eta^2=.297$. 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 $F(4,124)=5.091$, $p=.001$ with a large effect size $\eta^2=.14$, 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

($p>0.05$). **CONCLUSIONS:** As preventive strategy, blood glucose may be better controlled by a continuous moderate intensity walking program compared to an intermittent walking program for sedentary office employees.

D-41 Free Communication/Slide - Exercise Immunology

Thursday, May 31, 2018, 3:15 PM - 4:45 PM
Room: CC-101CD

1683 **Chair:** Jill A. Kanaley, FACSM. University of Missouri, Columbia, MO.

(No relevant relationships reported)

1684 May 31 3:15 PM - 3:30 PM

The Impact of Physical Activity Level on the Oral Microbiome: A Cross-Sectional Investigation

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(No relevant relationships reported)

Previous research indicates that the composition and diversity of the gut and lung microbiome is associated with many autoimmune and inflammatory diseases. However, aerobic exercise has recently been shown to preferentially shift the composition of the gut microbiome. The physiological significance of these changes is not well understood, and currently there are no published data exploring whether physical activity may impact the composition and diversity of the oral microbiome. **Purpose:** We conducted this exploratory analysis to determine whether the composition of the oral microbiome was impacted by habitual physical activity (PA) level. **Methods:** Sixteen young adults between the ages of 18-35 years ($n=8$ physically inactive (PI) subjects accumulating <30 minutes of planned exercise per week; $n=8$ trained athletes (TA) >150 minutes of moderate-to-vigorous PA per week) visited the laboratory after an overnight fast and without using any toothpaste or antibacterial mouthwash for 24 hours. Upon arrival to the laboratory, body composition assessment and PA questionnaires were administered, followed by saliva and sputum sample collection. Processing and DNA extraction was performed on samples within 48 hours of collection, and the bacterial 16S rRNA gene was amplified followed by sequencing. Subjects were given an accelerometer to wear around their waist for one week to verify chronic PA level. Principle components analysis followed by linear regression was used to compare oral microbial taxonomy across PA levels. **Results:** PI and TA had significantly different chronic PA levels (PI: 240 ± 26 METS/wk, TA: 3810 ± 1656 METS/wk) ($p<0.01$). The amount of vigorous PA that subjects accumulated in METS/week explained 19.69% of the composition in the oral microbiome. Of particular interest, *Veillonella spp.*, *Streptococcus spp.*, *Gemella spp.* and *Enterococcus spp.* were significantly higher in PI versus TA ($p<0.05$, respectively), which have been associated with various types of lung diseases, including chronic obstructive pulmonary disease and asthma. **Conclusion:** These data indicate that: (1) habitual PA level differentially impacts the oral microbiome and (2) that the amount of vigorous activity accumulated per week explains a significant portion of the variance in the oral microbiota composition.

1685 May 31 3:30 PM - 3:45 PM

Respiratory Infections in Young Elite Female Gymnasts

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(No relevant relationships reported)

PURPOSE: Immune function can be suppressed during periods of hard training and competition with Upper Respiratory Tract Infections (URTI's) as a possible consequence. The main aims of the study were (1) to map the incidence of URTI's in a non-endurance sport as gymnastics, and (2) to determine to which extent Immunoglobulin A (IgA) can be associated with URTI in young elite female gymnasts. **METHODS:** This study included 17 elite female gymnasts from the High Performance School Artistic Gymnastics in Ghent (Belgium) (age: 16.6 ± 3.4 years; body mass: 46.5 ± 6.7 kg; height: 153.9 ± 6.5 cm; VO2MAX: 52.09 ± 4.63 ml·min⁻¹·kg⁻¹). Before the first training of every week (after a minimum of 36h without training) for a period of 56 weeks, every gymnast completed an URTI and fatigue (VAS scale) questionnaire and donated 1 ml of unstimulated whole saliva for its assessment (saliva flow rate,

IgA secretion rate, absolute IgA and relative IgA (= mean values when URTI/Mean values when no URTI)). The saliva was analyzed using an ELISA assay kit (Salivary Secretory IgA Enzyme Immunoassay Kit, Salimetrics, USA). After normality checks through Shapiro-Wilk tests, Spearman rank correlations were used for the evaluation of relations between URTI, immune parameters and fatigue. **RESULTS:** Over the 56 weeks, gymnasts had 2.3 ± 2.8 URTI episodes and 99.5 ± 82.5 URTI symptoms with a mean fatigue score of 5.5 ± 0.6 . During this period, 632 saliva samples were collected and analyzed, resulting in $1.00 \pm 0.42 \text{ ml} \cdot \text{min}^{-1}$ for saliva flow rate, $130.40 \pm 39.05 \text{ } \mu\text{g} \cdot \text{ml}^{-1}$ for absolute IgA concentration, $119.17 \pm 49.83 \text{ } \mu\text{g} \cdot \text{min}^{-1}$ for IgA secretion rate and 101.10 ± 5.03 % for relative IgA values. A significant correlation was found between URTI symptoms and relative IgA concentration ($R = -0.733$, $P = 0.003$). **CONCLUSIONS:** Values for amount of URTI's and immunological parameters of young elite gymnasts were similar to those of adult sailors (Neville et al., MSSE. 2008; 40: 1228-36), with relative IgA concentrations being associated with the development of URTI symptoms. Thus, young athletes are as prone as adult athletes to develop URTI's. However, since these athletes exercise indoor in contrast to an outdoor sport as sailing, environment may have an impact on the prevalence of URTI's.

1686 May 31 3:45 PM - 4:00 PM

The Percentage Of Non-classical Monocytes In Obese Individuals Is Reduced By High-intensity Interval Training

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(No relevant relationships reported)

Obesity is associated with both metabolic and inflammatory disturbances. Exercise training represents an efficacious strategy to modulate these deleterious aspects of obesity. **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 = $20.8 \pm 1.7 \text{ kg} \cdot \text{m}^{-2}$), nine obese insulin sensitive (OBS, BMI = $35.1 \pm 3.8 \text{ kg} \cdot \text{m}^{-2}$) and nine obese insulin resistant (OBR, BMI = $37.8 \pm 4.6 \text{ kg} \cdot \text{m}^{-2}$) subjects were used in this study. The OBS and OBR underwent 8 weeks of HIIT, 3 x/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). Body composition was evaluated using dual-energy X-ray absorptiometry (DXA). **RESULTS:** Pre-training blood triglycerides, VLDL-cholesterol, HOMA- β and insulin concentration were higher ($p < 0.05$) in OBR compared to OBS and CON. OBR also had higher mass of visceral adipose tissue compared to OBS and CON ($1,785 \pm 754$, $1,153 \pm 431$ and $149 \pm 80 \text{ g}$, respectively). Both OBS and OBR individuals had increased ($p < 0.05$) percentage of non-classical monocytes (11.0 ± 5.5 and $12.2 \pm 5.9\%$, respectively), compared to CON ($4.8 \pm 2.2\%$). The percentage of non-classical monocytes was positively correlated to BMI, fat percentage, HOMA- β and OGTT. After 8 weeks of HIIT, the frequency of non-classical monocytes was reduced ($p < 0.05$) by almost 40% in OBS and OBR (12.1 ± 5.6 and $8.7 \pm 3.2\%$, pre- and post-HIIT, respectively). Although training had no effect on BMI and body fat, HOMA- β was improved ($p < 0.05$) after HIIT (267 ± 166 and 183 ± 109 , pre- and post-HIIT, respectively). **CONCLUSION:** HIIT reduces inflammation and improve metabolic parameters in obese insulin sensitive and insulin resistant individuals. Supported by CAPES, CNPq, FAPEMIG

1687 May 31 4:00 PM - 4:15 PM

Inflammatory Cytokine Production is Elevated in MAIT Cells Following Acute Exercise

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(No relevant relationships reported)

Mucosal associated invariant T (MAIT) cells occupy a unique niche within human immunity yet little is known regarding the effects of exercise on activation or cytokine production. **PURPOSE:** To determine if exercise alters MAIT cell proinflammatory cytokine production and early activation markers after submaximal aerobic exercise. **METHODS:** 17 healthy young males [age 22 (4y), $\text{VO}_{2\text{max}}$ 51.6 (10.2 mL/kg/min), %fat 18.0 (5.0%)] performed a graded exercise test on a cycle ergometer until

volitional exhaustion. Participants cycled for 40 min at 86% of ventilatory threshold following an overnight fast. Peripheral blood mononuclear cells were isolated from blood samples obtained at rest, 0h and 1h after submaximal exercise. Following a 4h stimulation with phorbol 12-myristate 13-acetate and ionomycin, MAIT cells counts and intracellular interferon gamma (IFN γ), tumor necrosis factor alpha (TNF α) and interleukin 17 (IL-17) production were quantified using flow cytometry. Data were analyzed using one-way ANOVA and are expressed as mean (SD). **RESULTS:** Stimulated $\text{Va7.2}^+ \text{CD161}^+$ 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. TNF α expression significantly increased with exercise before returning to baseline [rest: 71 (18%), 0h: 79 (13%), 1h: 65 (19%); $p = 0.017$] whereas IL-17 and IFN γ were unchanged. The total number of circulating cells significantly increased at 0h for MAIT cells [73.4 (85.6%); $p = 0.003$] and MAIT cells expressing TNF α [89.4 (139.9%); $p = 0.018$], IL-17 [275.4 (370.5%); $p = 0.026$], but not IFN γ [64.5 (127.5%); $p = 0.061$] with all counts returning to baseline at 1h. **CONCLUSIONS:** Submaximal aerobic exercise transiently increased the percentage and total number of MAIT cells expressing TNF α , which may aid in activation and recruitment of additional immune cells. The total number of MAIT cells positive for IL-17 and IFN γ 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.

1688 May 31 4:15 PM - 4:30 PM

Environmental Mobilization Of Hematopoietic Stem Cells With Exercise, Compression, And Cooling

Adam W. Anz, Danielle R. Hansen, Christopher S. Warell, Ronna S. Parsa, Hillary A. Plummer, Jan M. Stelly, Nicole K. Rendos. Andrews Research & Education Foundation, Gulf Breeze, FL.

(No relevant relationships reported)

Hematopoietic stem cells (HSC) have recently been studied to improve healing and rehabilitation from musculoskeletal injury. HSC are currently collected using invasive bone marrow aspiration and peripheral harvest after pharmaceutical mobilization. Animal studies show environmental stresses including heat, hypoxia, and cold mobilize HSC. HSC have also been mobilized to peripheral circulation (PC) with exercise. We hypothesized that the 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. **PURPOSE:** To determine if the combination of compression and cooling during exercise can mobilize HSC in PC. **METHODS:** Ten healthy, active males (height $1.78 \pm .06 \text{ m}$, weight $85.1 \pm 13.3 \text{ kg}$, age $30.4 \pm 4.7 \text{ y}$) completed a 20-min exercise protocol on the VasperTM recumbent cross trainer. The protocol entailed a 7-min warm up and 6 sprints alternating between 30s and 60s in duration with 90s recoveries. 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 min and 24h post exercise. A complete blood count with differential 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 ($M_{\text{diff}} = 1.740$, $SE = .48$, $p = .004$). The WBC differential revealed a decrease in neutrophils ($M_{\text{diff}} = 4.13$, $SE = 1.52$, $p = .015$) and eosinophils ($M_{\text{diff}} = .42$, $SE = .13$, $p = .009$), and an increase in lymphocytes ($M_{\text{diff}} = 4.51$, $SE = 1.62$, $p = .014$) 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 ($M_{\text{diff}} = 1.25$, $SE = .48$, $p = .028$) with no change in the viability of the WBCs. **CONCLUSION:** The VasperTM consistently 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.

1689 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. University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Jeffrey Woods, FACSM)

(No relevant relationships reported)

Several published studies suggest that acute eccentric exercise can improve vaccination responses in humans. However, whether this strategy can improve sub-optimal vaccine responses in the aged is unknown. While it has been suggested that such damaging exercise acts as an inflammatory adjuvant, the mechanism behind the effect is unknown. **Purpose:** To determine the effects of acute eccentric exercise on primary

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-ECC, A-ECC) or sedentary (Y-SED, A-SED) groups. For the Y-ECC and A-ECC groups, mice were exercised at 17m/min 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 100µg 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 100µg OVA into the dorsal 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 24h 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-ECC 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 intradermal injection (p=0.001). We also documented a significant immunosenescent effect in antibody (p< 0.001), but not cell-mediated (p=0.813), 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.

D-42 Free Communication/Slide - Obesity Patterns and Interventions

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

Room: CC-Mezzanine M100D

1690 **Chair:** Kathleen Woolf, FACSM. *New York University, New York, NY.*

(No relevant relationships reported)

1691 **May 31 3:15 PM - 3:30 PM**
Association Between Body Composition and Physical Activity Behaviors

Pedro J. Benito¹, Eliane A. Castro², Daniel Dos Santos², Rocío Cupeiro¹, Ana B. Peinado¹. ¹Universidad Politécnica de Madrid, Madrid, Spain. ²Universidade de Franca, São Paulo, Brazil.

(No relevant relationships reported)

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 accelerometry. 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.**

1692 **May 31 3:30 PM - 3:45 PM**

Change in Energy Intake and Health Eating Index in Response to Exercise During Weight Maintenance

Lauren T. Ptomey, Anna M. Gorczyca, Amanda N. Szabo, Felicia S. Steger, Ron Krebill, Matthew S. Mayo, Debra K. Sullivan, Richard A. Washburn, FACSM, Joseph E. Donnelly, FACSM. *University of Kansas Medical Center, Kansas City, KS.*
(No relevant relationships reported)

PURPOSE: It is hypothesized that energy intake increases and diet quality improves in response to increased exercise energy expenditure, thus diminishing the impact of exercise for weight loss and maintenance. The purpose of this analysis was to examine the impact of 3 levels of recommended exercise on energy intake and diet quality during weight maintenance. **METHODS:** Overweight/obese adults (n=175, age=43 yrs., BMI=32 kg·m²) who lost ≥ 5% of their initial body weight in response to a 3-mo. weight loss intervention which included energy restriction, increased exercise (100 min·wk⁻¹) and weekly behavioral counseling, completed a 12 mo. weight maintenance intervention. All participants were prescribed a weight maintenance diet (estimated RMR x 1.4), asked to attend biweekly behavioral sessions, and were randomized to one of 3 levels of exercise (150, 225, 300 min·wk⁻¹), with a minimum of 3 exercise sessions·wk⁻¹ completed under supervision. Exercise minutes across 12 mos. were obtained from direct observation or heart rate monitors for supervised and unsupervised sessions, respectively. Energy intake (3-day food records) was assessed at randomization (mo. 0), 6 and 12 mos. Energy intake and diet quality (Healthy Eating Index-2010 (HEI)) were calculated using the Nutrition Data System for Research 2014. **RESULTS:** Energy intake at mo. 0 was 1337 ± 309, 1284 ± 25, and 1344 ± 317 kcal·day⁻¹, and total HEI scores were 59.0, 57.9, and 60.8 in the 150, 225, and 300 min·wk⁻¹ groups, respectively. Average exercise across 12 mos. was 120, 147, and 170 min·wk⁻¹ in the 150, 225, and 300 min·wk⁻¹ groups, respectively. As expected with a weight maintenance diet, energy intake (kcal·day⁻¹) increased from 0-12 mos. in the 150 (319 ± 523), 225 (164 ± 441), and 300 min·wk⁻¹ groups (266 ± 454). However, the between group difference for change in energy intake (0-12 mos.) was not significant ($p=0.18$). There was no significant difference for change in HEI (0-12 mos.) between the 150 (+0.93), 225 (+2.38), and 300 min·wk⁻¹ groups (-2.60, $p=0.29$). Exercise min·wk⁻¹ was not associated with energy intake ($r=0.01$, $p=0.94$) or HEI ($r=0.11$, $p=0.15$). **CONCLUSION:** There was no impact of the volume of exercise (min·wk⁻¹) on energy intake or HEI in initially overweight/obese adults completing a weight maintenance intervention.

1693 **May 31 3:45 PM - 4:00 PM**

VO2max Is Associated With Energy Expenditure Measures, Including Diet Induced Thermogenesis, Under Sedentary Conditions

Takafumi Ando, Paolo Piaggi, Jonathan Krakoff. *National Institute of Diabetes and Digestive and Kidney Diseases, Phoenix, AZ.*

(No relevant relationships reported)

Low cardiorespiratory fitness predicts subsequent weight gain independently of physical activity. However, the physiological mechanisms underlying this relationship have not been fully explained. One hypothesis is that VO2max is related to measures of energy expenditure, in particular diet induced thermogenesis. Results from previous studies exploring these associations have been mixed. However, these studies may have been limited by methodological issues regarding the adjustment for energy expenditure (EE) by confounding factors and small sample size.

PURPOSE: To determine the association between VO2max and measures of 24-h thermogenesis under predominantly sedentary condition and in particular awake fed thermogenesis (AFT) a measure of diet induced thermogenesis. **METHODS:** Two hundred twenty-nine American Indians from the southwest (132 men, 97 women) had measures of body composition by hydrodensitometry, resting metabolic rate (RMR) by the ventilated hood method, and then performed the intermittent treadmill run test for assessment of VO2max. On a separate day, they spent 24 hours in a whole-room calorimeter for assessment of 24-h EE, AFT, sleeping metabolic rate (SMR), and spontaneous physical activity (SPA) by radar system. As we have reported previously, AFT was calculated as the intercept of EE vs. SPA at zero activity minus SMR. **RESULTS:** After adjustment for fat free mass, fat mass, age and sex, multiple regression analysis showed that a higher VO2max (L/min) was associated with a higher RMR (beta = 45.9 kcal/day per L/min, standardized beta = 0.184, $p = 0.010$, $n = 181$) and 24-h EE (beta = 62.1, standardized beta = 0.125, $p = 0.028$, $n = 229$) and including additional adjustment for energy intake higher AFT (beta = 65.8, standardized beta = 0.334, $p = 0.012$, $n = 179$). Neither SMR ($p = 0.64$) nor SPA ($p = 0.80$) were associated with VO2max. **CONCLUSION:** VO2max was associated with RMR, AFT and 24-h EE. In particular the association with AFT indicates a possible common mechanism regulating both processes and that the protective effect of higher VO2max on weight change reflect its association with measure of 24-h thermogenesis.

1694 May 31 4:00 PM - 4:15 PM

Weight Loss is Associated with Change in Left Ventricular Mass in Adults with Obesity: The Heart Health StudyRenee J. Rogers, Erik B. Schelbert, Yaron Fridman, Meghan R. Maher, John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: John M. Jakicic, FACSM)**Reported Relationships:** R.J. Rogers: Contracted Research - Including Principle Investigator; Weight Watchers International, Inc..

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±5.1 ml/kg/min; p<0.001), GXT termination time (7.8±3.0 to 9.7±3.5 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=0.263; 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: LVM may be 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.

1695 May 31 4:15 PM - 4:30 PM

Attenuation of Excessive Weight Gain One Year Post Pediatric Obesity Treatment InitiationKate 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-old obese children in a rural mid-western community. Fifty-eight families including 69 obese children (BMI 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 (age: 9.43 ± 2.08 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 ± 6.89 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.

1696 May 31 4:30 PM - 4:45 PM

Association Between Family Health Behaviors and Obesity Severity: Does Weight Metric Matter?Karissa L. Peyer¹, Joani Jack², Gregory W. Heath, FACSM¹.¹University of Tennessee at Chattanooga, Chattanooga, TN.²University 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 difference 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, ≥ 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 < 0.04). 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.

1697 May 31 4:45 PM - 5:00 PM

Outdoor Time and Metabolically Healthy Obesity in Children: Results from the Canadian Health Measures SurveyBrittany V. Rioux, Neeru Gupta, Danielle R. Bouchard, James Dunbar, Martin Sénéchal. *University of New Brunswick, Fredericton, NB, Canada.*

(No relevant relationships reported)

A large proportion of children are recognized as metabolically healthy obese (MHO) and present a favorable cardio-metabolic profile. However, the contribution of outdoor time physical activity (PA) to the MHO phenotype is unknown.

PURPOSE: To investigate the association between outdoor time PA and the MHO phenotype in children. **METHODS:** An analysis of overweight and obese children aged 6-14 (n=386) from the Canadian Health Measures Survey (cycles 3-4) was performed. Outdoor time PA (hours/week) was self-reported using a series of questions in relation to the school schedule, such as: "during the past month, on an average school day, how much time did you usually spend outside?" Participants were given a score of 0-5 based on their response: 0 min. (0); 1 to <15 mins. (1); 15 to <30 mins. (2); 30 to <1 hour (3); 1 to <2 hours (4); and ≥2 hours (5). Then, a computed score, ranging from 0-25, was created for outdoor time PA. MHO status was determined based on the absence of cardio-metabolic risk factors including: triglycerides, HDL-cholesterol, systolic or diastolic blood pressure, and glucose (MHO: 0 cardio-metabolic risk factors; non-MHO: ≥1 cardio-metabolic risk factors). Multiple logistic regression analyses for the likelihood of MHO were adjusted for age, sex, socioeconomic status, and moderate-to-vigorous PA (MVPA) intensity. **RESULTS:** The proportion of MHO children was 58.5%. No significant differences were observed between MHO and non-MHO according to outdoor time PA, sedentary time, or MVPA (p>0.05). Logistic regressions indicated that outdoor time PA was not significantly associated with the MHO phenotype (OR: 0.99, 95% CI=0.92-1.05; p=0.69), while MVPA was significantly associated with the MHO phenotype (OR: 1.01, 95% CI=1.00-1.02; p=0.03). **CONCLUSIONS:** Outdoor time PA is not associated with the MHO phenotype. Children are more likely to be MHO with greater amounts of MVPA, regardless of whether these activities are completed outdoors or indoors.

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 Kochenour, Patricia A. Shewokis, Stella L. Volpe, FACSM. *Drexel University, Philadelphia, PA.* (Sponsor: Stella L. Volpe, FACSM)

(No relevant relationships reported)

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 (\pm standard deviation [SD]) in HP and LP schools were 18.9 ± 4.7 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 (\pm 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

D-43 Clinical Case Slide - Head

Thursday, May 31, 2018, 3:15 PM - 4:55 PM
Room: CC-200E

1699 **Chair:** Anastasia Noel Fischer, FACSM. *Nationwide Children's Hospital, Columbus, OH.*

(No relevant relationships reported)

1700 **Discussant:** Sean Engel. *University of Minnesota, Minneapolis, MN.*

(No relevant relationships reported)

1701 **Discussant:** Robert B. Kiningham, FACSM. *University of Michigan, Ann Arbor, MI.*

(No relevant relationships reported)

1702 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.

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

Differential Diagnosis:

Migraine (hemiplegic/retinal) 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. Labwork 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 transseptal 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 scheduled for 6 months post-operation.

1703 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 AND 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 otolaryngologist, who saw him 1 month later. At that time, his facial nerve function had returned to normal.

1704 May 31 3:55 PM - 4:15 PM

Head And Neck Injury-SoccerTracy 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. **PHYSICAL EXAMINATION** Well appearing. Pupils equal and reactive to light. No nystagmus. Normal accommodation. Negative VOMS Cervical spine: Cervical spine ROM normal, painful with side bending and rotation. Paraspinals and sternocleidomastoids are tender to palpation, right worse than the left. Bilateral posterior chain lymphadenopathy noted. Spurling's negative. Upper extremity strength and sensation are intact. Abdomen: No hepatosplenomegaly. **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 contact sports and increase activity level as tolerated.

1705 May 31 4:15 PM - 4:35 PM

Vision and Vestibular Problems: A Bumpy RideOlivia E. Podolak, MD, Fairuz Mohammed, MPH, Christina L. Master, MD, CAQSM. *Children's Hospital of Philadelphia, Philadelphia, PA.*

(No relevant relationships reported)

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 sought evaluation by a Sports Medicine Physician.

The patient's medical history revealed congenital cataract of the right eye and glaucoma. She underwent surgical removal of the cataract as an infant, which resulted in amblyopia. Since childhood, she suffered from strabismus of the right eye and underwent patching for nine years with residual exophoria.

As a result of the concussion, the exophoria and glaucoma progressed. Corrective lenses for her exophoria began to overcompensate, resulting in esotropia.

PHYSICAL EXAMINATION: Initial presentation was 97 days post-injury. Her self-reported Post-Concussion Symptom Inventory (PCSI) score was 108 compared to a pre-injury symptom score of 1.

A vestibular/ocular exam revealed abnormalities with smooth pursuits, saccades, vestibulo-ocular reflex, visual motion sensitivity, near point of convergence (NPC) and accommodation tests. The exam provoked headache, dizziness, nausea, fogging, and diplopia symptoms. The patient's NPC was assessed but she reported discomfort with drifting of the eye. Assessment for monocular accommodation of the right eye was unsuccessful due to diplopia.

DIFFERENTIAL DIAGNOSIS:

1. Concussion
2. Natural progression of amblyopic strabismus
3. Vestibular migraine

WORKING DIAGNOSIS:

- Concussion with post-concussive monocular esotropia of the right eye requiring surgical intervention.

TEST AND RESULTS:

- Clinical examination and PCSI survey at both the initial and follow up visits.

TREATMENT AND OUTCOMES:

1. Surgical correction of strabismus.
2. 18 days after initial presentation and following surgical intervention: a. PCSI score decreased to 100.

- b. Primary complaints of motion sickness and diplopia resolved.
- c. Symptoms and performance on clinical examination improved.
- 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 PatientMary Daley. *Tufts Medical Center, Boston, MA.*

(No relevant relationships reported)

HISTORY: 10-year-old female with persistent emotional dysregulation and learning disorder after sustaining a mild head injury in a motor vehicle accident at age 5. She was evaluated in the ED but had no head imaging at the time. In the immediate aftermath of the injury, she developed headache, neck and shoulder pain, and generalized fatigue. These symptoms gradually resolved within several months. However, she also developed depression, irritability, and aggressive behaviors, all of which began within weeks of the accident and represented a drastic change of personality. She developed a regression in counting and language skills, and began struggling with inverting 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.

DIFFERENTIAL DIAGNOSIS: 1. Post-concussive syndrome

2. Post-traumatic stress disorder

3. Specific learning disorder in reading; dyslexia

4. Attention deficit hyperactivity disorder; inattentive type

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.

FINAL/WORKING DIAGNOSIS: 1. Traumatic brain injury

2. ADHD, Inattentive Type 3. Dyslexia 4. Dyscravias (voicing substitution dysgraphia)

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 dyscravias, as well as sustained impairments in working memory.

D-44 Clinical Case Slide - Leg

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

Room: CC-200F

1707 **Chair:** Philip F. Skiba. *Advocate Lutheran General Hospital, Park Ridge, IL.*

(No relevant relationships reported)

1708 **Discussant:** Terry Nicola, FACSM. *UIC Sports Medicine Center, Chicago, IL.*

(No relevant relationships reported)

1709 **Discussant:** Pierre L. Viviers, FACSM. *Stellenbosch University, Stellenbosch, South Africa.*

(No relevant relationships reported)

1710 May 31 3:15 PM - 3:35 PM

Right Distal Thigh Pain - Water PoloErin M. Conlee¹, Brett J. Kindle², Jay Smith¹. *¹Mayo Clinic, Rochester, MN. ²Andrews Institute, Gulf Breeze, FL.* (Sponsor: Karen L. Newcomer, MD, FACSM)

(No relevant relationships reported)

HISTORY: A 15 year old male experienced spontaneous onset of distal lateral thigh pain during his water polo season without preceding event. Symptoms, including an ache and hypersensitivity, responded to activity modification but recurred immediately

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.

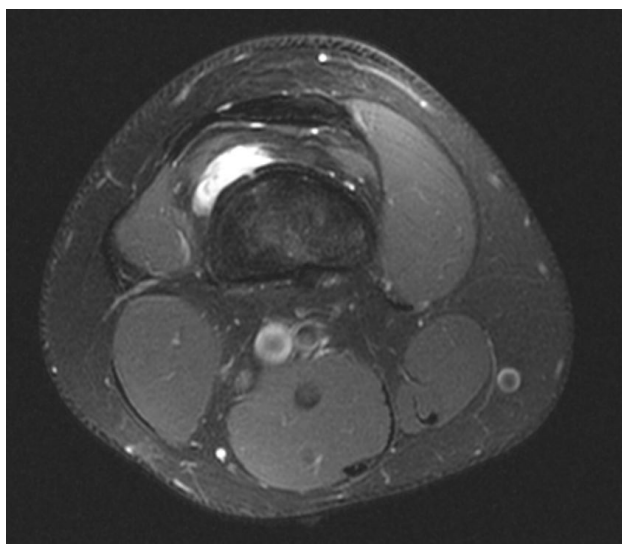
PHYSICAL EXAMINATION: Exam revealed tenderness localized to the superior pole of the patella and the vastus lateralis-retinacular interface without nodularity. No knee effusion was present, and all provocative maneuvers of the knee were negative. Give-way weakness of the right quadriceps was present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

DIFFERENTIAL DIAGNOSIS: 1. Proliferative synovial disorder 2. Vascular malformation 3. Chronic musculotendinous strain of the vastus lateralis-retinacular region 4. Malignancy

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.



1711 May 31 3:35 PM - 3:55 PM

Anterior Thigh Pain - Shot put/Discus

Casey Muir, Edward Laskowski, FACSM. *Mayo Clinic, Rochester, MN.*

(No relevant relationships reported)

History: A 17 year-old male who was a first year participant in shot put and discus events presented with gradual onset aching left hip pain for 3 weeks. He denied any precipitating trauma or injury prior to symptom onset. His pain localized primarily to the left proximal anterior thigh. Hip flexion and abduction aggravated the pain. He tried intermittent ice without improvement. He denied radicular pain, weakness, sensory, or mechanical hip symptoms. After 1 physical therapy session, the pain progressed to a 10/10 intensity, constant throbbing, sharp pain in the proximal anterior thigh. **Physical Examination:** Antalgic gait with shortened stance phase on the left. Focal tenderness to palpation at the AIIS and proximal hip flexor tendons. Range of motion was full and symmetric. Pain was elicited at the extremes of left hip flexion, internal rotation, and external rotation. No weakness with manual muscle testing, but he had pain with resisted hip flexion. Stinchfield elicited hip flexor and AIIS pain. FABER and FADIR aggravated left anterior hip pain. **Differential Diagnosis:** 1. Proximal Left Hip Flexor Muscle Strain 2. Traction Apophysitis 3. Labral Tear or other intra-articular hip pathology 4. Femur Stress Fracture 5. Abscess/infection **Tests and Results:** Left Hip X-ray - Negative left hip. Left Hip MRI - Partial thickness tearing of direct/indirect heads of rectus femoris tendons with extensive surrounding edema. Between the direct/indirect heads, lateral to AIIS, a 2 cm x 1.5 cm oval mass-like lesion heterogeneously dark and bright on T2 and intermediate to minimally dark on T1 with suggestion of a rim of decreased T1/T2 signal. Minimal periosteal reaction with bone marrow edema. Normal articular cartilage. **Final/Working Diagnosis:** Myositis Ossificans **Treatment and Outcomes:** 1. Crutches given with instructions to weight bear as tolerated. 2. Naproxen BID started after MRI findings. 3. Continued therapy with only range of motion initially. 4. Instructed to avoid impact exercises/activities. 5. Repeat left hip x-ray six weeks later revealed calcification in soft tissues lateral to left hip consistent with heterotopic ossification. 6. Therapy program was advanced. Eight weeks later reported no symptoms during over 85% of activity. 7. Returned to football in the fall and completed outstanding season, no hip region pain.

1712 May 31 3:55 PM - 4:15 PM

Atypical Leg Pain in a Chi Runner

Jennifer Oberstar. *University of Minnesota, Minneapolis, MN.*

(Sponsor: Steven Stovitz, FACSM)

(No relevant relationships reported)

General Medicine- Chi Running

HISTORY:

A 67-year-old white male, using Chi running to treat bilateral calf pain presented with worsening pains over the past month. He exercises for 30 minutes, 3 times/week, and has sharp cramping pain in both calves exacerbated by running. After increasing the intensity of runs, his right leg goes to sleep. Gait modifications have helped reduce pain slightly. The patient's history included the following: shin splints and chondromalacia patella since age 30, non-smoker, non-diabetic, no cardiac history, and treatment for hypertension and hyperlipidemia. Family history included coronary artery disease. The patient was sent to Interventional Radiology (IR) for an ankle-brachial index (ABI) and was started on aspirin. No mechanical or structural cause of pain was identified, but moderate peripheral arterial disease (PAD) was discovered in the right leg. CT angiogram of the pelvis and lower extremities was recommended. Results of the CTA lead to the patient's direct admission.

PHYSICAL EXAMINATION:

BMI: 34.91, CONSTITUTIONAL: Healthy, HEENT: normocephalic, LUNGS: clear, CV: RRR, no bruits, GI: soft, NT/ND, SKIN: No rashes, NEURO: intact sensory and motor function of the lower extremities, VASCULAR: No bruits

DIFFERENTIAL DIAGNOSIS:

1. Claudication
2. Abnormal gait
3. PAD

TEST AND RESULTS:

Ultrasound ABI Doppler with Exercise-

Right: Resting ABI of 0.84, Positive exercise study

Left: Resting ABI of 1.29, Negative exercise study

CT angiogram of the pelvis and bilateral lower extremity-

Abdominal aorta Large fusiform infrarenal AAA 8.6 x 7.5 cm. Dilated right and left common iliac arteries 2.4 and 2.8 cm. Focal fusiform aneurysmal dilatation of the mid to distal main trunk of the left internal iliac artery 3.2 cm.

Right leg elongated thrombus within the right popliteal artery appearing to attach to the arterial wall proximally resulted in high-grade stenosis

FINAL WORKING DIAGNOSIS:

1. Large fusiform infrarenal AAA
2. Left internal and bilateral common iliac aneurysms
3. Popliteal artery embolism

TREATMENT AND OUTCOMES:

1. Evaluation: IR, Vascular surgery, and Cardiology
2. AAA repair: left internal and bilateral common iliac aneurysms and right popliteal embolectomy
3. Walking 3-4 miles with mild pressure but no pain in his calves at 5 weeks postoperatively

1713 May 31 4:15 PM - 4:35 PM

Unilateral Quadriceps Weakness

Jacqui Stone. *University of Calgary, CALGARY, AB, Canada.*

(No relevant relationships reported)

HISTORY: 17-year-old male athlete presenting with insidious onset of isolated, painless, unilateral quadriceps weakness and wasting. **PHYSICAL EXAMINATION:** Significant unilateral quadriceps atrophy with relative rectus femoris sparing. Strength was mildly reduced on the affected side, but much less than would be expected given his level of atrophy. There were no other sensory or focal neurologic deficits on examination. **DIFFERENTIAL DIAGNOSIS:** Monomelic Amyotrophy, Amyotrophic Lateral Sclerosis, Cord compression, Nerve root/plexopathy **TESTS AND RESULTS:** Nerve conduction studies, EMG, and MRI findings consistent with final diagnosis **FINAL WORKING DIAGNOSIS:** Monomelic Amyotrophy (quite rare) **TREATMENT AND OUTCOMES:** Observation and long-term follow up, conservative management with physiotherapy. Typically clinical deficit remains stable and isolated, but follow-up is required to ensure it is not a different diagnosis. In this clinical case presentation, we review the natural history, epidemiology, diagnosis, differential considerations, prognosis and management of this rare entity.

1714 May 31 4:35 PM - 4:55 PM

Say It Aint Sew: A Unique Cause of Calf Pain in MarathonerMatthew D. Sedgley, MD FAAFP CAQSM. *MedStar Sports Medicine, Ellicott City, MD.* (Sponsor: Nailah Coleman, MD, FACSMD)

(No relevant relationships reported)

HISTORY: 53 year old female who is a marathoner presents with a chief complaint of calf pain. Located near the gastrocnemius muscle on the left leg. Mechanism of injury was she is 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
WNWD, NAD ENT: NCAT, normal teeth
Skin: No rashes or ulcers
Cardiac Vasc: normal capillary refill, no cyanosis and palpable pulses distally at dorsalis pedis bilaterally
Neuro: normal sensation, no tremors, symmetric knee and ankle reflex +2 bilaterally, negative slump sign
Psyche: nervous that she will not BQ in qualifying race, no depression
MSK: Inspection: no atrophy, swelling or bruising
Palpation: tender gastrocnemius on the left leg only, no defect ROM: ankle dorsiflexion -15 degrees bilaterally and plantar flexion 40 degrees bilaterally
Strength: 5 out of 5 dorsiflexions, plantar flexion, inversion and eversion and FHL and EHL bilaterally.
Special Testing: negative slump sign, negative homans sign, negative Thompson test.

DIFFERENTIAL DIAGNOSIS: Tennis calf/muscle strain Lumbar radiculitis MTSS vs stress fracture CECS PAES Peripheral neuritis/entrapment

TEST AND RESULTS: Xray 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 muscle deep fibers.

FINAL WORKING DIAGNOSIS: Foreign object in muscle

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



1715 May 31 4:55 PM - 5:15 PM

Leg Pain in Recreational Runner with Parkinson's Disease - RunningTimothy M. Dekker, George G.A. Pujalte, FACSMD. *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 Piriformis syndrome Lumbar radiculopathy

TEST AND RESULTS: X-ray of left thigh: Mild pelvic enthesopathy at hamstrings' tendinous origins along bilateral ischial tuberosities Hips and knees with mild degenerative changes.

FINAL WORKING DIAGNOSIS: Recurrent proximal hamstring strains, in a Parkinson's disease sufferer intent on running recreationally.

TREATMENT AND OUTCOMES:

The challenge is that the patient insists on running, but gait changes caused by Parkinson's make it difficult.

Physical Therapy initiated special program starting with light stretching and submaximal strengthening, progressing to increased resistance training.

Refrained from running initially; after weeks of therapy, was able to walk/run again.

Patient made to understand gait effects of Parkinson's; continues therapy, wants to run in spite of condition.

D-45 Clinical Case Slide - Medical Issues III

Thursday, May 31, 2018, 3:15 PM - 4:55 PM

Room: CC-Mezzanine M100F

1716 **Chair:** Carrie A. Jaworski, FACSMD. *NorthShore University Healthsystems, Chicago, IL.*

(No relevant relationships reported)

1717 **Discussant:** Kathryn E. Ackerman, FACSMD. *Boston Children's Hospital, Boston, MA.*

(No relevant relationships reported)

1719 May 31 3:15 PM - 3:35 PM

Seizure - RunningVanessa Franco. *Kaiser Los Angeles Medical Center, Los Angeles, CA.*

(No relevant relationships reported)

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 EEG 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 bupropion 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, Hgb 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. Statin side effect 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. 4. 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 DO¹, Joseph Edison DO¹. *VCOM-Auburn, Auburn, AL. ¹Auburn University, Auburn, AL.*

(No relevant relationships reported)

HISTORY: A 17 year old male NCAA Div 1 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 nondisplaced fracture of his proximal tibia repaired by ORIF at the age of 12. The hardware was removed 3 months later. The patient has no other complaints.

PHYSICAL EXAMINATION: His vital signs were within normal limits. The HEENT, CV, Respiratory, and Skin exam were unremarkable. On musculoskeletal exam of his right knee he was tender to palpation over the right medial tibial plateau, medial joint line, and over his MCL. He had no obvious effusions. His right knee opens 1+ to valgus stress testing. He had a 1 cm shorter leg length discrepancy on the right compared to the left. He had full range of motion. His knee was otherwise stable to varus stress. He had a stable anterior and posterior drawer and he was neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: 1. MCL Sprain, 2. Tibial Bone Bruise, 3. Tibial Fracture, 4. Medial Meniscal Injury.

TEST AND RESULTS: X-ray obtained for evaluation of his right knee pain demonstrated a multiloculated cystic bone lesion with sclerotic and thin margins abutting the articular surface of the proximal medial tibia. MRI confirmed a 3.7 X 3.6 X 6.9 cm multiloculated mass in the medial metaphysis of the right tibia extending to the subchondral surface. There was no enhancement of the ACL, PCL, MCL, or LCL.

SECONDARY DIFFERENTIAL DIAGNOSIS: 1. Giant Cell Tumor, 2. Aneurysmal Bone Cyst, 3. Chondromyxofibroma, 4. Osteosarcoma

Orthopedic oncology performed an open bone biopsy of the lesion and the patient was subsequently diagnosed with a simple bone cyst.

FINAL WORKING DIAGNOSIS: Simple Bone Cyst

TREATMENT AND OUTCOMES: Curettage and bone grafting were performed. The patient was discharged and kept on 50% weight bearing with no ROM restrictions with progression off crutches for 6 weeks. At his 6 week post op appointment the patient was off crutches and doing well. He was ambulating without assistance. X-rays obtained at that time showed improvement and new bone growth. At his 3 month follow up he was pain free. X-rays showed bone growth and no interval growth of the lesion. At that time he was cleared for full practice and sport participation.

1722 May 31 4:15 PM - 4:35 PM

18yo Female Lacrosse Player with Abdominal Pain

Kyle H. Yost, Valerie Cothran, 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 physiological 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:

Constitutional: Well-developed and well-nourished. No distress.

Cardiovascular: Normal rate and rhythm.

Pulmonary: Lungs clear to auscultation.

Abdominal: Soft, non-distended. Diffusely tender over the abdomen with the pain concentrated over the epigastric area. Normal bowel sounds.

Differential Diagnosis:

1. Abdominal muscle contusion.
2. Pancreatic laceration/contusion.
3. Splenic laceration.
4. Liver laceration/contusion.

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-yo 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:

1. Malabsorptive disorder
2. Hypogonadism
3. Hypothyroidism
4. Relative Energy Deficiency in Sport (RED-S)

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 hip 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); 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:

-Dietary recall: 2700 to 3000 kcal/d (protein: 1.4 g/kg/d, carb: 8 g/kg/d, fat 0.5 g/kg/d). 1000-1500 kcal deficit/d.

Goal= 4,000+ kcal/d. Diet insufficient in macronutrients. Initial goal: begin with small change- increase fat to 1 g/kg/d.

Recommended: Vit D, Iron, and B12 supplements (patient refused).

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 Copp¹, Nicole J. Chimera³. ¹Northern 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±1.1 yrs, 171.1±8.8 cm, 68.5±9.6 kg), injury-free at testing (prior to the season) were included in the study. The order of the clinical tests was randomized for each SA, and included the single, triple, and crossover hop for distance, and isometric hip strength and jumping tests. Any injury that caused the SA to report to the athletic training room was abstracted from the medical record. Only the first injury for each SA was recorded. Contact injuries were excluded. ROC curves and area under the curve (AUC) were calculated using absolute values of the difference between the right and left leg for each hopping test to determine the optimal cut-point. Logistic regression determined the odds of non-contact or overuse injury with each hopping test using the cut-point determine from ROC curve. History of previous injury was assessed for confounding.

RESULTS: 53 athletes were injured during their sport season. The cut-point for single hop was 6 (sensitivity = 0.55, specificity = 0.67, AUC = 0.51), and triple and crossover hop was 12 (sensitivity = 0.74 and 0.66, specificity = 0.75 and 0.58, AUC = 0.42 and 0.41, respectively). After adjusting for previous injury, a statistically significant association was found with the triple hop and the odds for non-contact injuries (odds ratio = 7.43 [95% confidence interval 1.72 - 32.17]). No significant association was found with single or crossover hop after adjusting for previous injury.

CONCLUSIONS: Using a clinically relevant injury definition, the triple hop showed the strongest predictive ability for non-contact and overuse injuries. This hopping test may be a clinically useful tool to help identify increased risk of injury in female athletes playing high-risk sports.

- 1741 Board #2 May 31 2:00 PM - 3:30 PM
The Association of Proximal Hip Strength and Non-Contact Injury in Division I Female Student-Athletes
Nicole J. Chimera¹, Monica R. Lininger², Craig A. Smith³, Adam Copp², Meghan Warren². ¹Daemen College, Amherst, NY. ²Northern Arizona University, Flagstaff, AZ. ³Smith Performance Center, Tucson, AZ.
(No relevant relationships reported)

Rehabilitation progress has been measured using jump performance and strength testing. However, there remains a paucity of research examining the relationship between strength performance and future injury. If strength tests are able to determine which athletes are at an increased risk of injury, then education and targeted injury-prevention programs can be implemented.

PURPOSE: To determine the association between proximal hip strength and non-contact and overuse injuries in Division I female basketball, soccer, and volleyball student-athletes. **METHODS:** 68 female student-athletes (SA; 19.1 ± 11 yrs, 171.3±8.7 cm, 68.4± 2.5 kg), recruited over 3 years, injury-free at the time of testing (prior to their respective seasons) were included in the study. Clinical tests were 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 (0.18-2.82)), external rotation (weakest vs. strongest odds ratio: 3.87 (95% confidence interval 0.67-22.36), 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. Berkson¹, Mary M. Eckert¹, Nan-Wei Gong³. ¹Massachusetts 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-limb symmetry testing of peak quadriceps (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, ICC_{2,1} = 0.91 (0.18-0.99) and ICC_{2,1} = 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.

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

Measure (n = 5)	Right limb Mean \pm standard deviation (% sensor stretch)	Left limb Mean \pm standard deviation (% sensor stretch)
Quadriceps Peak displacement	3.047 \pm 0.742	2.877 \pm 0.764
Hamstrings Peak displacement	5.025 \pm 0.754	6.195 \pm 0.906
Quadriceps/Hamstrings Ratio	0.630 \pm 0.218	0.487 \pm 0.200

1743 Board #4 May 31 2:00 PM - 3:30 PM
Knee Extension Strength Asymmetry does not affect Peak Power or Fatigue during the Wingate Test

Stuart Best, Reiley Bergin, Scott Royer, Joshua Winters, Kathleen Poploski, Nicholas Heebner, John Abt, FACSM, Scott Lephart, FACSM. *University of Kentucky, Lexington, KY.* (Sponsor: John Abt, FACSM)

(No relevant relationships reported)

PURPOSE: Peak and mean power during the Wingate test is associated with knee extensor strength, however it is unknown if knee extensor asymmetry affects this relationship. We hypothesized that increased muscle asymmetry would be associated with decreased peak and mean power during the Wingate test in healthy subjects. **METHODS:** 206 highly active male subjects (27 \pm 4 yrs, 84 \pm 9 kg) completed individual limb isokinetic strength testing on a dynamometer (60°·sec⁻¹), as well as a 30 second Wingate anaerobic test in a seated position. Strength testing included maximal knee extension strength (% Body Weight). Knee extension asymmetry ratio between legs (A_{ext}) was calculated as $E_{\text{min}}/E_{\text{max}}$, where E_{max} = strongest leg, E_{min} = weakest leg. Subjects were later classified as High Symmetry (HS, $A_{\text{ext}} \geq 0.95$, n=76), Moderate Symmetry (MS, $0.90 \leq A_{\text{ext}} < 0.95$, n=60), Moderate Asymmetry (MA, $0.85 \leq A_{\text{ext}} < 0.90$, n=35) or High Asymmetry (HA, $A_{\text{ext}} < 0.85$, n=35). Wingate data (W·kg⁻¹) were analyzed for peak power (P_{peak}), mean power (P_{mean}), as well as power output at 5 second intervals. **RESULTS:** There were significant differences in E_{min} (HS > MA, p=0.012; HS > HA, p<0.001; MS > HA, p=0.044) but not E_{max} between groups. No significant differences in P_{peak} (12.89 \pm 0.68, 12.74 \pm 0.63, 12.71 \pm 0.52, 12.87 \pm 0.79 W·kg⁻¹), P_{mean} (9.26 \pm 0.81, 9.05 \pm 0.82, 9.15 \pm 0.78, 9.32 \pm 1.08 W·kg⁻¹) or any other power variables were found between the HS, MS, MA and HA groups respectively (all p>0.055). When all subjects were combined, knee extensor asymmetry (A_{ext}) was not associated with any power variables (all p>0.133). P_{peak} and P_{mean} respectively were positively associated with E_{max} (r=0.414, p<0.001; r=0.464, p<0.001) and E_{min} (r=0.397, p<0.001; r=0.420, p<0.001). Although all relationships were significant, the associations between strength variables (E_{min} and E_{max} respectively) and power decreased from 5 seconds (r=0.490, p<0.001; r=0.490, p<0.001) to 30 seconds (r=0.265, p<0.001; r=0.331, p<0.001). **CONCLUSIONS:** Greater knee extensor strength imbalance between legs is not associated with decreased power throughout a 30 second Wingate test. These data suggest that for bilateral tasks in which the legs do not move independently, such as cycling, training focused only on improving strength symmetry between legs may not improve peak power production.

1744 Board #5 May 31 2:00 PM - 3:30 PM
Cardiorespiratory Fitness of Otherwise Healthy Obese Women

Vipa Bernhardt¹, Dharini M. Bhammar², Rubria Marines-Price³, Tony G. Babb, FACSM³. ¹Texas A&M University Commerce, Commerce, TX. ²University 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)

(No relevant relationships reported)

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 current EACPR/AHA Scientific Statement includes peak oxygen uptake ($\text{VO}_{2\text{peak}}$) both in ml/min/kg and as percent of predicted (Guazzi et al, 2016). We have previously shown, in a small cohort of otherwise healthy obese women (n = 26), that obese adults have normal or slightly reduced CRF (~85% of predicted), depending on the prediction equation used (Lorenzo & Babb, 2012). Here, we wanted to validate our earlier findings in a larger sample of women. **METHODS:** Obese women underwent hydrostatic weighing to assess body fat percentage, fat mass, and lean body mass. They then completed an incremental cycling test to exhaustion to determine $\text{VO}_{2\text{peak}}$. Prediction equations from Riddle et al (R; 1980), Wasserman et al (W; 2005), and Gläser (G; 2010) were used to assess CRF as previously described. Differences

between percent predicted $\text{VO}_{2\text{peak}}$ values derived from the three equations were analyzed using repeated measures ANOVA. **RESULTS:** Data from 121 women (34 \pm 7 yr, 36 \pm 4 kg/m² BMI, 46 \pm 5% body fat, 44 \pm 9 kg fat mass, 52 \pm 6 kg lean body mass, mean \pm SD) were analyzed. $\text{VO}_{2\text{peak}}$ (ml/min/kg) was low (18.9 \pm 3.0 ml/min/kg) and decreased with increasing body mass, severely penalizing heavier individuals. In fact, applying the current ACSM CRF classification, 113 women would be considered "very poor" and 8 as "poor" (all below the 25th percentile). Mean values of % predicted $\text{VO}_{2\text{peak}}$ were significantly different between equations R and W, and W and G, but not between R and G (R: 92 \pm 14%, W: 91 \pm 14%, G: 92 \pm 14%, p < 0.01). Using a cutoff for low CRF of < 84% of predicted $\text{VO}_{2\text{peak}}$, only 27-32% of women fell into this category, depending on the equation used. **CONCLUSIONS:** The commonly used method of evaluating $\text{VO}_{2\text{peak}}$ based on body weight (ml/kg/min) is not appropriate in obese individuals; $\text{VO}_{2\text{peak}}$ 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 Constantinou¹. ¹University of Nevada, Reno, Reno, NV. ²University of Utah, Salt Lake City, UT.

(No relevant relationships reported)

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 \pm 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 $\text{VO}_{2\text{Peak}}$ from the Astrand-Ryhmig cycle ergometer test, and standard push-ups. Criterion measures consisted of DXA-assessed percent body fat (%BF), measured $\text{VO}_{2\text{Peak}}$ 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 %BF (F(5, 517) = 44.6, p < 0.001, eta-squared = 0.31), measured $\text{VO}_{2\text{Peak}}$ (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.

1746 Board #7 May 31 2:00 PM - 3:30 PM
Work Performed Above The Respiratory Compensation Point Is Not Equivalent To W'

Jeffrey A. Leo¹, Surendran Sabapathy¹, Michael J. Simmonds¹, Troy J. Cross². ¹Griffith University, Gold Coast, Queensland, Australia. ²Mayo Clinic, Rochester, MN.

(No relevant relationships reported)

The hyperbolic power-time relationship for severe-intensity cycling exercise is defined by two physiological parameters: (i) the asymptote, critical power (CP); and (ii) the curvature constant, W' . Recently, we reported that the respiratory compensation point (RCP) displays poor measurement agreement with the CP. However, it is unknown whether the amount of supra-RCP mechanical work (RCP') performed during ramp-incremental cycling is similar to that performed above the CP (i.e., W').

PURPOSE: We sought to determine the measurement agreement between W' and RCP' obtained during incremental cycling of varying ramp slopes.

METHODS: Twelve male cyclists completed three separate ramp-incremental cycling protocols, where the work rate increment was slow (SR, 15 W·min⁻¹), medium (MR, 30 W·min⁻¹), or fast (FR, 45 W·min⁻¹). Initially, the RCP (adjusted for mean response time) was obtained using the ventilatory equivalent for CO_2 method. To assess RCP' , we calculated the power-time integral between the RCP and the instantaneous power output observed at exercise termination for each ramp-incremental test, separately. W' was determined via Morton's model for ramp-incremental exercise. The assumption that W' and RCP' occur at equivalent kilojoule (kJ) values was assessed by one-way repeated-measures ANOVA and by evaluating the concordance correlation coefficient (CCC) and typical error (root-mean-square error [RMSE]) for each ramp-incremental test, separately.

RESULTS: RCP' decreased with increases in the ramp-incremental slope ($P < 0.05$). RCP' in SR (21.5 \pm 6.5 kJ), MR (16.8 \pm 5.6 kJ) and FR (13.3 \pm 4.3 kJ) were not

different from W' (15.7 ± 6.9 kJ). The degree to which the relationship between W' and RCP' approximated the line of identity was poor for SR (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 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 W' .

1747 Board #8 May 31 2:00 PM - 3:30 PM

Effectiveness of Preseason Conditioning on VO_{2max} in College Athletes Assessed via Ift and Gxt

Kallie LaValle, Jordan Nieuwsma, 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, Engen, Wisloff & 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 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 VO_{2max} via GXT (45.1 vs. 48.9 ml/kg/min, $P < 0.001$) and estimated 30-15 IFT VO_{2max} (46.7 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 (150bpm vs. 141bpm, $P = 0.019$) following preseason training. GXT measured VO_{2max} and 30-15 IFT estimate VO_{2max} 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 ± 2 kg, $P = 0.019$).

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.

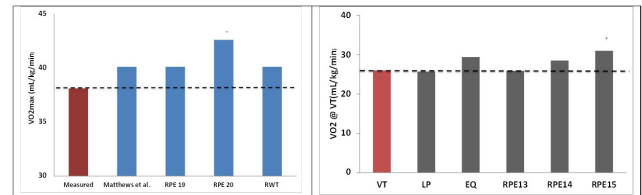
1748 Board #9 May 31 2:00 PM - 3:30 PM

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. Doherty. *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 VO_{2max} 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 Talk Test 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 VO_{2max} and VT, with correlations > 0.80 and SEE ~ 1 MET. VO_{2max} 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 VO_{2max} and VT.



1749 Board #10 May 31 2:00 PM - 3:30 PM

Normative Benchmark Workout Scores Forcrossfit® Athletes

Gerald T. Mangine¹, Brant Cebulla², Yuri Feito, FACSM¹.

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(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 Games®.

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-50, and Fight-Gone-Bad).

Subsequently, a randomly-selected sample was used to calculate the mean, standard deviation, and normative percentiles (in deciles) for each workout in I_M ($n = 500$; 178.7 ± 7.4 cm; 86.1 ± 10.1 kg), I_F ($n = 500$; 164.0 ± 6.7 cm; 64.2 ± 7.3 kg), MS_M ($n = 500$; 178.8 ± 7.4 cm; 87.1 ± 10.6 kg), and MS_F ($n = 500$; 164.7 ± 6.7 cm; 64.3 ± 7.7 kg). Due to limited user profiles, the entire populations were assessed for T_M ($n = 285$; 175.8 ± 8.5 cm; 73.7 ± 11.6 kg) and T_F ($n = 136$; 163.7 ± 7.1 cm; 61.6 ± 9.1 kg). **RESULTS:** Separate norms were calculated for each sex and age category for Fran (T_M : 314.6 ± 142.5 sec; T_F : 250.0 ± 109.4 sec; I_M : 300.2 ± 125.2 sec; I_F : 361.3 ± 129 sec; MS_M : 330.2 ± 138.4 sec; MS_F : 363.1 ± 145 sec), Grace (T_M : 212.8 ± 76.8 sec; T_F : 257.3 ± 97.9 sec; I_M : 178.8 ± 86.5 sec; I_F : 207.4 ± 80.5 sec; MS_M : 213.4 ± 95.4 sec; MS_F : 242.4 ± 114.8 sec), Helen (T_M : 9.8 ± 1.8 min; T_F : 12.0 ± 1.9 min; I_M : 9.5 ± 2.0 min; I_F : 10.9 ± 1.9 min; MS_M : 10.1 ± 2.0 min; MS_F : 11.3 ± 2.2 min), Filthy-50 (T_M : 24.3 ± 6.1 min; T_F : 29.2 ± 6.6 min; I_M : 24.9 ± 5.5 min; I_F : 26.8 ± 6.3 min; MS_M : 26.9 ± 6.7 min; MS_F : 27.4 ± 5.6 min), and Fight-Gone-Bad (T_M : 291 ± 50 reps; T_F : 269 ± 48 reps; I_M : 331 ± 60 reps; I_F : 284 ± 60 reps; MS_M : 314 ± 60 reps; MS_F : 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 Tamjid¹, Jamie DeRevere¹, Elizabeth O'Neill², Kimberly Kostelis¹. ¹Central Connecticut State University, New Britain, CT. ²Springfield College, Springfield, MA. (Sponsor: Sean Walsh, FACSM)

(No relevant relationships reported)

In an attempt to improve athletic performance and assess potential dysfunction of core fascial lines, the 'Bunkie test' is a functional performance test consisting of five different plank positions. There is no current literature that establishes appropriate rest intervals for in-between plank positions, as well as no established termination criteria.

PURPOSE: The current study was conducted to examine the rest interval duration and test termination criteria for the Bunkie test. **METHODS:** Forty college students from two universities volunteered to participate in the study. Participants completed three sessions separated by at least 48 hours, which consisted of 5 plank positions held bilaterally. Positions included the anterior power line (APL), lateral stabilizing line (LSL), posterior power line (PPL), posterior stabilizing line (PSL), and medial stabilizing line (MSL). The plank positions were held for as long as possible with proper form. Each session utilized a different rest interval of either 30s, 1min, or 2min between each of the plank positions.

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 PPL. LSL and MSL and PSL had significant differences among rest intervals on one side (LSL left, $p=.002$; MSL right, $p=.006$; PS 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 (30s) appears to 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

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(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 ≥ 6 -min, and the JNOSH 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 workdays, and non-workdays. 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 (150903-01).

1752 Board #13 May 31 2:00 PM - 3:30 PM
Investigating The Effects Of Obesity On Fitness Among Community-dwelling Older Adults In Taiwan

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(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 ($BMI \geq 27.0$ kg/m², $n=17$) or non-obesity ($BMI < 27.0$ kg/m², $n=52$) 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, 2-min leg lift, 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% ($t_{(67)} = 5.492$, $p<0.01$) and 13% ($t_{(67)} = 3.443$, $p=0.001$), 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.

1753 Board #14 May 31 2:00 PM - 3:30 PM
Relationship Between Body Mass Index, Core Strength, and Balance in Adults

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(No relevant relationships reported)

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 \pm SD: age, 39.4 ± 9.8 y; BMI 28.3 ± 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 is measured while a subject stands 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
Inertial Load Influences Power Measures during the Wingate Test

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(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 (3.75, 5.25, 6.75, 8.25, and 9.75 kp). Pedaling force was removed 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 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.

- 1755 Board #16 May 31 2:00 PM - 3:30 PM
Comparison of 3 Alternative Systems for Measuring Vertical Jump Height
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(No relevant relationships reported)

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 (Just 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 wear the Vert™ 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 submaximal effort practice jumps prior to performing 5 maximum effort vertical jumps. After each jump, the 3 measurements were recorded. Each subject completed a 2nd 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: 21.2 ± 6.2 in.; Vertec™: 21.0 ± 6.2 in.; Vert™: 20.1 ± 4.9 in.; $p = 0.227$; Day 2 - Just Jump™ mat: 21.2 ± 6.0 in.; Vertec™: 21.1 ± 6.2 in.; Vert™: 20.2 ± 4.9 in.; $p = 0.233$). In addition, there were no significant differences between the vertical jumps between the 2 days for any of the devices (Just Jump™ mat: $p = 0.616$; Vertec™: $p = 0.141$; Vert™: $p = 0.897$). **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.

- 1756 Board #17 May 31 2:00 PM - 3:30 PM
Comparison of Anaerobic Power Tests During Cycle and Non-Motorized Treadmill Ergometry at Optimized Loads.
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(No relevant relationships reported)

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 ($P < 0.001$) on NMT (924.44 ± 297.72 W, 636.90 ± 309.55 W and 364.34 ± 123.20 W, respectively) than CE (501.90 ± 154.20 W, 309.55 ± 115.28 W and 178.11 ± 58.93 W, respectively). Significant correlation was found between PP ($r = 0.938$, $p < 0.001$), relative PP ($r = 0.871$, $p < 0.001$), MP ($r = 0.859$, $p = 0.001$), relative MP ($r = 0.721$, $p = 0.012$), Pmin ($r = 0.824$, $p = 0.02$) and relative Pmin ($r = 0.779$, $p = 0.05$). FI was not significantly different on the NMT ($= 59.9 \pm 9.6\%$) compared to the CE ($= 63.9 \pm 6.7\%$, $p = 0.172$), although they were not significantly correlated, $p > 0.05$. HRmax was higher on the NMT than CE (184.1 ± 11.0 bpm and 177.7 ± 11.0 bpm, $p = 0.001$, respectively). BLa (NMT = 11.6 ± 2.5 mmol/l; CE = 10.4 ± 2.4 mmol/l) and RPE (NMT = 17.6 ; CE = 17.1), ($p > 0.05$), were not significantly different. Optimal braking force on the NMT was $20.8 \pm 4.3\%$ for males and $14.5 \pm 1.9\%$ 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.

- 1757 Board #18 May 31 2:00 PM - 3:30 PM
Stride Time Variation and Resilience in Healthy Young Adults during a Graded Exercise Task
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(No relevant relationships reported)

Trait level of ego-resilience is how well individuals can adapt and be open to events as they occur. Cardiac and locomotor behaviors during exercise may represent physiological manifestations of resilience in an individual. Resilience has been related to parasympathetic activity, which may predict changes in heart rate during a graded exercise task. The prediction of performance during an exercise task has implications towards training as well as injury. Gait fluctuations have been previously associated with fall risk and trained runners tend to demonstrate smaller variability of stride time intervals than untrained runners. **PURPOSE:** The purpose of this study was to investigate the association between ego-resilience scores and physiological characteristics during a graded exercise test in young, healthy adults. **METHODS:** 30 young, healthy participants (21.73 ± 1.88 yrs) completed a valid and reliable online questionnaire assessing ego-resilience and demographic information. Prior to the task, blood pressure, using a sphygmomanometer, and resting heart rate, using electrocardiogram (ECG) were collected. Each participant then completed a graded exercise protocol on a treadmill. The protocol began with a 3-minute warm-up at 4.0 mph and 0% grade followed by 90-second stages of increasing speed ($+0.5$ mph) at 3% grade until the person reached exhaustion or until the 10th stage was completed. From the trial, cardiac and locomotor rhythms were measured using ECG and digital video, respectively. **RESULTS:** Ego-resilience was not significantly related to blood pressure, resting heart rate, maximum heart rate, total time spent on the exercise task, or average change in heart rate ($p > .05$). The coefficient of variation of stride time during recovery was significantly positively related to ego-resilience score ($r = .38$, $p < .05$). **CONCLUSION:** Higher ego-resilience was associated with more variance in stride time throughout the exercise task. Increased variability in stride time may reflect a more robust, or resilient, running behavior. In this study, cardiovascular measures did not demonstrate significant relationships with ego-resilience. However, the data do suggest that ego-resilience may have behavioral manifestations, such as more robust movement patterns.

- 1758 Board #19 May 31 2:00 PM - 3:30 PM
Using Vertical Shoulder Press To Find The Occurrence Of Bilateral Deficit In Recreationally Trained Participants
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(No relevant relationships reported)

Bilateral deficit (BLD) is an occurrence where the unilateral sum in force output is higher than the bilateral force output in the upper or lower limbs. Maximal bilateral and unilateral lifts can be used to determine if a BLD is present. BLD can often have negative effects on performance and daily activity due to an uneven force output per limb in bilateral movements. This is important for health and fitness professionals because it can help them to recognize and reduce the occurrence of BLD. **PURPOSE:** To determine if there was a difference between a combined maximal unilateral lift (cMUL) and a maximal bilateral lift (MBL) for vertical shoulder press (VSP) and to determine if BLD was present in recreationally trained participants. It was hypothesized that the cMUL will be significantly greater than the MBL. **METHODS:** Thirty participants (19 male, 11 female) were recruited for this study. Participants engaged in three separate visits which were each 72 hours apart. The first visit consisted of a movement screening that assessed biomechanical functionality when performing the VSP. This was accomplished by observing efficiency in a set of 8 to 10 repetitions at 30% of their one repetition maximum (1RM) for the VSP. Participants were then randomly assigned for visit 2 to either a MUL or MBL testing condition and completed the other condition during visit 3. In each testing condition, participants performed 6 to 8 repetitions at 50% 1RM. Participants then proceeded to lift one repetition at 70% 1RM, which was increased by 10% after a successful lift. This pattern was followed until volitional fatigue was present. Unilateral values for the left and right limbs were combined (cMUL). A paired samples t-test was used to determine if there was a difference between cMUL and MBL ($p < 0.05$). **RESULTS:** Participants were 22.96 ± 3.72 years old, 170.1 ± 9.3 cm tall, and weighed 73.7 ± 11.50 kg. Although 15 participants presented a BLD, a significant difference was not observed between the MBL (99.0 ± 36.4 lbs) and cMUL (98.3 ± 32.3 lbs). **CONCLUSIONS:** The results did not support the hypothesis that the cMUL would be greater than the MBL. This could be due to the training status of the participants. Future studies are needed to assess training programs and their effect on the occurrence of BLD.

1759 Board #20 May 31 2:00 PM - 3:30 PM
Does a Push-Up Using the Spyder 360™ Elicit More Muscle Activation Compared with a Standard Push-up?

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(No relevant relationships reported)

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%; $p=0.0054$). 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.

1760 Board #21 May 31 2:00 PM - 3:30 PM
Lifespan Physical Fitness Analysis In A University-Sponsored, Guided Exercise Program

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(No relevant relationships reported)

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 training (predicted VO_2 from the YMCA cycle test and skinfold body fat percentage) and resistance training (hand grip strength and push ups). One sample t-tests were used to compare mean data with 50th percentile ranking/good ranking (ACSM), stratified by the following age groups: 20-29 years (n=615), 30-39 years (n=178), 40-49 years (n=62), 50-59 years (n=98), ≥60 years (n=38). **RESULTS:** Regarding outcomes largely influenced by aerobic exercise, $\text{VO}_{2\text{max}}$ values were lower in the male 20s (40.0±12.8 ml/kg/min) and 30s groups (33.7±11.3 ml/kg/min) and the female 20s group (33.8±9.7 ml/kg/min, all $p=0.000$), yet higher in the female 50s group (28.8±5.3 ml/kg/min, $p<0.05$); body fat percentage was higher in the female 20s (27.0±6.6%), 30s (28.0±8.9%), and 40s groups (34.4±8.9%, all $p=0.000$). For outcomes largely influenced by resistance training, grip strength was significantly lower in the male 20s (86.8±24.4 lbs) and 30s (66.0±30.2 lbs, both $p=0.000$) groups, whereas the 60s female group was significantly higher (57.6±12.0 lbs, $p<0.05$); for pushups men performed significantly worse in the 30s (14.0±10.9 repetitions) and 40s (11.2±4.6 repetitions, both $p<0.05$) groups, whereas women performed better in the 20s (19.8±10.9 repetitions), 40s (18.5±10.6 repetitions), and 50s (13.3±8.1 repetitions, all $p=0.000$) groups. **CONCLUSION:** Aerobic fitness was markedly low in the early lifespan for men and women. Specific to genders, muscular fitness was low in men through the 30s and body fat percentage high in women through the 40s. Focus should be placed on enhancing all physical fitness values early in the lifespan to more effectively raise and maintain throughout older adulthood.

1761 Board #22 May 31 2:00 PM - 3:30 PM
Chinese Collegiate Fitness Index Report Based on the Supporting Active Lifestyle Perspective

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(No relevant relationships reported)

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 789 colleges 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) Beijing 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 ($p=0.009<0.05$); The fitness index of the subordinate universities was significantly higher than other two group universities ($p=0.000<0.05$).

ACKNOWLEDGEMENT: Supported by NPOSS Grant 15CTY011, and Fundamental Research Funds for the Central Universities SWU1709240.

1762 Board #23 May 31 2:00 PM - 3:30 PM
Unsupervised Home-based Intermittent Walking Effectively Improves Physiological and Psychological Health

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(No relevant relationships reported)

Laboratory-based intermittent exercise (IE) improves exercise tolerance and other independent cardiovascular disease (CVD) risk factors in a range of populations. For IE to be truly effective this must translate to the unsupervised home environment, and overcome key perceived barriers to exercise participation. This requires that the exercise be achievable, but of a sufficient intensity to drive physiological adaptations, and also promote increases in health-related quality of life (HRQoL). **PURPOSE** To investigate whether unsupervised home-based IE walking presents an achievable, but sufficient, physiological stimulus to reduce perceived barriers to exercise, CVD risk and, as a consequence, increase HRQoL in an overweight, but otherwise healthy population. **METHODS** 25 participants (45 ± 10 yr; 32 ± 3.8 kg/m²; 10 m, 15 f) undertook 12 weeks of home-based IE walking, completing 3 sessions/week and 32 min/session of IE_{SHORT}; 60 s of fast walking interspersed with 60 s recovery, or IE_{LONG}; 4 min of fast walking interspersed with 4 min recovery. Pre- and post-IE training, perceived barriers to exercise, maximal oxygen uptake ($\text{VO}_{2\text{max}}$), body mass, blood pressure (BP), resting heart rate (HR), blood biomarkers, and HRQoL were all measured using standard techniques. **RESULTS** Perceived barriers to exercise were reduced following IE ($p<0.05$), this was largely driven by reductions in IE_{LONG} (IE_{LONG} vs. IE_{SHORT}: 11 ± 13 vs. 3 ± 15 % reduction). Body mass index and resting HR were both reduced following IE ($p<0.05$); however, blood biomarkers and BP were unchanged. $\text{VO}_{2\text{max}}$ increased following IE ($p<0.05$; pre-post increase vs $\text{VO}_{2\text{max}}$: IE_{LONG} 2.7 ± 3.7; IE_{SHORT} 1.6 ± 2.6 ml·kg⁻¹·min⁻¹). HRQoL increased following IE, with this a consequence of an increase in IE_{LONG} (IE_{LONG} vs. IE_{SHORT}: 23 ± 22 vs. 7 ± 15 % increase; $p<0.05$). It is also noteworthy that adherence to IE_{LONG} was greater than IE_{SHORT} (78 ± 24 vs. 58 ± 36 %; $p<0.05$). **CONCLUSION** Home-based IE walking was achievable and provided a sufficient exercise stimulus to improve physiological

and psychological markers of health in an overweight, but otherwise healthy population. IE_{LONG} may be more effective than IE_{SHORT} for reducing barriers to exercise, CVD risk and increasing HRQoL. Support: Heart Research UK RG2631

1763 Board #24 May 31 2:00 PM - 3:30 PM
Examination of the Relationship between Handgrip Strength and Upper Body Muscular Endurance in College-age Females

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 (No relevant relationships reported)

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 \pm 2.5, range 18-27), and performed an average of 11.7 push-ups (SEM \pm 1.30, range 0-47). Their average right and left handgrip was 35.1 kg (SEM \pm 0.63) and 32.8 kg (SEM \pm 0.62), respectively. Both Spearman rank and Kendall's Tau correlations showed no significant 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.

1764 Board #25 May 31 2:00 PM - 3:30 PM
Effects Of A 12-minute Daily Physical Activity Intervention On Health Measures Of Office Workers

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 (No relevant relationships reported)

Office workers are known to sit for 65-75% of their working hours. Prolonged sedentary behaviour is linked to chronic disease. Physical activity programmes offered at the worksite tend to be generally attended only by the fitter or highly motivated office workers and are still unsuccessful in the long-term.

PURPOSE: To investigate the effects of a six-week 'bite size' physical activity intervention (3 x 4 minutes daily) on health measures and exercise adherence of office workers.

METHODS: Forty office workers employed in administrative positions (age range 24 to 59 yrs) performed a series of physiological measurements including body mass (BM; kg), body fat (BF; %), blood pressure (BP; mmHg), resting heart rate (HR; bpm), waist to hip ratio (WHR), upper and lower body endurance test (number of push ups and timed wall squat), and core endurance (timed plank; s) at baseline and at the end of the study. For the bite size intervention, participants worked in small groups and completed nine stretch and strengthening exercises in approximately 4 min, three times a day, for 6-weeks. Participants also completed a Wellness questionnaire pre- and post-intervention and recorded their adherence to sessions in a self-administered log.

RESULTS: The bite size intervention significantly improved muscular endurance of the upper body (pre: 11.6 ± 3.5 v post: 20.1 ± 2.6 push ups), lower body (8.36 ± 4.2 v 22.7 ± 5.6 s; $p = 0.001$) and core (43.2 ± 6.1 v 50.8 ± 4.8 s; $p = 0.005$). No significant effects were found for BM, BF% or WHR, HR or BP (all at $p > 0.05$). Wellness questionnaire results showed improved mood, sleep quality and reduction in stress levels and fatigue post-intervention. Adherence rate was 67.5%, as only 13 participants completed the intervention. **CONCLUSIONS:** The improvements in upper/lower and core endurance shown in this study could be beneficial in improving posture and alleviating low back pain often experienced by office workers due to prolonged sitting. Bite size exercise in just four minutes 3x a day might be a time saving and effective alternative to previous methods aiming to improve the health and well being of office workers.

1765 Board #26 May 31 2:00 PM - 3:30 PM

Bone Strength Differences According to Peak Power Norm Table Categories

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 (No relevant relationships reported)

Purpose: To determine if a commonly used peak power (PP) norm table (Patterson & 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. Moment of Inertia (J), Cortical Area (Ct. Ar), cortical Bone Mineral Density (cBMD), and Strength-Strain Index (SSI) were measured using peripheral Quantitative Computed Tomography (pQCT) to quantify bone strength at the 50% tibia site. A one-way ANOVA and a Tukey post hoc test assessed differences between PP categories at a significance level of $p < 0.05$ (Graphpad Prism). **Results:** Bone strength variables were significantly different between PP norm table categories, except cBMD in males. Females: SSI ($p = 0.0001$), J ($p = 0.0001$), Ct.Ar ($p = 0.0001$), cBMD ($p = 0.0063$). Males: SSI ($p = 0.0457$), J ($p = 0.0101$), Ct.Ar ($p = 0.0226$). Post hoc testing revealed a significant difference between the Well Above Average and Well Below Average groups 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.

1766 Board #27 May 31 2:00 PM - 3:30 PM

Aerobic And Anaerobic Parameters Of A Three-minute All-out Test Are Associated With Rowing Performance

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 (No relevant relationships reported)

Critical power can be estimated utilizing a three-minute all-out exercise test. The 2000-m rowing test is utilized by US rowing as a standard test for all of their rowers. Critical power has been reported to predict 2000-m rowing performance, however the three-minute all-out test has not been used to predict 2000-m rowing performance.

PURPOSE: The purpose of this study was to examine the relationship between 2000-m rowing performance and the parameters of a three-minute all-out rowing test in collegiate club rowers.

METHODS: Ten (F=6, M=4) collegiate rowers (mean \pm SD; age 19.3 ± 1.2 y; height 176.7 ± 10.0 cm; weight 75.6 ± 19.5 kg) completed a peak power test to determine peak power output (PPO) and a one-minute all-out test, a three-minute all-out test to determine end-power (EP) and work done above end-power (WEP), and a 2000-m time trial on a rowing ergometer. Testing days were separated by 72 hours and began with a five-minute warm-up on the rowing ergometer. The peak power, one-minute, and three-minute tests were all completed on a damper setting 10 whereas the 2000-m time trial was completed at a self-selected damper setting. Repeated measures ANOVA was used to compare PPO for all the tests and Pearson's product moment correlations were conducted to measure the relationships between 2000-m time and the parameters of the all-out rowing tests.

RESULTS: The strongest relationship with 2000-m time was average power for the 3-minute test ($r = -0.968$, $p < 0.001$). Additionally, 2000-m time was significantly correlated with EP ($r = -0.931$, $p < 0.001$), average power during 1-minute test ($r = -0.784$, $p < 0.01$), and PPO ($r = -0.762$, $p = 0.01$). Work above end-power (WEP) was significantly related to PP of all the tests. There were significant differences between PP for all tests ($p < 0.01$).

CONCLUSIONS: These results suggest that a single 3-minute all-out rowing test can predict both peak power output and 2000-m time, therefore rowing coaches could use this test to more efficiently assess rowers.

- 1767 Board #28 May 31 2:00 PM - 3:30 PM
Counting Talk Test Measurements and the Relationship to Heart Rate for Exercise Prescription
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 (Sponsor: John Porcari, FACSM)
 (No relevant relationships reported)

BACKGROUND: 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 ± 1.6 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) \times 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 HR 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.

- 1768 Board #29 May 31 2:00 PM - 3:30 PM
Effects of Eight Weeks of Self-Determined Training on Cardiorespiratory Fitness in Recreationally Trained Females
 Anthony J. Bull, Julia Lauzon, Kaitlyn DiMarco. *Colorado College, Colorado Springs, CO.* (Sponsor: Terry J. Housh, FACSM)
 (No relevant relationships reported)

Maintaining or increasing cardiorespiratory fitness (CRF) throughout a training season can be challenging for recreationally trained endurance athletes. Even if athletes intend to increase training during a training season, variables such as the total number of minutes they train per week ($\text{min} \cdot \text{wk}^{-1}$) and/or the $\text{min} \cdot \text{wk}^{-1}$ of moderate to high intensity training (MHIT) they participate in may affect these athletes' ability to maintain or increase CRF. **Purpose:** The purpose of this study was twofold: 1) to examine changes in CRF over 8 weeks of self-determined training in recreational female endurance athletes who indicated they planned to increase training $\text{min} \cdot \text{wk}^{-1}$; and 2) to examine changes in minutes of total training and MHIT per week from self-reported exercise logs from weeks 1 and 8. **Methods:** Fourteen recreationally trained female endurance athletes (cyclists ($n=4$) and runners ($n=10$)), all of whom had a baseline $\text{VO}_{2\text{max}} \geq 80^{\text{th}}$ percentile for their age, completed incremental running or cycling trials to exhaustion to determine $\text{VO}_{2\text{max}}$, and provided 7 d exercise training logs at weeks 1 and 8. Runners completed incremental trials on a motorized treadmill, cyclists completed trials on an electronically braked cycle ergometer, and expired gases were measured with a metabolic system during all trials. To record training, athletes were instructed on the use of the Borg RPE scale (15-grade scale) to estimate exercise intensity (I), and were asked to record exercise min and I independently for all phases of exercise sessions. MHIT was considered to be any exercise $I \geq$ an RPE of 13 (Somewhat Hard to Maximal Exertion on the Borg scale). **Results:** There was no significant change in mean $\text{VO}_{2\text{max}}$ values in weeks 1 vs. 8 ($p=0.062$, 46.50 ± 3.68 vs. $45.87 \pm 4.21 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$). There was also no significant change in mean total training minutes ($p=0.32$, 601.8 ± 221.4 vs. $551.9 \pm 194.2 \text{ min} \cdot \text{wk}^{-1}$) or mean total MHIT minutes ($p=0.38$, 272.5 ± 193.3 vs. $334.5 \pm 218.1 \text{ min} \cdot \text{wk}^{-1}$) in weeks 1 vs. 8. **Conclusions:** On average, CRF was maintained during the 8 weeks of self-determined recreational training. In addition, we found that average total training min and MHIT min did not change for this group in weeks 1 vs. 8, even though these recreational endurance athletes intended to increase their training during this 8-week period.

- 1769 Board #30 May 31 2:00 PM - 3:30 PM
The Impact of Exercise on Stress Management in Federal Officers
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 (No relevant relationships reported)

Many Federal Officers (FO) serve in a high-stress, yet highly sedentary position. This combination places FO at greater risk for a variety of health issues. **PURPOSE:** The purpose of this descriptive study was to examine the level of physical fitness in FO and determine the relationship between exercise (EX) on Quality of Life (QoL) scores. **METHODS:** A total of 19 FO participated in this study (10 males and 9 females; mean \pm SD age = 39.1 ± 8.1 y, height = 172.1 ± 8.6 cm, weight = 75.9 ± 15.3 kg, and BMI = $25.5 \pm 3.8 \text{ kg/m}^2$). The Cooper's Test of physical fitness (1.5 mile run, 1-min max push-ups, 1-min max sit-ups, and vertical jump) as well as a 150m shuttle run and max grip strength were performed before and after six-months of unsupervised, voluntary exercise. In addition, subjects completed weekly online surveys indicating EX type, weekly total EX time, feelings of well-being, and a 10-point questionnaire on weekly stress (QoL). **RESULTS:** Time reported performing cardiorespiratory and resistance training was slightly below ACSM recommendations (cardio = 129.5 ± 20.3 min/week, resistance = 81.0 ± 18.5 min/week). A paired-samples t-test showed no significant changes in any anthropometric scores after 6-months of unsupervised training. Baseline vs 6-month Cooper's Test fitness results showed no significant changes with the exception of performance on the Sit-&-Reach (pre = 34.5 ± 9.2 cm, 6-month = 41.9 ± 8.8 cm, $p < 0.05$). There was little to no correlation between QoL scores and amount or type of EX (average $r^2 = 0.03$). During follow up interviews, some participants indicated they were less likely to respond to weekly surveys if they did not exercise that week. The average response rate ranged from 36% to 80%. **CONCLUSIONS:** While EX is an important element for overall health and well-being, in FO there was little connection between amount of type of EX and overall QoL.

- 1770 Board #31 May 31 2:00 PM - 3:30 PM
Measured Fitness and Self-Reported Exercise and Stress in Law Enforcement Officers: A Longitudinal Study
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 (No relevant relationships reported)

The job duties of law enforcement officers (LEO) are highly sedentary and stressful. **PURPOSE:** The purpose of this year-long descriptive study was assess physical activity levels in LEO and to determine if self-reported stress indicators were related to exercise. **METHODS:** Twelve LEO completed a 12-month unsupervised exercise program (7 males and 5 females; age = 38.5 ± 7.6 y, height = 171.4 ± 9.2 cm, weight = 77.2 ± 16.4 kg, body fat % = 25.7 ± 6.1 , BMI = $26.0 \pm 4.2 \text{ kg/m}^2$). Participants completed the Cooper's Test of physical fitness as well as a 150m shuttle run and max grip strength at baseline, at 6-months and again at 12-months. Participants also completed an online survey indicating EX type, weekly total EX time, feelings of well-being, and a 10-point questionnaire on weekly stress. **RESULTS:** Survey response rates ranged from 36% to 80% over the course of the study. Reported cardiorespiratory and resistance training exercise levels were slightly below ACSM recommendations (cardio = 145.0 ± 34.4 min/week, resistance = 58.4 ± 15.7 min/week). Time was significantly lowered ($p=0.002$) in the 1.5 mile run over a 12 month period. No significant changes were observed in body weight ($p=0.149$) or BMI ($p=0.447$); however, body fat percentage was significantly reduced by 2.61% ($p=0.47$). Total 12 month volume of exercise in LEO did not meet ACSM recommendations and was ineffective in changing self-reported stress ($r=-0.037$, $p>0.05$). In addition, some subjects indicated reduced weekly response rate because they did not exercise that week. **CONCLUSIONS:** The overall level of fitness among the tested sample of LEO was in the fair category. A 12-month, unsupervised training program of this particular volume was sufficient in maintaining fitness parameters but did not influence self-reported stress in this law enforcement population.

1771 Board #32 May 31 2:00 PM - 3:30 PM
Association Between Anthropometric Characteristics And Aerobic Capacity In Firefighters

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(No relevant relationships reported)

Firefighting is a physically demanding profession with high requirements for aerobic capacity (VO_{2max}). However, this population has a high rate of obesity, consistent with the general population. Previous research in general populations has identified a relationship between VO_{2max} and anthropometrics, specifically the impact of body weight and lean body mass. Moreover, research suggests an association between increased percent body fat (%BF) and decreased aerobic and strength measures in similar tactical populations such as military. However, this relationship has not been thoroughly examined in firefighters. **PURPOSE:** To determine the association between anthropometric characteristics and VO_{2max} of firefighters. **METHODS:** Eighteen healthy firefighters (Age= 39.9 ± 11.0 years; Body Mass Index (BMI)= 28.0 ± 3.4 kg/m²; %BF= 27.1 ± 8.7%; Waist to Hip Ratio (WHR)= 0.88 ± 0.04; VO_{2max} = 41.2 ± 7.5 ml/kg/min) completed measurements of anthropometry (height, weight, bioelectrical impedance analysis, waist and hip circumferences) and a treadmill graded exercise test (GXT) to determine VO_{2max} utilizing open circuit spirometry. Normality was assessed, and Pearson correlation and Spearman coefficients were used when appropriate to determine the associations between VO_{2max} and anthropometric characteristics (BMI, %BF, WHR). **RESULTS:** Data revealed a significant moderate correlation ($r = -0.636$; $p = 0.005$) between %BF and VO_{2max} , indicating that higher levels of body composition are related to lower VO_{2max} . No relationship was found between BMI and VO_{2max} ($r = 0.05$; $p = 0.845$), and the association between WHR and VO_{2max} approached significance ($r = -0.462$; $p = 0.053$). **CONCLUSION:** Results of the current investigation suggest %BF may be associated with maximal aerobic capacity. Additionally, data revealed no significant relationship between BMI and VO_{2max} , suggesting that total body weight may not have a significant impact on aerobic capacity. Future research should continue to investigate the effects that maintaining an ideal body composition have on work performance and injury risk, including the negative effects of obesity on thermoregulation in job specific tasks for firefighters.

1772 Board #33 May 31 2:00 PM - 3:30 PM
Validity of Hit & Turn Tennis Test in Estimating Aerobic Capacity with Amateur Players

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(No relevant relationships reported)

Validity of Hit & Turn Tennis Test (H&TTT) in Estimating Aerobic Capacity with Amateur Players

The Hit & Turn Tennis Test (H&TTT) is an acoustically controlled on-court test designed for evaluating tennis-specific endurance. Performance levels achieved during this test has been proposed to estimate the peak oxygen uptake (VO_{2peak}), but the validity of the regression equations warrant further investigation.

Purpose: To evaluate the validity of H&TTT in estimating VO_{2peak} .

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 field. A portable spirometric system (K4b², Cosmed, Italy) was utilized to measure the ventilatory activities to calculate VO_{2peak} during the test. VO_{2peak} was also estimated with a H&TTT regression equation ($VO_{2peak} = [Level * 2 + 30] \text{ ml/min/kg}$). Additionally, for the directly measured ventilator activities two smoothing methods (5 vs. 3 successive points) were utilized to process VO_2 data, and five different methods (the highest consecutive 5 points vs 5s vs 10s vs 15s) were utilized to calculate VO_{2peak} .

Result: The levels subjects achieved in H&TTT were 14.6 ± 3.4. The estimated VO_{2peak} were 59.3 ± 6.7 ml/min/kg using the regression equation. The calculated VO_{2peak} using different smoothing methods and criterion ranged between 53.5 ± 5.1 and 57.7 ± 6.0 ml/min/kg. No significant correlation was found between estimated and calculated VO_{2peak} ($r < 0.3$, $p > 0.05$). Significant differences were found for calculated VO_{2peak} using different smoothing methods and criterion ($p < 0.01$).

Conclusion: Inconsistent with the literature, the validity of H&TTT in estimating VO_{2peak} 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 VO_2 from direct measurements.

D-57 Free Communication/Poster - Resistance Training

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

1773 Board #34 May 31 2:00 PM - 3:30 PM
Ambulation and Physical Function after Eccentric Resistance Training in Adults with Incomplete Spinal Cord Injury

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(No relevant relationships reported)

Strengthening the lower extremities positively influences walking mechanics for people with a neurological deficit. Eccentric resistance training (ERT) is a potent stimulus for the development of muscular strength characterized by low metabolic demand. This mode of training may serve to benefit those with incomplete spinal cord injuries (iSCI) seeking to improve ambulatory capacity.

PURPOSE: Determine the effect of ERT on walking speed, mobility, independence, and at-home function in those with iSCI. A secondary goal was to evaluate the relationship of daily step activity to ambulation and physical function variables.

METHODS: Training intervention with pre-, mid-, post-assessments. Adults ($N = 11$) with longstanding (> 1 year) iSCI, with no concurrent musculoskeletal injuries or lower extremity strength training, trained twice a week for 12 weeks on a motor driven, eccentrically biased recumbent stepper. Walking speed (10 meter walk test; 10MWT), mobility (timed up and go; TUG), independence (Walking Index for Spinal Cord Injury; WISCI), and at home function (Spinal Cord Independence Measure; SCIM) were assessed at baseline, after 6 weeks, and after 12 weeks of ERT. **RESULTS:** There were improvements in walking mobility ($p = .034$, $d = 0.62$), speed ($p = .005$, $d = .23$), and independence ($p = .004$, $d = .73$) after 12 weeks of ERT. At home function was unchanged ($p = .10$, $d = .12$). The TUG and 10MWT were correlated with step activity at mid- and post-test whereas the WISCI was significantly related at mid-test. **CONCLUSION:** The ERT improved walking function in the absence of gait training. Training on an isokinetic ergometer to improve eccentric strength promoted independence and, may potentially improve exercise self-efficacy. Additionally, this mode of ERT may diminish therapist burden in programs designed to improve ambulatory capacity or strength in those with iSCI.

1774 Board #35 May 31 2:00 PM - 3:30 PM
Preservation Of Explosive Force In Long-term Strength Trained Elders Is Determined By Neural Adaptations

Lucas B. R. Orsatto¹, Matheus J. Wiest², Bruno M. Moura¹, David F. Collins³, Fernando Diefenthaler¹. ¹Universidade Federal de Santa Catarina, Florianópolis, Brazil. ²Toronto Rehabilitation Institute, Toronto, ON, Canada. ³University of Alberta, Edmonton, AB, Canada.

(No relevant relationships reported)

Preservation of explosive force in long-term strength trained elders is determined by neural adaptations

PURPOSE: To understand the effects of long-term strength training in the neural and contractile properties of explosive force in young adults and elders. **METHODS:** 54 healthy males were divided in four groups: untrained young control (YC - $n = 14$; 26 ± 4 yrs), untrained elder control (EC - $n = 14$; 66 ± 3 yrs), strength trained young (YT - $n = 14$; 27 ± 3 yrs), and strength trained elder (ET - $n = 12$; 64 ± 4 yrs). Knee extension isometric torque was recorded during: 1) maximum voluntary isometric contractions (MVIC; peak torque); 2) explosive voluntary contractions (rate of torque development - RTD at 0-50 and -150 ms); and 3) supramaximally-evoked octets (8 pulses at 300 Hz; torque at 50 and 75 ms). Surface electromyography (sEMG; 0-50, 50-100 ms) of the quadriceps muscle was recorded during explosive contractions and was normalized to the MVIC sEMG root mean square (RMS) data. The skeletal muscle index (SMI) was estimated using DXA. One-way ANOVA (Tukey post hoc) was used to compare groups. **RESULTS:** Displayed in table 1.

Table 1. SMI, MVIC and octets torque, RTD and sEMG (mean ± SD).

Variables	EC	ET	YC	YT
SMI (kg/height ²)	8.9 ± 1.0 ^A	10.0 ± 1.3 ^B	9.3 ± 0.9 ^{AB}	11.5 ± 0.7 ^C
MVIC peak torque (N·m)	212 ± 39 ^A	245 ± 50 ^{AB}	290 ± 55 ^B	358 ± 67 ^C
RTD (N·m·s ⁻¹)	0-50 ms	981 ± 219 ^A	1340 ± 252 ^B	1396 ± 483 ^B
	0-150 ms	870 ± 182 ^A	1125 ± 195 ^B	1255 ± 291 ^B
Octet torque (N·m)	50 ms	52 ± 18 ^A	62 ± 12 ^A	77 ± 13 ^B
	75 ms	72 ± 29 ^A	85 ± 17 ^A	112 ± 19 ^B
sEMG (% RMS)	0-50 ms	39 ± 13 ^A	83 ± 24 ^B	35 ± 14 ^A
	50-100 ms	95 ± 28 ^{AB}	119 ± 25 ^C	80 ± 25 ^B
				106 ± 18 ^{AC}

Different letters within the same factors are significantly different ($p < .05$).

CONCLUSIONS: Strength training optimizes the RTD through different mechanisms. YT benefited from adaptations in the neural (increased activation capacity - sEMG) and intrinsic contractile (i.e. increased octet torque) properties of the neuromuscular system. ET showed higher RTD due to adaptations in the neural (sEMG: ET > EC and YC) but not in the intrinsic contractile (Octet torque: ET = EC) properties. YC showed greater intrinsic contractile capacity than ET; however, the lower magnitude of muscle activation during the explosive contractions limited YC RTD, resulting in similar performance compared to ET. Thus, long-term strength training preserves explosive force in elders mainly due to positive neural adaptations.

1775 Board #36 May 31 2:00 PM - 3:30 PM

Suspended Weight Training During Squats: Does It Improve Balance More Than Traditional Squats?

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(No relevant relationships reported)

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. **PURPOSE:** 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 38 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 for 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 calculated between the percent of leg length scores pre-test and post-test. An independent samples t-test was conducted between these difference scores. Finally, a paired samples pre and post t-test was conducted within groups to see if there were any significant improvements within each group. **RESULTS:** The mean percent change of both the control (2.13±4.42%) and treatment (0.60±6.37%) groups improved slightly from pre-test to post-post but there were no significant differences ($t = 0.79$, $p = 0.44$) between the two groups. The paired samples t-test were not significant for the traditional squat (pre mean = 99.80 ± 8.30%, post mean = 101.93 ± 7.11%, $t = 1.92$, $p = 0.074$) or the suspended loaded squat (pre mean = 99.70 ± 6.86%, post mean = 100.30 ± 7.94%, $t = .375$, $p = 0.71$), indicating that neither technique significantly improved balance. **CONCLUSION:** The results of this study indicate that completing traditional or suspended weight squats as part of an overall 6-week strength and conditioning program will not lead to significant improvements in balance in highly trained college athletes.

1776 Board #37 May 31 2:00 PM - 3:30 PM

Male And Female Fatigue Responses To Heavier- And Lighter-load Lumbar Extension Resistance Training

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(No relevant relationships reported)

The literature has suggested higher endurance levels in females compared to males, allowing them to withstand fatigue for a longer period. Though these gender disparities are well supported research is specific to muscle groups, and disparity in fatigue between sexes are less significant when load of resistance increases. **PURPOSE:** To determine force and fatigue differences in the lumbar extensors between males and females following heavy- (HL) and light-load (LL) exercise conditions. **METHODS:** A sample of 17 recreationally active participants (9 males; 23.8 yrs, and 8 females;

21.3 yrs) were tested for maximal voluntary isometric torque (MVIT) of the lumbar extensors before, and immediately following 3 conditions; dynamic lumbar extension exercise at 80% (HL) and 50% (LL) of MVIT and a non-exercising control condition (CON). The three conditions were performed in a randomised order with no less than 72 hours between conditions. Fatigue comparisons between sex and condition were made using ANOVA with repeated measures. **RESULTS:** Analyses revealed a significant effect by condition for absolute change in strength ($p < 0.001$), furthermore there was a significant interaction effect ($p < 0.016$). Independent t -tests revealed differences in decrement in maximal force between males and females for heavy ($p = 0.04$; males = -18.7%, females = -12.0%) and light-load ($p = 0.005$; males = -29.3%, females = -25.9%).



CONCLUSION: Fatigue responses in the lumbar extensors 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.

1777 Board #38 May 31 2:00 PM - 3:30 PM

Effects of Vibration Resistance Training on Bone Mineral Density of Postmenopausal Females

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(No relevant relationships reported)

PURPOSE: To determine the effects of vibration resistance training on bone mineral density (BMD) of postmenopausal females, and to compare the results of different resistance trainings.

METHOD: Forty eight postmenopausal females (66.1±0.9 yrs) were randomized into two groups. One group participated in a conventional resistance training (CRT), and another completed a vibration resistance training (VRT) on lower limbs 40 min one day, 3 days a week for 24 weeks. BMD at spine, femur neck and greater trochanter were determined before and after trainings. Data were compared and analyzed using 2-way repeated measures ANOVA.

RESULTS: There was no obvious before-after change in BMD at spine (1.06±0.04 vs. 1.07±0.05 g/cm²; $p > 0.05$, ES=1.92, but a positive change at femur neck (0.82±0.05 vs. 0.86±0.04 g/cm²; $p < 0.05$, ES=26.50) and greater trochanter (0.73±0.03 vs. 0.78±0.03 g/cm²; $p < 0.05$, ES=17.52) of postmenopausal females in CRT group. BMD at spine (1.07±0.05 vs. 1.10±0.03 g/cm²; $p < 0.05$, ES=7.91), femur neck (0.83±0.04 vs. 0.93±0.03 g/cm²; $p < 0.05$, ES=19.26) and greater trochanter (0.73±0.04 vs. 0.80±0.06 g/cm²; $p < 0.05$, ES=4.88) were elevated significantly in VRT group after training. BMD at each part was increased greater in CRT group than those in VRT group.

CONCLUSIONS: While CRT on lower limbs was more effective in improving BMD of the femur region in postmenopausal females, VRT showed a more significant improvement at both spine and femur regions. Therefore, VRT may be a more effective intervention for promoting core strength and balance ability, as a result for reducing fall frequency of postmenopausal females. The effectiveness of a combined CRT and VRT should be examined.

1778 Board #39 May 31 2:00 PM - 3:30 PM

Impact of a Restricted Breathing Mask on Proteolytic Activity Post Resistance Training

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(No relevant relationships reported)

Circulating glucocorticoids are elevated during stressful situations and act as an inhibitor of protein synthesis through varied mechanisms. Evidence suggests the stimulation of glucocorticoids on muscle proteolysis also occurs with activation

of the UPS, the lysosomal system (autophagy), and the calcium-dependent calpain system. **PURPOSE:** To define the impact a restricted breathing mask (RBM) has on serum cortisol and proteolytic genes during resistance exercise. **METHODS:** In a counterbalanced cross-over design, ten resistance trained male participants (20.3 ± 1.3 years) performed two separate testing sessions, RBM and No Mask, consisting of squat, leg press, and leg extension. Muscle samples were obtained at baseline, 3hr, 6hr, and 24hr post-exercise. Blood samples were obtained at baseline, 30min, 3hr, 6hr, and 24hr post-exercise. From each muscle sample, glucocorticoid receptor-DNA (GR-DNA) binding and mRNA expression of Atrogin-1, Foxo1, MuRF1, MAFbx, Myostatin, and REDD1 were determined. Two-way repeated-measures analyses of variance (ANOVA) were performed with condition and time as main effects ($p \leq 0.05$). **RESULTS:** No significant interactions between session and time for Atrogin-1, Foxo1, MuRF1, MAFbx, Myostatin, and REDD1. There was no main effect for session for serum cortisol. There was a significant interaction between session and time for GR-DNA binding. For the RBM session, compared to baseline GR-DNA binding was significantly elevated at 3-hr ($p = .007$), 6-hr ($p > .001$), and 24-hr ($p = .002$) post-exercise. **CONCLUSION:** The use of a RBM failed to affect serum cortisol or alter the mRNA expression of proteolytic genes. However, there was an increase in delta change GR-DNA binding during the RBM compared to the no mask session.

1779 Board #40 May 31 2:00 PM - 3:30 PM
Comparative Responses To Squats Done With Free Weights And An Exoskeleton.

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(No relevant relationships reported)

PURPOSE: To compare physiological, performance and perceptual responses to the squat exercise done with a barbell, to those using an exoskeleton (Institute of Human and Machine Cognition; Pensacola FL) designed for use during manned space flight. **METHODS:** Subjects ($n = 15$) made four laboratory visits, which began with two familiarization sessions on the exoskeleton, followed by two squat workouts in which the exercise mode (exoskeleton, barbell) was administered in a randomized sequence. Per workout they performed four repetitions each against progressively heavier (23, 34, 45.5 and 57 kg) loads separated by 90-second rests. A series of physiological, performance and perceptual data from the final two laboratory visits were collected before, during and after workouts. Per workout, we collected the same dependent variables. Z-scores were used to identify outliers, which along with its paired value from the other workout, were eliminated from further analyses. To assess data validity, dependent physiological, performance and perceptual variables from each workout were compared with paired t-tests and Cohen's d. **RESULTS:** All subjects completed each workout (100% compliance). Z-scores results show less than 0.5% of our total data were deemed outliers. Average t-test and Cohen's d values were 0.68 and 0.25 respectively. **CONCLUSIONS:** Prior research suggests t-test and Cohen's d values less than 1.0 and 0.4 respectively denote acceptable degrees of data similarity. Based upon these guidelines, current results denote an acceptable degree of data validity derived from exoskeleton squats. We conclude exoskeleton squats yield physiological, performance and perceptual responses like those done with a barbell, and warrant continued inquiry involving microgravity simulation in human subjects.

1780 Board #41 May 31 2:00 PM - 3:30 PM
A Comparison Between Bench Press and Overhead Press Concentric Velocity and Power

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(No relevant relationships reported)

Measuring average concentric velocity (ACV) during barbell exercises can be used for autoregulation of training loads; however, research is needed to clarify the load-velocity relationship for different barbell exercises. Training age, frequency, relative strength and limb length may influence the ACV on an individual basis. **PURPOSE:** To compare the ACV of the bench press and press over a spectrum of relative loads and to determine the influence of training age, frequency, relative strength, and limb length on ACV for the bench press (BP) and overhead press (OHP). **METHODS:** BP and OHP one-repetition maximum (1RM) was assessed in fifty-one individuals (33 males, 18 females). Height, body mass, and humerus length were measured while training age and frequency were obtained via questionnaire. ACV was measured during warm-up sets and 1RM attempts using a TENDO Power and Speed Analyzer. Relative 1RM was calculated as the 1RM divided by body mass. Average power (AP) was calculated as the load (kg) multiplied by 9.81 m/s² multiplied by the ACV. Paired samples t-tests were used to determine differences in ACV and AP between the BP and OHP at loads 35-100% 1RM. Pearson's product moment correlations were used to determine relationships between variables. **RESULTS:** ACV values were significantly ($p < 0.05$) greater for the OHP compared to the BP at all submaximal loads (35-95% 1RM) as well as the 1RM (0.24 ± 0.09 vs. 0.18 ± 0.07 m/s; $p < 0.01$). AP values were significantly

greater ($p < 0.05$) for the BP compared to the OHP at loads $\leq 85\%$ 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 1RM ACV were significantly ($p > 0.05$) related to humerus length, training age, or training frequency. Only BP 1RM ACV 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.

1781 Board #42 May 31 2:00 PM - 3:30 PM
A Comparison Between Squat And Deadlift Concentric Velocity And Power

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(No relevant relationships reported)

The average concentric velocity (ACV) of barbell exercises can be used to adjust training loads (autoregulation). The velocity ranges used for autoregulation can vary and research is needed to clarify the load-velocity relationship for each exercise. Anthropometric factors and training history may also affect the load-velocity relationship. **PURPOSE:** To compare the ACV of the squat and deadlift over a spectrum of relative loads and to determine the influence of training age, training frequency, limb length, and relative strength on ACV for the squat and deadlift. **METHODS:** One-repetition maximum (1RM) for the squat and deadlift was assessed in fifty-one individuals (33 males, 18 females). Height, body mass, and femur length were measured while training age and frequency were obtained via questionnaire. ACV was measured during warm-up sets and 1RM attempts using a TENDO Power and Speed Analyzer. Relative 1RM was calculated as the 1RM divided by body mass. Average power (AP) was calculated as the load (kg) multiplied by 9.81 m/s² multiplied by the ACV. Paired samples t-tests were used to determine differences between the squat and deadlift. Pearson's product moment correlations were used to determine relationships between variables. **RESULTS:** ACV values were significantly ($p < 0.05$) greater for the squat compared to the deadlift at loads $\geq 55\%$ 1RM including the 1RM (0.26 ± 0.08 vs. 0.22 ± 0.10 m/s; $p = 0.004$). AP values were significantly greater ($p < 0.05$) for the deadlift compared to the squat at loads $\leq 55\%$ 1RM but similar at loads $\geq 65\%$ 1RM including the 1RM (321 ± 134 vs. 317 ± 141 watts/kg; $p = 0.844$). Squat 1RM ACV was significantly related to relative strength ($r = -0.297$; $p = 0.033$). Deadlift 1RM ACV was significantly related to relative strength ($r = -0.308$; $p = 0.028$) and training frequency ($r = -0.489$; $p < 0.001$). **CONCLUSION:** These data suggest velocity ranges used for autoregulating training loads should not be used interchangeably for the squat and deadlift; Deadlift velocity ranges should be lower than squat velocity ranges for the same relative loading. Velocity ranges for both exercises 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

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(No relevant relationships reported)

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 on strength asymmetry between limbs. **METHODS:** Ten volunteers (8 male, 2 left hand dominant) completed twelve training visits 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 MVIC 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 compare the mean strength asymmetry scores before and after the training intervention. **RESULTS:** There was a significant ($P = 0.031$) mean difference in the direction of strength asymmetry post-training (mean \pm SD: $-2.21 \pm 5.83\%$, range: $-9.8 - 4.5\%$) compared to baseline (mean \pm SD: $2.12 \pm 5.34\%$, range: $-5.9 - 9.7\%$). However, the magnitude of asymmetry was unchanged ($P = 0.875$). **CONCLUSIONS:** The mean strength asymmetries were relatively small

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

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(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 ($\dot{V}O_{2max}$), cognitive performance, and total mood disturbance (TMD). Participants were then randomly placed into one of two experimental groups. The two groups were 90-seconds (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 ($p=0.041$). 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?

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(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 (SCC), certified by the U.S. Track and Field and Cross Country Coaches Association (USTFCCCA). The National Collegiate Athletic Association (NCAA) only requires a nationally-accredited strength and conditioning certification program and USTFCCCA is one of them. This revised 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 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. The response rate was 60%. 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 SCC credential is essential for most NCAA teams. The regulation of the strength and conditioning

world is crucial to prevent future incidents of unsafe and therefore, ineffective exercise prescription. Without accounting for other factors, the process of obtaining a CSCCa certification could be a potential solution to increase the effectiveness of SCCs.

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

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(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% 1RM & 8RM) 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 1 way ANOVA with repeated measures on 2 factors (group and time). Statistical analysis revealed that there was no significant main effect for group (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.

RMR Measurement	1	2	3	4	5	6	7
Experimental (kcal)	1922.76 ± 118.57	2199.89 ± 118.57	2426.10 ± 118.57	2066.59 ± 118.57	2427.42 ± 118.57	2205.77 ± 118.57	2008.55 ± 118.57
Control (kcal)	1783.70 ± 118.57	2336.24 ± 118.57	2189.38 ± 118.57	2010.28 ± 118.57	2392.67 ± 118.57	2180.48 ± 118.57	2109.41 ± 118.57

Note. Values are means ± standard error.

Table 2.
Mean RMR Values across Measurements

RMR Measurement	1	2	3	4	5	6	7
kcal	1853.23 ± (83.85)	2268.07 ±* (83.85)	2307.74 ±* (83.85)	2038.43 ± (83.85)	2410.04 ±* (83.85)	2193.13 ± (83.85)	2058.98 ± (83.85)

Note. Values are means ± standard error. * = Significant difference vs. Measure 1; ◊ = Significant difference vs. measure 4

1786 Board #47 May 31 2:00 PM - 3:30 PM
Cluster Sets Attenuate Power Loss at Higher Intensities During the Back Squat Exercise

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(No relevant relationships reported)

Cluster sets (CLU), a training method in which a brief rest is inserted between a group of repetitions, attenuates the loss 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 (23.9 ± 3.3 y; 177.2 ± 7.9 cm; 82.7 ± 11.0 kg; $11.9 \pm 3.5\%$ body fat) had body composition and one-repetition maximum (1RM) 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 ($p \leq 0.05$). **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 CLU. A significant CONDITION x REP interaction ($p < 0.001$) was also observed. Compared to REP 1, significantly lower power outputs were observed for every subsequent repetition during TRD. In contrast, reduced power output was not observed until later in the set when performing CLU. The greater mean power was attributed to velocity, as no main effect or interactions were observed for mean force ($p \leq 0.05$). A CONDITION x SET interaction approached significance ($p = 0.069$) for velocity, while the CONDITION x REP interaction effect was significant ($p < 0.001$), 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.

1787 Board #48 May 31 2:00 PM - 3:30 PM
Hypertrophic Responses Do Not Completely Explain Increases in Strength After 12 Weeks of Resistance Training in Previously Untrained Young Men

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(No relevant relationships reported)

Purpose: It has been suggested that resistance training-induced increases in lean mass are related to increases in strength metrics. We aimed to examine if increased lean mass was related to increased strength in untrained young men after 12 weeks of resistance training. **Methods:** 72 young male subjects performed 12 weeks of supervised resistance training (RT). Ultrasound, dual x-ray absorptiometry (DXA), 3 repetition maximum (RM), isometric mid-thigh pull (IMTP), and isokinetic dynamometry testing were performed before and after the intervention. Training was completed 3 days weekly and consisted of squat, bench press, trap bar deadlift, and barbell rows within an undulated program design. **Results:** While DXA lean mass increased by 4.7%, squat 3RM increased by 48.2% and IMTP increased by 11.7%, on average. Changes in lean mass and 3RM squat were moderately correlated ($r^2=0.102$, $p=0.005$) while changes in lean mass and IMTP were not significantly associated ($r^2=0.04$, $p=0.08$). **Conclusion:** While studies have reported that increases in lean mass in trained individuals are seemingly related to increases in strength, we report herein that increases in lean mass do not seem to sufficiently explain changes in strength in previously untrained young men. Supported by: Gifts from Hilmar Inc., BNRG, Lockwood, LLC, JW Nutritional, and Glambia.

1788 Board #49 May 31 2:00 PM - 3:30 PM
Effect of Nine Months of Resistance Exercise on Glycemic Levels and Macrosomia in Pregnant Women

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(No relevant relationships reported)

Resistance training is considered a beneficial strategy to reduce the impact of high glycemic levels in patients with diabetes mellitus (DM). Gestational diabetes mellitus (GDM) is considered one of the most common pathologies during pregnancy, affecting pregnant women and their children both during the pregnancy and after birth. High glycemic index and type 2 diabetes (DM2) are also associated with macrosomia during and after pregnancy. **PURPOSE:** Analyze the chronic effect of 9 months of resistance training on glycemic levels and macrosomia incidence in 54 pregnant women. **METHODS:** Fifty-four pregnant women without any complications related to DM and who were completely inactive before the study were recruited. Participants were randomized into two groups: a control group (CG) who remained inactive during the 9 months of pregnancy or an intervention group (IG) who performed resistance training (60% of 1 RM x 3 times per week). Training was progressively increased every two weeks to sustain the intensity of training. Glucose levels were analyzed before and after the training protocols and two months after pregnancy. The APGAR score was used to determine the health of the newborn and the incidence of macrosomia. The weight gained during the pregnancy was used to compare CG to IG. **RESULTS:** A

significant difference between CG and IG was observed on glycemic levels during the last 3 months of intervention (122 ± 8.5 to 105 ± 7.2 mg/dl $p=0.012$). Weight gain was significantly lower in IG compared to CG (21% less, $p<0.05$). Fetal macrosomia incidence was significantly lower in IG compared to CG (4.32 ± 1.2 to 13.19 ± 3.9 $p=0.001$). **CONCLUSION:** Regular resistance exercise appears to be a good strategy to avoid GDM, eliciting positive outcomes during the pregnancy and afterwards. The reduction of glycemic levels were significantly correlated in reducing the risks related to macrosomia.

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

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(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 was comprised of 3 sets of 10 repetitions 3x/wk at 50% of 1RM. BFR-1 program consisted of 4 sets of 30, 15, 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 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.

1790 Board #51 May 31 2:00 PM - 3:30 PM
Using Velocity Loss for Monitoring Resistance Training Effort in a Real World Setting

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(No relevant relationships reported)

Previous studies demonstrated the importance of analyzing movement propulsive velocity (MPV) loss during resistance training as an estimate of intensity of effort. However, these studies involved sets performed with maximal intended velocity and used special devices, which is not usual for most people practicing resistance training. **PURPOSE:** The purpose of the present study is to evaluate the changes in MPV during resistance training with different loads while the trainees are attempting to move the load at a pre-determined repetition duration. **METHODS:** Twenty-one resistance-trained men (age: 25.7 ± 5 years; height: 177.0 ± 7.2 cm; mass: 85.4 ± 13.56 kg) participated in the study. Participants performed two tests sessions. The first to determine 1 repetition maximum (1RM) load, and the second to evaluate MPV loss during a set to momentary muscle failure (MF) performed at 75% and 50% of 1RM using a 2 second concentric and 2 second eccentric repetition duration controlled by a mobile app metronome. **RESULTS:** Mean one-repetition maximum 1RM load was 98 ± 21.6 Kg, with a relative strength of 1.15 ± 0.2 , obtained by ratio of the load of 1RM relative to body mass. The average number of repetitions performed at 75% of 1RM was 7.5 ± 1.7 and 13.7 ± 2.8 for 50% of 1RM. With 75% of 1RM there was a significant difference among repetitions MPV. Post hoc analysis revealed that MPV in the last repetition was lower than in the preceding three. Similarly, MPV during the penultimate repetition was lower than during the antepenultimate and the 4th from last. However, there was no difference in MPV between the 4th last and the antepenultimate repetition. Velocity loss from

the antepenultimate to the penultimate repetition was 5.33%, from the last to the penultimate was 22.11% and the accumulated loss from the last to the 4th last was 25.4%. ANOVA for MPV values obtained at 50% 1RM load showed no significant effects, which suggested the same predetermined velocity pattern was maintained until reaching MF

CONCLUSIONS: Accessing MPV loss during resistance training using simple methods can be an important tool for standardize the intensity of effort employed during submaximal training with high loads, but not with light loads. This can be specially useful in clinical conditions where maximum exertions are contraindicated.

1791 Board #52 May 31 2:00 PM - 3:30 PM
Comparison of Different Eccentric Phase Tempo of Knee Extension Resistance Exercise on Hypertrophy Response

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(No relevant relationships reported)

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 isotonic 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 Isotonic 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 0.55, with Hedge's g approach; however, there was no difference ($P<0.05$) between treatments. Time Under Tension (TUT) was different between groups (G2S=1300.6±356 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 extensors, except for the Vastus Medialis, although the time under tension was greater in G4S.

1792 Board #53 May 31 2:00 PM - 3:30 PM
Impact of Explanations on Strength Exercises and Daily Movements

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(No relevant relationships reported)

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-stand up (SS), overhead dumbbell press (DBP), and overhead barbell press (OHP). **PURPOSE:** To determine if peak velocity and peak acceleration of SQ, SS, DB, 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.

D-58 Free Communication/Poster - Renal Physiology

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

1793 Board #54 May 31 3:30 PM - 5:00 PM
The Effect of Dietary Nitrates on Exercise Capacity in Chronic Kidney Disease

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(No relevant relationships reported)

PURPOSE The purpose of this study was to test the hypothesis that an acute dose of 12.6mmol dietary nitrate in the form of concentrated beetroot juice (BRJ) would improve exercise capacity and skeletal muscle mitochondria function in adults with moderate to severe chronic kidney disease (CKD). **METHODS** 12 individuals with moderate to severe CKD participated in this study (61±4 yrs; 9 males; eGFR 47.8ml•min⁻¹•1.73m²). Participants reported to the laboratory and a baseline blood sample was obtained for determination of NO metabolites (NOM; Nitrate, nitrite, s-nitrosothiols and metal bound NO). Participants were then randomized to ingest 12.6mmol of BRJ or a nitrate depleted placebo (PLA). Exercise testing began 2.5 hours post beverage ingestion to coincide with peak plasma nitrite levels. Skeletal muscle mitochondrial oxidative function testing was performed using near infrared spectroscopy (NIRS) followed by a symptom limited graded exercise test (GXT) on a cycle ergometer for determination of peak oxygen consumption (VO₂ peak). Participants repeated the entire protocol in the other condition a minimum of 7 days later. **RESULTS** Plasma NOM values were significantly increased in the BRJ condition 2.5 hours post ingestion compared to BRJ baseline as well as PLA at 2.5 hr (2.5 hr: PLA 30.2±6.6uM vs BRJ 973±261uM, $p>0.05$). We did not observe an improvement in mitochondrial oxidative capacity or VO₂ peak in the BRJ condition compared to PLA ($p>0.05$). The amount of work performed and total exercise time was significantly increased after BRJ compared to PLA (Work: PLA 39.5±9.9 vs BRJ 44.7±10.7kJ; Exercise Time: PLA 627±86 vs BRJ 674±85 seconds; $p<0.05$ for both). VO₂ at the ventilatory threshold (VT) was significantly greater in the BRJ condition compared to PLA (PLA 0.79±0.08L/min vs BRJ 0.95±0.09 L/min; $p<0.05$). **CONCLUSION** An acute dose of 12.6mmol dietary nitrate significantly improved VO₂ at VT, work performed, and total exercise time in adults with moderate to severe CKD. This research was supported by an ACSM Foundation Research Grant from the American College of Sports Medicine Foundation and NIH grant HL113514.

1794 Board #55 May 31 3:30 PM - 5:00 PM
The Kidney As A Hub For Ph Modulation: Interrelationship Of Lactate, Pulse, And Blood Pressure

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(No relevant relationships reported)

Following the pioneering work of Hill and Meyerhoff, in 1933, Margaria and colleagues published a compelling relationship between pH and lactate in the blood. In 1976, Sahlin and colleagues detected and presented that same relationship in skeletal muscle. These events helped make lactate metabolism one of the most famous and misunderstood phenomena in exercise physiology. We now know that rates of ATP hydrolysis and hydrogen ion clearance are fundamental to exercise-induced metabolic acidosis; however, the role of the kidney in modulation of blood lactate and pH still requires further elucidation in athletic and ill populations. **PURPOSE:** To better understand the determinants of blood pH by examining the interrelationship between lactate, pH, and cardiovascular parameters in a patient population. **METHODS:** We analyzed a sample of 248 patients who were admitted to a Midwestern U.S. hospital for acute trauma. All patients were assessed for predictors of pH based on complete blood count and other measurements collected during intake. Multiple linear regression tested the effect of demographic, anthropometric, and metabolic variables on blood pH. **RESULTS:** Subjects were 63.3% male with a mean age of 50.5 ± 21.6 years, normal blood pH (7.3 ± 0.4), and slightly elevated lactate (2.0 ± 1.7 mmol/L). Mean arterial pressure (98.5 ± 18.5 mmHg) and heart rate (90.7 ± 18.1 bpm) were also slightly elevated. The variables that predicted significant reductions in pH were

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.

1795 Board #56 May 31 3:30 PM - 5:00 PM
Home-based Exercise Improves Heart Contractility Determined by 2D Speckle Tracking Strain in Renal Transplant Recipients

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(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 analysis with the goal of achieving 150 minutes*wk⁻¹ of activity at moderate intensity (minimal levels were set at $3 \times \text{week}^{-1}$ with a goal of at least 30 minutes*session⁻¹). Subjects completed 2D echocardiographic examination at T₀, T₆, and T₁₂ months. Repeated measure ANOVA and a two-way mixed ANOVA with Tukey post-hoc analysis were used to detect differences across time and sex differences.

RESULTS: GLS and Lo increased significantly from T₀ to T₆ and remained high at T₁₂ (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 T₀ (-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 than EF, 2D ST analysis appears more sensitive in detecting training adaptations. Future studies should investigate the potential role of GLS in the assessment of cardiac function following unsupervised exercise training.

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

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Reported Relationships: C.L. Butts: Consulting Fee; Gatorade Sports Science Institute.

Dehydration, exertional hyperthermia, and muscle damage commonly occur in athletic, 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 ± 6.3 kg, body fat $14.5 \pm 4.1\%$) completed two trials, one euhydrated (EU; fluid replacement $\leq 2\%$ body mass loss) and one hypohydrated (HY; fluid restriction 24-h prior to and throughout exercise), separated by ≥ 28 days. Trials consisted of muscle damaging unilateral eccentric knee flexion, 60 minutes of treadmill running ($\sim 60\% \text{VO}_{2\text{max}}$) in the heat (33°C , $54\% \text{RH}$), and 30 minutes of passive recovery. Participants were provided a rehydration protocol in both trials and returned 24-h later for a follow-up visit.

RESULTS: Urine osmolality when HY was greater pre- (HY 1045 ± 102 , EU 612 ± 142 mOsm/kg; $P < 0.01$) and post-trial (HY 1007 ± 105 , EU 503 ± 205 mOsm/kg; $P < 0.01$), but not 24-h post (HY 543 ± 310 , EU 545 ± 404 mOsm/kg; $P = 0.98$). Serum osmolality was also different pre-trial (HY 301 ± 5 , EU 290 ± 5 mOsm/kg; $P = 0.02$), but was

similar 24-h post (HY 295 ± 4 , EU 293 ± 3 mOsm/kg; $P = 0.25$). Isometric strength was reduced regardless of condition immediately after eccentric exercise (grand mean $\Delta = -33.6 \pm 27.9 \text{ N}\cdot\text{m}$, $P = 0.03$). Rectal temperature increased to a greater degree when HY ($2.11 \pm 0.60^\circ\text{C}$) compared to EU ($1.65 \pm 0.44^\circ\text{C}$; $P = 0.01$). Plasma neutrophil gelatinase-associated lipocalin (pNGAL) 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 pNGAL were greater, regardless of time, when HY ($19.1 \pm 7.5\%$) compared to EU ($6.1 \pm 11.2\%$, $P < 0.01$). **CONCLUSION:** Exercise in the heat with muscle damage increased renal strain when HY and resulted in greater changes in pNGAL, 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
Associations of Physical Activity, Diet, and Kidney Function in Pre-diabetic Early Stage Chronic Kidney Disease

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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) $76.7(8.0)$ 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 accelerometry. 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 against 95% level of significance ($p \leq 0.05$). **Results** Between baseline and 24 months eGFR decreased by $-3.04(9.4)$ ml/min/1.73 m². There were no changes in MVPA, steps, fat and fibre intake but responses were highly variable between individuals. Baseline and change in eGFR at 24 months were positively associated with baseline MVPA (Pearson correlation, $r = 0.182$, $p = 0.02$ and $r = 0.160$, $p = 0.04$ for baseline eGFR and change in eGFR respectively), but not change in MVPA. There was a positive association 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.

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 36 Stage 3-5 CKD patients (eGFR, 44 ± 2 ml/min/1.73m²) with no 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% HRR 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 expired 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 $\text{VO}_{2\text{peak}}$ compared to CON (EXT: 17.89 ± 1.21 vs. 19.98 ± 1.59 ; CON: 18.29 ± 1.73

vs. 17.36 ± 1.60 ml/kg/min; $p < 0.01$). 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 AU, $p < 0.01$). Relative O_2 pulse improved following EXT, suggestive of improved 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 (V_E/VCO_2) was still evident following EXT (EXT: 32 ± 2 vs. 33 ± 0.9 ; CON: 32 ± 2 vs. 34 ± 1 AU; $p = 0.1$). EXT had no effect on the ventilatory cost of oxygen uptake (V_E/VO_2 ; EXT: 40 ± 2 vs. 42 ± 2 ; CON: 37 ± 2 vs. 41 ± 2 AU; $p = 0.5$). EXT had no effect on autonomic function assessed by maximal heart rate (EXT: 149 ± 8 vs. 143 ± 8 ; CON: 131 ± 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 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. Simmering, University of Iowa, Iowa City, IA. (Sponsor: Kathleen F. Janz, FACSM)
(No relevant relationships reported)

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, and jumping and used 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 (R^2) and median absolute error. **RESULTS:** The percentage of variation 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 from Five Random Forest Models to Predict Mechanical Load.		
Model	R^2	Median Absolute Error
1. Known Activity Categories	0.44	0.43
2. Accel Variables	0.65	0.27
3. Known Activity Categories + Accel Variables	0.78	0.20
4. Derived Activity Categories	0.32	0.49
5. Derived Activity Categories + Accel Variables	0.66	0.23
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 symphysiolysis, 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 ± 14.5 yr, 154.6 ± 6.74 cm) 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 superior pubis ramus (the malalignment in pelvic) 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 \pm 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 standing was 1.41 ± 0.894 . The CSA of 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 ($r_s = -0.213$, $p > .05$), 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

Samuel R. Buchanan, Robert E. Hight, Breanne S. Baker, Christopher D. Black, Michael G. Bemben, FACSM, Debra A. Bemben, FACSM. The University of Oklahoma, Norman, OK. (Sponsor: Debra Bemben, FACSM)
(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% site before and after four weeks of dominant leg plantar flexor strength training. GST muscle thickness was assessed in the lateral head by measuring the distance from fat tissue to the fibula. Two-way repeated measures ANOVAs (leg \times 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 . Intraclass correlation coefficients (ICC), coefficient of variation % (CV%), and least significant change (LSC) were calculated to determine precision. **RESULTS:** The ICCs 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 37cm² 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.

Table 1. pQCT and US Measures for Dominant (DOM) and Non Dominant (ND) Lower Legs (means \pm SD)

Variable	DOM (n=4)			ND (n=4)		
pQCT mCSA						
Pre (cm ²)	743.36	\pm	180.76	740.26	\pm	193.54
Post (cm ²)	741.96	\pm	183.46	748.32	\pm	193.52
US MTH						
Pre (cm)	2.39	\pm	0.79	2.43	\pm	0.49
Post (cm)	2.19	\pm	0.53	2.46	\pm	0.61

1802 Board #63 May 31 3:30 PM - 5:00 PM
Measurement Of Nitrate And Nitrite In Biopsy-Sized Muscle Samples

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(No relevant relationships reported)

Studies of rats have demonstrated that skeletal muscle plays a central role in whole-body nitrate (NO_3^-)/nitrite (NO_2^-)/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 Nyakayiru et al. (J Appl Physiol 2017; 123:637-644) reported that NO_2^- 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 NO_3^- and NO_2^- content of biopsy-sized muscle samples. **METHODS:** NO_3^- and NO_2^- were extracted from rat soleus muscle samples using methanol combined with mechanical homogenization + ultrasound, bead beating, pulverization, or pulverization + 0.5% Triton X100. After centrifugation to remove precipitated proteins, NO_3^- and NO_2^- 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 NO_3^- content (62 ± 16 pmol/mg), with high variability (CV >50%) across samples from the same muscle. NO_2^- content (1.00 ± 0.18 pmol/mg) was also elevated, suggestive of NO_2^- reduction during tissue processing. Bead beating or pulverization yielded higher NO_3^- and lower NO_2^- levels, but reproducibility was still poor. Pulverization + 0.5% Triton X100 provided the highest NO_3^- (97 ± 15 pmol/mg) and lowest NO_2^- (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 NO_3^- and NO_2^- in muscle samples as small as 10 mg. The theoretical limit is even lower, i.e., 1 mg for both NO_3^- and NO_2^- and 5 ng for NO_3^- alone. This method should prove highly useful in investigating the role of skeletal muscle $\text{NO}_3^-/\text{NO}_2^-/\text{NO}$ metabolism in both healthy and diseased subject populations, in response to exercise and dietary interventions, etc.

1803 Board #64 May 31 3:30 PM - 5:00 PM
2D Ultrasound-Based Characterization of Achilles Tendon Micromorphology in Runners Using Spatial Frequency Parameters

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(No relevant relationships reported)

Achilles tendinopathy is a common overuse condition in runners, and if degenerative can be a precursor to rupture even in absence of symptoms. Ultrasonography 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, 42 ± 9.8 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.

1804 Board #65 May 31 3:30 PM - 5:00 PM
Test-Retest Reliability of Muscle Cross Sectional Area and Echo Intensity in Upper Extremity Muscles

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(No relevant relationships reported)

Ultrasonography 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 ± 6.73 cm, mass: 78.37 ± 12.17 kg). 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 (ICC_(2,1)=0.960) and EI (ICC_(2,1)=0.850) demonstrated the highest relative consistency among the three muscles (supraspinatus CSA: ICC_(2,1)=0.717, EI: ICC_(2,1)=0.762; flexor carpi ulnaris CSA: ICC_(2,1)=0.954, EI: ICC_(2,1)=0.676). Infraspinatus CSA and EI (CSA: SEM=3.28%, MDC=9.09%, EI: SEM=9.40%, MDC=26.05%) also demonstrated the lowest SEM 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.

1805 Board #66 May 31 3:30 PM - 5:00 PM
Assessment of Muscle Injury Using Diffusion Kurtosis MRI and ¹H MRS

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(No relevant relationships reported)

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 Tensor Imaging (DTI). Proton MR spectroscopy (¹H 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, EMCL). 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 EMCL *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 ($N=3$, 300 ± 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. LCModel package (Provencher 2001, Version 6.3) was used for quantification of the MRS data. TA imaging was compared to functional

changes, and BODIPY 495/503 staining of TA cross-sections sections was used to identify lipid depositions. **RESULTS:** Injury was confirmed by a significant loss of isometric torque ($70 \pm 2\%$ loss). There was a significant lactate accumulation (≥ 68 mM) with corresponding reductions of EMCL and total creatine (tCr) at 4 hours post injury. The complicated metabolic patterns were expected during muscle regeneration, remodeling, 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
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(No relevant relationships reported)

PURPOSE: The primary aim of this study was to compare frequency-domain multi-distance (FDMD) Near-Infrared Spectroscopy (NIRS) derived total heme concentration (hemoglobin + myoglobin) to the total heme derived during a chemical assay. The secondary aim of this study was to explore the influence of adipose tissue thickness on NIRS measurements of mammalian muscle. We hypothesized that the total heme measured by the FDMD NIRS would not be significantly different from the assay values.

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 *deltoideus* (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, ST, 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 ($r^2 = 0.56$, $p < 0.0001$). The NIRS total heme signal was significantly less for the intact skin compared to direct muscle conditions for BF, DT, ST, TFL, and TL ($p < 0.05$), but not for the LL ($p = 0.922$).

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.

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
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(No relevant relationships reported)

PURPOSE: Heavyweight athletes, e.g., linemen reportedly have excess body fat mass, increased cardiometabolic risk, and insulin resistance, compared to non-heavyweight athletes. Visceral fat is related to cardiometabolic risk. Visceral adipose tissue (VAT) mass is usually assessed with magnetic resonance imaging (MRI). However, this method is labor- and time-intensive. VAT measurement using dual X-ray absorptiometry (DXA) takes less time to scan and analyze findings than MRI. Moreover, DXA can accurately measure abdominal VAT in average-weight individuals. However, this method has not been validated in athletes with a wide range of body habitus. This study compared VAT volume measured by DXA (DXA-VAT) and MRI (MRI-VAT).

METHODS: The study included 30 male collegiate athletes (height 173.3 ± 6.7 cm, weight 90.4 ± 21.3 kg, body mass index 29.9 ± 6.0 kg/m², waist circumference 90.9 ± 16.4 cm) from the following sports: judo, American football, sumo, skiing, and weight

lifting. Paired measurement of VAT was performed using MRI and DXA. MRI-VAT volume was calculated by integrating six 65-mm single MRI slices corresponding to the level of DXA-VAT volume measurement. Data were compared using a paired *t*-test and a Bland-Altman plot was used to assess systematic error.

RESULTS: DXA and MRI-VAT volume differed significantly ($p < 0.01$). Regression analysis showed a linear relationship between DXA and MRI-VAT volume ($r = 0.90$). The fit line for the relationship between MRI and DXA-VAT volume was calculated as follows: DXA-VAT volume = MRI-VAT volume + 97 (cm³). Bland-Altman analysis showed DXA-VAT volume overestimation by 94 ± 53 cm³ compared with MRI-VAT volume, with no systematic error ($p = 0.203$). Less subcutaneous abdominal fat in athletes than in nonathletes may cause overestimation of DXA-VAT volume.

CONCLUSIONS: DXA-VAT volume was overestimated compared with MRI-VAT volume, with strong correlations for a wide range of values. A new equation may be needed to assess DXA-VAT in athletes.

1808 Board #69 May 31 3:30 PM - 5:00 PM
Utilizing Ultrasound Imaging to Evaluate Acute Doppler Flow Adaptions of the Medial Elbow
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(No relevant relationships reported)

The use of musculoskeletal ultrasound imaging (MSKUI) has been rapidly gaining use and application in the orthopedic clinical setting. An emerging feature of MSKUI is power Doppler imaging quantification (PDQI) that can be used to quantify circulation in MSK tissues and provide a measure of tissue perfusion and/or inflammation.

PURPOSE:

To examine the use of PDQI for evaluation of tissue perfusion of the ulnar collateral ligament (UCL) following an in-game performance in collegiate pitchers.

METHODS:

Ten Division I collegiate baseball pitchers (mean age 20.4 ± 1.4 yrs and mean body fat percentage $18.6 \pm 3.9\%$), with no history of significant upper extremity injuries participated. MSKUI 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 PDQI ratios were calculated to assess the maximum level of tissue perfusion of the UCL in the throwing arm.

RESULTS:

Differences in maximum UCL PDQI ratios pre and post the first pitching outing of the season were analyzed through paired sample *t*-tests. There was no significant difference ($t(9) = -1.37$, $p \geq 0.5$) between the PDQI ratios before (mean max ratio: $0.82 \pm .06$) and after pitching (mean max ratio: $.22 \pm .29$). Assessment of the following control variables: pitch count ($F_{1,7} = 0.73$, $p = .42$) and innings pitched ($F_{1,7} = 0.37$, $p = .56$) indicated no significant effect on the PDQI ratios.

CONCLUSIONS:

No statistically significant difference in perfusion of the UCL, as expressed by PDQI ratios was found after a single pitching outing. However, a numerical increase in the mean PDQI 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
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(No relevant relationships reported)

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. **Purpose:** To 1) evaluate the relationship of DEXA-derived JSW with patient-reported pain and physical function and 2) evaluate the reliability of a semi-automatic knee analysis software for measuring JSW from DEXA-derived images. **Methods:** Eleven adults (6 females; 5 males) with radiographically defined KOA (Mean \pm SD: Age = 60.0 ± 9.0 yrs, BMI = 29.0 ± 3.7 kg/m², WOMAC pain = 8.3 ± 2.8 ; WOMAC function = 27.4 ± 6.7) completed scans of the involved and uninvolved knees using the GE Lunar iDXA orthopedic application for the knee. Medial and lateral JSW was analyzed using semi-automatic knee analysis

software (OASys 1.0, Optasia Medical, Cheadle, UK). Pain and physical function were evaluated using the respective Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) subscales. **Results:** Despite the non-weight bearing nature of the DEXA scan, greater medial JSW narrowing of the involved knee was significantly correlated with greater WOMAC pain scores (Spearman correlation; $R = -0.815$; $p = 0.002$). There were no significant correlations with lateral JSW of the involved knee, medial or lateral JSW of the uninvolved knee, and WOMAC subscales ($p > 0.05$). There was strong test-retest reliability for involved lateral (intraclass correlation coefficient [ICC] = 0.95; standard error of the measurement [SEM] = 0.22 mm) and medial (ICC = 0.99; SEM = 0.15 mm) DEXA-derived JSW using the semi-automatic software. **Conclusions:** The strong relationship between WOMAC pain and DEXA-derived JSW suggests potential use of DEXA as a practical tool for tracking severity and pain associated with KOA. Semi-automatic knee analysis software designed to evaluate radiographic images can reliably evaluate JSW from a DEXA-produced image. Further validation of DEXA-derived images of the knee for KOA diagnosis is warranted. Supported by: NIAMS (1R21AR067560-01) and the Rehabilitation Research Resource to Enhance Clinical Trials (1P2CHD086851-01).

1810 Board #71 May 31 3:30 PM - 5:00 PM
Evaluating Near Infrared Spectroscopy Signals From Skeletal Muscle

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(No relevant relationships reported)

Near Infrared Spectroscopy (NIRS) uses the relative absorption of light at 850 and 760nm to determine skeletal muscle oxygen saturation. There are currently disagreements in the literature over how to report oxygen saturation and the relative contributions of hemoglobin and myoglobin. **Purpose:** 1) Compare the separate 850nm (HbO₂) and 760nm (HHb) signals during rest, ischemia, and reperfusion, and 2) test whether electrical stimulation to increase metabolic rate changes oxygen saturation values during 5-6 minutes of complete ischemia. **Method:** Ten participants ages = 20-29 years were measured. NIRS measurements were made in the forearm flexor muscles at rest, after 30 seconds of 6 Hz electrical stimulation, during and after 5-6 minutes of complete ischemia produced by arterial occlusion preceded by 30 seconds of 6 Hz electrical stimulation. After 5-6 minutes of ischemia 30 seconds of 6 Hz electrical stimulation was performed. **Results:** Six Hz stimulation for 30 s increased metabolic rate for HbO₂ and HHb; 6.2 ± 3.1 and 5.5 ± 2.7 fold over rest, respectively. Six Hz stimulation during cuff ischemia did not change either the HHb or HbO₂ values ($p > 0.05$). There was significantly greater ($p < 0.05$) pulsatility associated with heart rate in the HbO₂ ($0.78 \pm 0.41\%$ range) compared to HHb ($0.16 \pm 0.09\%$ range). Pulse size increased during reperfusion; HbO₂ ($2.37 \pm 0.38\%$ range) compared to HHb ($0.96 \pm 0.32\%$ range). **Conclusions:** The difference in the magnitude of pulsatility between HbO₂ and HHb signals suggests different anatomical locations for these signals, further suggesting that using various ratios of HbO₂ and HHb signals should be performed with caution. Increasing metabolic rate with electrical stimulation during complete ischemia did not further change the NIRS signals, suggesting complete ischemia is obtained with 5-6 minutes of complete cuff occlusion.

Keywords: Skeletal Muscle, Near Infrared Spectroscopy (NIRS), Oxygen consumption, Hemoglobin, Myoglobin

Word Count:
 Lines

1811 Board #72 May 31 3:30 PM - 5:00 PM
Measuring Thigh Cross-sectional Areas From CT Scans: Validation Of NIH Image J And SliceOmatic Methods

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(No relevant relationships reported)

PURPOSE: Muscle and fat areas in thigh CT scans are important outcomes in aging and exercise research. NIH Image J and SliceOmatic 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 (HDF); 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 smaller (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 ($R^2 = 0.99$) with those from SliceOmatic 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 (115 ± 24 v 106 ± 21 , $P < 0.0001$) and HDM (2.5 ± 1.8 v 1.8 ± 1.6). These results were from SliceOmatic and were not affected by skin fat and bone marrow. **CONCLUSIONS:** Image J and SliceOmatic generate similar results for measurement of muscle and fat of all densities in the thigh. SliceOmatic 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 RRD Merit RX001203 (RAD) and NIH NIA R01 AG046920 (CAP and MMB).

1812 Board #73 May 31 3:30 PM - 5:00 PM
Common Muscle Tests As Related To Trabecular Bone Strength In Division II Athletes.

Kimberly D. Espartero, Andrew Denys, Maria G. Alvarez, Priscilla Franson, Arianna M. Mazzarini, Rebekkah J. Reichert, Vanessa R. Yingling, 94501, FACSM. *California State University, East Bay, Hayward, CA.* (Sponsor: Vanessa R Yingling, FACSM)

(No relevant relationships reported)

High impact repetitive loading, associated with most sports is beneficial to the skeleton. The mechanostat theory illustrates a dependence of bone strength on muscle strength. Therefore, a field measure of muscle function that can approximate bone strength is important to optimize bone strength in educational and recreational settings. Recent studies reporting significant correlations between muscle power and bone strength (Janz, 2015, Yingling, 2017) have focused on cortical bone sites. Trabecular bone is a common site of stress and osteoporotic fracture. **PURPOSE:** To investigate the relationship between common muscle function tests (Relative Grip Strength, 1 Rep Max of Leg Extensors, Peak Power-vertical jump) and bone strength in the trabecular bone of the distal tibia of Division II athletes. **METHODS:** Eighty-six Division II athletes, 56 females and 30 males (age 20.2 ± 1.7 , height (m) 1.7 ± 0.1 , body fat % 17 ± 7.4) performed a relative grip strength (RGS) test using a hand dynamometer, a one repetition maximum leg extension test (1RM) and a vertical jump test using a Vertec. PP was calculated from vertical jump height (Sayers, 1999). Trabecular Bone Mineral Content (vBMC.tb), Trabecular Bone Mineral Density (vBMD.tb), Total Area (T.Ar.tb), and Bone Strength in compression (BSIc) were measured using peripheral Quantitative Computed Tomography (pQCT) at the 4% tibial site. Linear regressions were run to relate muscle function and trabecular bone strength. **RESULTS:** All three muscle function measures significantly predicted trabecular bone strength parameters in the distal tibia. However, the R^2 values for PP were much higher than the values for RGS and 1RM. PP explained 41% of the variance in BSIc compared to 30% for 1RM and 13% for RGS. Similar results were found for vBMC.tb (PP [$R^2 = 0.5272$], RGS [$R^2 = 0.1216$], 1RM [$R^2 = 0.2818$]) and T.Ar.tb (PP [$R^2 = 0.4996$], RGS [$R^2 = 0.1242$], 1RM [$R^2 = 0.1560$]). The R^2 values for vBMD.tb were low for all muscle function variables. **CONCLUSION:** PP is a predictor of trabecular bone strength parameters. Muscle function seems to have the greatest effect on the strength (BSIc) geometry (T.Ar.tb) and amount of the trabecular bone (vBMC.tb) and is less related to the density of the trabecular bone (vBMD.tb). Lower limb muscle power could provide a means to monitor trabecular bone health.

D-60 Free Communication/Poster - Aging Biomechanics

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1813 Board #74 May 31 3:30 PM - 5:00 PM
Difference in Attentional Involvement and Respiratory Complexity During Static Balance Between Older and Young Adults

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(No relevant relationships reported)

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 balance 2) 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 first 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 (SE_x), anteroposterior-direction (SE_y), chest RC (SE_{ch}), abdominal RC (SE_{ab}) in R. Factorial MANOVA used to test the effects of group and breathing conditions (independent variables) on SE_x, SE_y, SE_{ch}, SE_{ab} (dependent variables). ANOVA and post-hoc tests used when needed. **Results:** MANOVA showed significant difference in group and breathing condition (Wilks' $\lambda < .000$). Older adults exhibited higher means ($p < .05$) in SE_x (OA: 0.149 \pm 0.052; YA: 0.108 \pm 0.040) and SE_y (OA: 0.271 \pm 0.106; YA: 0.142 \pm 0.062). A significant interaction was observed between groups and breathing conditions (Wilks' $\lambda < .000$). ANOVA showed significant interactions in SE_{ch} and SE_{ab} ($p < .000$). Post-hoc tests showed YA AB (0.013 \pm 0.004) was significantly higher than all conditions and OA AB (0.006 \pm 0.002) was significantly higher than YA CB (0.010 \pm 0.003) with respect to SE_{ch} ($p < .05$); YA NB (0.011 \pm 0.005) and YA CB were significantly higher than OA NB (0.006 \pm 0.001), OA CB (0.006 \pm 0.001), OA AB, and YA AB with respect to SE_{ab}. **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 SE_{ch} and SE_{ab}.

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

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(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 increasing their 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 \pm 6.4 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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(No relevant relationships reported)

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 female) 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:

	Stroop task	N-back task	More oddshifting task	Working memory	CRT	Dual task
Hand force,	.11	.10	.09	.11	-.16**	-.41*
30-s chair-stand test	.20*	.22	.18*	.18	-.26**	.25
Eyes closed standing	.32**	.19*	.29**	.12	-.15**	-.40*
The timed "Up & Go"	-.27**	-.21*	-.31**	-.25*	.39**	.24*

Note: *= $p < .05$, **= $p < .01$.

Conclusion: The cognition does have low-to-moderate 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

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(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 manifesting as 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 \pm 6.3 years; 9 males/ 10 females) walking at a normal walking speed across a GAITrite walkway for 5 trials. Step activity (# 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 used 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 ($\rho = -0.482$, $p = 0.036$). 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 ($\rho = -0.349$, $p = 0.143$), stride length ($r =$

-0.3, $p = 0.212$), step width ($\rho = -0.088$, $p = 0.721$), and double support time ($\rho = -0.249$, $p = 0.304$) showed weak inverse but not significant correlation with step activity. **CONCLUSION:** In general, gait variability seems to be inversely related to step activity in older adults meaning those with greater gait variability showed lower step activity. In particular, stance time variability has earlier shown to be critical in identifying older adults with mobility disability and those older adults at risk for future disability. Our finding of decreased step activity in those older adults with increased stance time variability suggests that step activity monitoring could provide surrogate and complimentary measures to identify mobility disability in older adults.

1817 Board #78 May 31 3:30 PM - 5:00 PM
Elevated Bmi Impairs Balance Among Older Adults With Vestibular Disorders

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(No relevant relationships reported)

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, obesity, 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.

1818 Board #79 May 31 3:30 PM - 5:00 PM
The Effect of Mental Fatigue on Postural Stability in Young and Older Women

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(No relevant relationships reported)

Allocation of attentional resources is required for maintaining postural stability. Fewer attentional resources are available for balance control when individuals perform a dual task paradigm involving concurrent performance of a cognitive task. However, these effects have not been studied under conditions of mental fatigue. **PURPOSE:** To determine if mental fatigue influences postural stability and if there are age differences in stability in response to mental fatigue. **METHODS:** Center of pressure (COP) displacement in response to standing platform perturbations was recorded at the beginning and end of 20 minutes of the psychomotor vigilance task (PVT; mental fatigue condition) and 20 minutes of watching a nature video (control condition) in 16 young (22.4 ± 3.72 years) and 16 older females (72.6 ± 6.50 years). The PVT is a sustained attention task that induces mental fatigue, as indicated by increases in reaction time (RT) to visual stimuli. **RESULTS:** Older adults had a significantly longer RT (325.17 ± 30.90 ms) than young (287.95 ± 29.53 ms) at baseline ($p = 0.002$). Both groups had significantly longer RTs by the end of the PVT task (young 11% increase, $p = 0.002$; older 7% increase, $p = 0.03$), indicating the presence of mental fatigue in the mental fatigue condition. Older adults had a significantly larger anterior-posterior (AP) COP displacement (7.37 ± 0.75 cm) than young adults (5.77 ± 1.67 cm) at baseline ($p = 0.001$). Nine young and 8 old adults had increases of 0.7-54% in AP COP displacement after the mental fatigue condition. However, there was no significant main effect of condition ($p = 0.12$) nor an interaction of age and condition ($p = 0.85$) for the percent change in AP COP from the beginning to the end of the session.

CONCLUSION: These results indicate that although postural control and reaction time performance was worse in older than young at baseline, there was no significant effect of mental fatigue on postural stability in either group.

1819 Board #80 May 31 3:30 PM - 5:00 PM
Electrical Nerve Stimulation Elicits Intensity-dependent Changes in Force Steadiness in Young and Older Adults

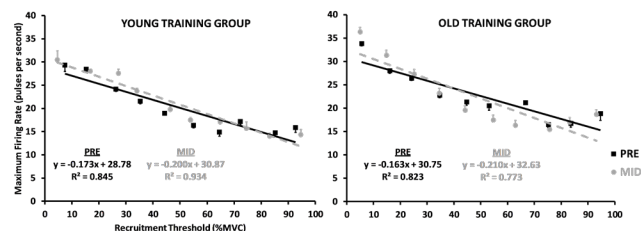
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(No relevant relationships reported)

When individuals attempt to match a submaximal target force by performing a steady isometric contraction, the fluctuations in force are often quantified as force steadiness (coefficient of variation [CV] for force) to provide an index of the neural drive to muscle. **PURPOSE:** To compare force steadiness of the wrist extensors during evoked and voluntary submaximal contractions in young and older adults. **METHODS:** Thirteen young (5 men, 25 ± 4 yrs) and 12 older (7 men, 78 ± 5 yrs) adults participated in a 1-hr protocol that involved maximal voluntary contractions (MVCs) and voluntary and evoked isometric contractions to match a 10% MVC target force. Force steadiness during the voluntary contraction was compared with that evoked by wide, high-frequency (1 ms pulses at 100 Hz) and narrow, low-frequency (0.2 ms pulses at 50 Hz) neuromuscular electrical stimulation (NMES), and a voluntary contraction with superimposed submotor transcutaneous electrical stimulation (TENS). CV for force was compared between age groups with unpaired t-tests and within age groups by paired t-tests. **RESULTS:** CV for force was less for young adults ($1.82 \pm 0.43\%$) than older adults ($2.80 \pm 1.08\%$) during the voluntary contraction with the wrist extensors ($p < 0.03$). Force steadiness did not differ between age groups during the evoked contractions. However, older adults were steadier during both types of NMES (wide: $2.01 \pm 0.67\%$, $p < 0.04$; narrow: $1.69 \pm 0.62\%$, $p < 0.02$) than during the voluntary contractions ($2.80 \pm 1.08\%$). Concurrent TENS did not influence force steadiness for older adults, but young adults were less steady during TENS ($2.41 \pm 1.02\%$, $p < 0.03$) than during the voluntary contraction by itself ($1.82 \pm 0.43\%$). **CONCLUSION:** The improvement in force steadiness for older adults during the NMES-evoked contractions indicates that the age-associated decline in force steadiness is attributable to changes in the neural drive to muscle, rather than the mechanical properties of muscle. In contrast, the decline in force steadiness for young adults during concurrent TENS suggests that heightened sensory feedback compromised the neural drive to muscle during the steady contraction.

1820 Board #81 May 31 3:30 PM - 5:00 PM
Effects Of Resistance Training On Maximal Motor Unit Firing Rates In Young And Older Males

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(No relevant relationships reported)

It is unknown if resistance training (RT) has differential effects on maximum firing rates (MAX_{FR}) of motor units (MUs) across the recruitment threshold (REC_t), and whether or not age has an influence. **PURPOSE:** To examine the effects of short-term RT on MAX_{FR} of MUs in young and older males. **METHODS:** Thirteen young and seventeen older males were randomly assigned to either a training (young group [YTG]: $n = 8$, age = 21 ± 1.6 yrs; old group [OTG]: $n = 10$, age = 64.1 ± 7.4 yrs) or control (young group [YCG]: $n = 5$, age = 22 ± 3.1 yrs; old group [OCG]: $n = 7$, age = 64 ± 9.3 yrs) group. RT involved knee extensions for 4 sets of 10 repetitions for 2 weeks. Before (PRE) and after (POST) RT subjects performed 2 maximum isometric ramp contractions (MVCs) of the knee extensors while 4 surface electromyography (sEMG) signals were recorded from the vastus lateralis. The raw sEMG signals were then decomposed into their constituent MU action potential trains. REC_t , defined as the relative force level (%MVC) when the MU began firing, and MAX_{FR} were calculated for each MU. The highest 500 ms average for torque was considered peak torque (PT). Linear regression was used on the pooled and individual data for the groups separately, to examine the relationship between REC_t and MAX_{FR} . Two-way (group [young vs. old] \times time [PRE vs. POST]) repeated measures analyses of variance were used to compare individual slope coefficients (SLP_c) and PT across time. **RESULTS:** A total of 1,403 (PRE = 713; POST = 690) MUs were detected. SLP_c ($p = 0.136$) and PT ($p = 0.781$) remained unaltered in the control groups at POST. No significant group \times time interactions were observed for SLP_c ($p = 0.678$) or PT ($p = 0.100$), but a main effect for time was demonstrated for SLP_c (-44.1% ; $p = 0.001$) and PT ($+12.5\%$; $p = 0.001$). **CONCLUSION:** These findings, in addition to a qualitative, visual inspection of the pooled regression lines (figure below), indicate RT induced a slightly more negative relationship between REC_t and MAX_{FR} and this effect was not influenced by age.



1821 Board #82 May 31 3:30 PM - 5:00 PM
Dynamic Balance Changes in Older Adults Following 12-Weeks of a Self-Managed Exercise Program

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 (No relevant relationships reported)

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 unimpaired 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±2.4yrs, 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 30 seconds 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=.522, G3 p=0.0172) from PRE to POST. Cohen's d values for the TUG (all participants=0.832, G1=.917, G2=.145, G3=1.75) and the 4S (all participants=0.383, G1=.517, G2=-.037, G3=.505) 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.

D-61 Free Communication/Poster - Biomechanics of Resistance Training

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

1822 Board #83 May 31 3:30 PM - 5:00 PM
An Analysis of Squat Mechanics Between Individuals With High and Low Strength Levels

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 (No relevant relationships reported)

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±3.86yrs, 1.76±0.08m, 74.43±11.32kg) 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 ($F_{1,26}=1.05$, $p=0.31$) and moments ($F_{1,26}=0.61$, $p=0.44$), or for peak hip adduction angles ($F_{1,26}=0.87$, $p=0.61$) 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.

1823 Board #84 May 31 3:30 PM - 5:00 PM
Improving Posterior Chain Engagement and Forward Trunk Lean During The Front Squat

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 (No relevant relationships reported)

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 gluteus 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 intervention itself or participants requiring more training time requires further investigation.

Table 1. Means (± standard deviations) pre and post intervention.

	Pre	Post	p	d
Peak pelvic tilt (°)	30.4 ± 10.5	28.7 ± 14.2	.341	0.134
Forward trunk lean (°)	28.9 ± 5.6	29.9 ± 6.9	.521	0.157
Peak hip extensor moment (Nm)	89.6 ± 66.9	85.8 ± 68.3	.313	0.057
Mean erector spinae RMS (mV)	6.0 ± 3.2	5.5 ± 3.0	.034	0.148
Mean gluteus maximus RMS (mV)	1.1 ± 0.7	1.5 ± 1.0	.069	0.472

1824 Board #85 May 31 3:30 PM - 5:00 PM
Effects of Squat Depth and Stance Width on Lower Extremity Frontal Plane Kinetics

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(No relevant relationships reported)

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: This study compared hip and knee frontal plane kinetics during body-weight squats with varying depths and stance widths. Methods: 11 healthy, college-aged participants (6 female, 5 male, height = 1.68 ± 0.08 m, mass = 67.4 ± 10.7 kg) performed 5 body squats at 100%, 150% and 200% of shoulder width for each of the following knee flexion angles: 55°, 90° and 125°. Trials were randomized and data were collected using Vicon Nexus and AMTI force plates. Frontal plane kinetics were processed using Visual 3D. Results: At the hip, adduction moments showed significant increases as the width (100% = 0.301 ± 0.02 , 150% = 0.539 ± 0.04 and 200% = 0.736 ± 0.04 ; $p < 0.001$) and depth (55° = 0.306 ± 0.03 Nm/kg, 90° = 0.545 ± 0.04 Nm/kg and 125° = 0.725 ± 0.05 Nm/kg, $p < 0.001$) increased. At the knee, adduction moments significantly increased with wider stances (100% = 0.116 ± 0.02 Nm/kg, 150% = 0.178 ± 0.01 Nm/kg and 200% = 0.221 ± 0.01 Nm/kg; $p < 0.001$) while greater knee abduction moments were observed as depth of the squat increased (55° = 0.006 ± 0.02 Nm/kg, 90° = 0.147 ± 0.04 Nm/kg and 125° = 0.465 ± 0.05 Nm/kg; $p < 0.001$). Conclusion: Deep squats and larger stance widths may place greater demand on the hip and knee joints as evidenced by increased frontal plane moments. These data may benefit rehabilitation and strength training programs. For example, clinicians using squats as a rehabilitative exercise might decrease stance width when aiming to avoid LE frontal plane joint loading. Further, athletes who repeatedly stress the frontal plane stabilizing structures of the LE during dynamic movements may benefit from deeper and wider squats in training that would prepare these structures for their sport specific movements. Further research is needed to investigate other means of altering joint loading in the LE during exercise.

1825 Board #86 May 31 3:30 PM - 5:00 PM

Influence of Attentional Focus in a Weighted Barbell Back Squat Among Experienced Performers

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(No relevant relationships reported)

Previous research suggests that adopting an external attentional focus (i.e. an object) rather than an internal focus (i.e. a body part) improves motor skill performance such as jump height, and increases peak force during isokinetic elbow flexion. However, little is known about the impact of attentional focus during a barbell back squat (BBS). PURPOSE: To determine the influence of attentional focus on ground reaction force (GRF), peak power (PP), and peak moment (PM) in the sagittal, frontal, and transverse planes at the knee, hip, and ankle joints in weight-lifters performing a BBS. METHODS: Male weight-lifters (age 23.1 ± 2.4 ; >3 years strength training experience) performed 8 BBS repetitions at 50% of their 1RM. Repetitions were performed under 3 conditions: Control (CON) followed by counterbalanced internal (INT; putting pressure on the heels and lateral aspect of the feet) and external (EXT; pushing the ground away from the body) focus conditions. PP (W) and PM (Nm) were measured using the software Motion Monitor; GRF (N) was measured using Bertec force plates. Participants also completed an attentional focus adherence questionnaire. RESULTS: For inversion PP at the ankle (i.e., negative power in the frontal plane), the absolute value for EXT ($-59.5 \text{ W} \pm 6.6$; 0.021, 0.016) was significantly greater than CON ($-42.3 \text{ W} \pm 4.1$) and INT ($-42.2 \text{ W} \pm 4.8$). For valgus PP at the knee (i.e. negative power in the frontal plane), the absolute values for EXT ($-231.8 \text{ W} \pm 18.8$; 0.016) and INT ($-227.3 \text{ W} \pm 23$; 0.033) were significantly greater than CON ($-187.4 \text{ W} \pm 15.9$). For abduction ankle PM (i.e. positive moment in the transverse plane), the EXT ($39.4 \text{ Nm} \pm 4.6$; 0.016) was significantly greater than INT ($30.7 \text{ Nm} \pm 3.7$). With an EXT focus, participants focused on pushing the ground away in significantly more repetitions (6.3 ± 0.72 ; 0.03) than the INT focus (5.2 ± 1.9). Focus conditions elicited no significant differences in the other variables. CONCLUSION: Results indicate attentional focus has little influence on hip, knee, and ankle joint kinetics during a BBS among experienced weightlifters. Instructing experienced weightlifters to shift their attentional focus may have little effect on BBS performance. Future studies should investigate the impact of attentional focus on novice weightlifters performing lower body multi-joint movements.

1826 Board #87 May 31 3:30 PM - 5:00 PM
Load-dependent Relative Muscular Effort of the Knee Extensor Muscles During Back and Front Squats

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(No relevant relationships reported)

Introduction: The back squat (BS) and the front squat (FS) are mainstay exercises of strength training programs. However, not much is known about joint-specific kinematic and kinetic changes during the execution these two exercises as the external load is varied. In addition, the Relative Muscular Effort (RME), which quantifies a muscle groups operating level with respect to its maximum capacity, of the knee extensor muscle group during both exercises is not well characterized.

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.

1827 Board #88 May 31 3:30 PM - 5:00 PM

Development and Validation of Efficient Assessment Tool to Quantify Strength Training Technical Expertise

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(No relevant relationships reported)

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 SD; 67% with Ph.D.) 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 ($d = 0.78$, $p = .041$). 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

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(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-training) 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 climbs 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 ± 86 and 686 ± 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) and IRT (9.6 ± 4.6 and 39.1 ± 15.9 min, pre and post-training) groups showed the same gain in MIR ($P > 0.05$). The DRT group presented reduction of lipid peroxidation (17 ± 4 and 9 ± 3 μ M, pre and post-training, $P < 0.05$) (TBARS), with increased bioavailability of nitric oxide (NO) (122 ± 28 and 177 ± 14 μ M, pre and post-training, $P < 0.05$) and total antioxidant capacity (627 ± 32 and 715 ± 45 μ M, pre and post-training, $P < 0.05$) (TAC). These redox status indicators did not change between CTL; TBARS (15 ± 5 and 17 ± 7 μ M, pre and post-training), NO (118 ± 15 and 125 ± 32 μ M, pre and post-training) and TAC (636 ± 29 and 660 ± 10 μ M, pre and post-training) and IRT; TBARS (16 ± 3 and 15 ± 3 μ M, pre and post-training), NO (126 ± 18 and 133 ± 14 μ M, pre and post-training) and TAC (631 ± 8 and 647 ± 20 μ M, pre and post-training) groups ($P > 0.05$).

CONCLUSIONS: These results suggest that DRT promotes better neuromuscular benefits with improved oxidative stress in healthy Wistar male rats.

1829

Board #90

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Mechanomyographic Amplitude Is Sensitive To Neuromuscular Adaptations Following High- Versus Low-load Resistance Training

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(No relevant relationships reported)

PURPOSE: To examine the changes in mechanomyographic (MMG) amplitude following 3 and 6 weeks of 80% vs. 30% one repetition maximum (1RM) resistance training in the leg extensors. **METHODS:** Twenty-six healthy men (23.1 ± 4.7 years; height = 180.6 ± 6.0 cm; weight = 80.0 ± 14.1 kg) participated in this randomized, repeated measures, between-group design. Participants were assigned to either an 80% 1RM (n = 13) or a 30% 1RM (n = 13) group and completed leg extension training to failure 3 times per week for 6 weeks. MMG amplitude was recorded and averaged from the three superficial quadriceps femoris muscles (MMG_{QAMP}) during randomly ordered, isometric step-muscle actions at the absolute torques associated with 10 - 100% of each subject's baseline maximal voluntary isometric strength (MVIC) at baseline, 3, and 6 weeks of training, and expressed relative to the baseline MVIC. **RESULTS:** There were no significant interactions for time \times torque \times group ($p = 0.08$; $\eta^2p = 0.06$) or torque \times group ($p = 0.14$; $\eta^2p = 0.06$), but there were for time \times group ($p = 0.02$; $\eta^2p = 0.15$) and time \times torque ($p < 0.001$; $\eta^2p = 0.12$). We further evaluated the time \times group interaction by collapsing across torque and using ANCOVAs with baseline MMG_{QAMP} as the covariate to examine between group differences at week 3 and 6, and one-way ANOVAs to examine the change in MMG_{QAMP} across time within groups. The adjusted mean for MMG_{QAMP} during the submaximal isometric step muscle actions was lower in the 80% than 30% 1RM group at week 3 (mean \pm SE; $67.8 \pm 4.5\%$ vs. $83.2 \pm 4.7\%$) and 6 ($65.9 \pm 4.5\%$ vs. $80.5 \pm 4.6\%$). In the 80% group, MMG_{QAMP} decreased from baseline to week 3 ($77.7 \pm 4.3\%$ to $66.8 \pm 4.5\%$; $p < 0.01$), and from baseline to week 6 ($77.7 \pm 4.3\%$ to $65.2 \pm 3.8\%$; $p < 0.05$), but did not change from week 3 to 6 ($p = 0.93$). There were no changes in MMG_{QAMP} for the

30% 1RM group ($p = 0.69$; $\eta^2p = 0.03$). **CONCLUSION:** We observed a decrease in MMG_{QAMP} 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

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Prediction of Ground Reaction Forces of Flexible Barbells using their Bar End Displacement

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(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 associated 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 among 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		
Bar Type	Loading (kg)	R ² *
Ultra Light	6.56	0.938
Golf SS	10	0.922
Light	15	0.899
Light	28.6	0.988
Light Plus	28.6	0.915
Level 1	28.6	0.976
Level 1	46.7	0.944
Level 3	28.6	0.954
Level 3	46.7	0.942
*denotes statistical significance (p<0.005)		

1831

Board #92

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Comparison of Peak Ground Reaction Forces at Natural Frequencies of a Flexible Barbell

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(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 GRFs 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.

Comparison of ground reaction forces at first two fundamental frequencies of flexible barbell (FB)					
FB Type (Loading)	Fundamental Frequency	Lifting Velocity (m/s)	Peak GRF (N)	Peak GRF (N) of Equivalently loaded Steel Bar	Effect Size, d
Ultra Light (6.56 kg)	1st	0.62	190±2*	167±2	11.5
Light (6.56 kg)	2nd	1.01	527±6*	337±5	34.4
Golf SS (10.0 kg)	1st	0.54	262±2*	191±4	22.5
Golf SS (10.0 kg)	2nd	0.91	418±3*	355±6	13.3
Light (15.0 kg)	1st	0.67	858±4*	310±4	137
Light (15.0 kg)	2nd	1.14	889±6*	651±8	33.7
Light (28.0 kg)	1st	0.49	680±12*	396±8	27.8
Light (28.0 kg)	2nd	0.78	1033±2*	666±5	96.4
Light Plus (28.6 kg)	1st	0.52	963±36*	402±6	21.7
Light Plus (28.6 kg)	2nd	0.83	1020±3*	723±5	72
Level 1 (28.6 kg)	1st	0.67	1232±5*	513±6	130.2
Level 1 (28.6 kg)	2nd	1.09	1754±18*	1006±32	28.8
*Significance at p<0.05					

1832 Board #93 May 31 3:30 PM - 5:00 PM
Relationship between Mechanical & Neuromuscular indices of Fatigue during Resistance Exercise

Andrew Renggli, Jarod Vance, Randal Claytor. *Miami University, Oxford, OH.* (Sponsor: Helaine Alessio, FACSM)
(No relevant relationships reported)

Methods for monitoring resistance exercise (RE) loads have been popularized through new technologies. However, little is known about the use of these technologies to explore the relationship between mechanical & neuromuscular indices of muscle fatigue during RE. Purpose: (1) To examine the relationship between changes in external mechanical variables such as Work (W), Power (P) & Velocity (V) & EMG of the quadriceps muscles during 1 set of 1-leg knee extension (RE) to failure. (2) To determine if external mechanical variables can be used as a proxy to predict EMG-based acute muscle fatigue during RE. Methods: 28 males familiar with resistance training volunteered. Body composition (air plethysmography) & 1-RM for a 1-leg knee extension RE was completed. After at least 96 hours, subjects performed as many reps (5.4±1.1) as possible at 90% 1-RM until failure. EMG was collected from the vastus medialis (VM), vastus lateralis (VL), and rectus femoris (RF) of the exercise leg & VM of the non-exercise leg. Total Power (TP), Mean frequency (MF) & Area (A) spectral/amplitude data were used for EMG analysis. Mechanical data was collected via an ultrasound sensor & custom-built software to measure weight-stack movement (time & distance). 1 X 4(Reps) ANOVA & 3(Muscle) X 5(Reps) MANOVA with Repeated Measures, and a-priori contrasts were used to make specific pairwise comparisons. Results: V & P for Reps1&2 (V=23.6±15.5 cm/s; P=182.5±125.4 J/s) was significantly greater than Reps3-5 (V=14.3±9.4 cm/s; P=107.3±77.8 J/s); p<0.05. W was not statistically different across Reps1-5. EMG for VM, VL & RF exhibited similar patterns of activation (no between muscle differences or interactions). TP, M & A during Reps1&2 (TP=118758±18066mV2/Hz; MF=254.0±20.7 Hz; A=571.2±84.5 uV/s) were significantly less than Rep3-5 (TP=229874±66374 mV2/Hz; MF=318.8±21.2 Hz; A=994.0±155.5 uV/s); p<0.05). Conclusion: Quadriceps EMG responses representative of local neuromuscular fatigue begins to occur after Rep2 during 90% of 1-RM RE. Similarly, V & P during the concentric phase of the muscles' action significantly decrease after Rep2, without a decrease in W. These data suggest that measures of V & P can be used as proxy measures of local neuromuscular fatigue during localized high-intensity knee extension RE.

1833 Board #94 May 31 3:30 PM - 5:00 PM
Relationship Between Mechanical Work and Metabolic Cost of Multiple Sets of Resistance Exercise to Failure

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(No relevant relationships reported)

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 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: Day1 included body composition (air-plethysmography) and 1-RM assessment of dominant 1-leg LE; Day2: (≥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 (sets to failure) continued until 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=3491.1±2127.9Nm, VO₂=13210.9±2858.5ml/min, VCO₂=15407.4±4136.1ml/min, and failure-set=3.1±1.2. Insignificant correlations were found between TMW and VO₂ (r=0.28) & TMW and VCO₂ (r=0.21). Linear Regressions suggested TMW had little explanatory power for VO₂ (p=0.18, 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 and intensity of activity.

1834 Board #95 May 31 3:30 PM - 5:00 PM
Influence Of Anthropometric Factors On Balance In Masters Olympic Weightlifters

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(No relevant relationships reported)

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 (35-65yrs) and 22 women (35-61yrs) competitors from the Masters Olympic Weightlifting Championship volunteered to undergo 30s balance testing trials on firm (FI) 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>.05) relationships between age and balance performance (r: -.068 to .265). Except for LM and FI EO and EC performance in the women, there were no significant (p>.05) relationships between anthropometrics (r: -.277 to .267), body composition (r: -.304 to .271) and strength (r: -.341 to .016) with balance performance. No sex differences (p>.05) were identified. Complex post hoc comparison of a significant surface by vision interaction (p<.001) demonstrated the EO-EC difference for the FO surface as significantly greater than the FI (p<.001, d=3.4). **CONCLUSIONS:** In contrast to the general population, except for LM and FI 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.

1835 Board #96 May 31 3:30 PM - 5:00 PM

Support Moment Distribution While Squatting With Different Depths and Percentages One Rep MaxWilliam Goodman¹, Scott Wilson¹, Linnea Zavala¹, Victoria Flores², Joshua Cotter², James Becker¹. ¹Montana State University, Bozeman, MT. ²California State University, Long Beach, Long Beach, CA.

(No relevant relationships reported)

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_s) during the squat. **PURPOSE:** Examine how hip, knee, and ankle contributions to M_s change with increasing squat loads and depths. **METHODS:** 19 females (age: 25.1 ± 5.8 year; squatting experience: 3.8 ± 2.6 years) participated in this study. Participants performed squats at above parallel (AP), parallel (P), and below parallel (BP) depths with 0%, 50%, and 85% of a measured 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_s . Differences between depths and loads in peak M_s and the percent each joint contributed to peak M_s were evaluated using a 3x3 repeated measures ANOVA. **RESULTS:** Peak M_s 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, $p < .001$), but not as depth increased ($p = .149$). There was a significant depth*load interaction for hip contributions to M_s ($p = .013$), with hip contributions increasing with heavier loads for AP and P depths, but not BP (Figure 1A). There was also a depth*load interaction for knee contributions to M_s ($p = .046$). However the opposite pattern was displayed. As load increased, knee contributions to M_s decreased for the AP and P depths, but not BP (Figure 1B). Ankle contributions to M_s did not change with depth ($p = .483$) or load ($p = .581$). **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_s .

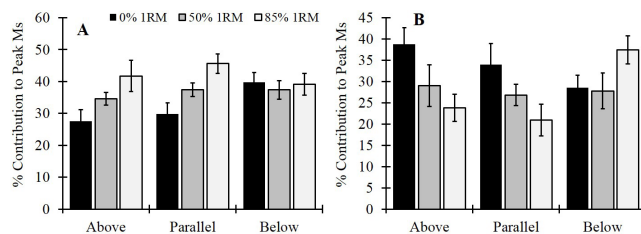


Figure 1. Percent contributions to total support moment at different depths and loads for the hip (A) and knee (B).

Methods: 9 men (age 35 ± 14 yr, height 178 ± 8 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.

Table 1	CMJ			CMJAT		
Performance Metrics	FP	IS	r-Value	FP	IS	r-Value
Flight Height (cm)	30.9	29.6*	0.987	37.1	34.6*	0.989
Jump Height (cm)	40.4	38.0	0.916	48.2	46.4	0.885
Countermovement Metrics						
Low Force (N)	408	375*	0.986	423	351*	0.750
Countermovement (cm)	33.5	36.5	0.778	33.8	29.9	0.205*
Force at Low point (N)	1648	1517*	0.908	1574	1562	0.418*
Rate of Force Development (N/s)	3303	3056	0.879	3000	3956	0.275*
Eccentric Power (W)	-1019	-962	0.691	-1039	-1125	0.405*
Propulsive Metrics						
Peak Propulsive Force (N)	1766	1726	0.778	2721	2467	0.750
Peak Velocity (m/s)	2.54	2.61	0.836	2.78	2.92	0.713
Takeoff Velocity (m/s)	2.41	2.50	0.814	2.65	2.81	0.743
Maximum Power (W)	3687	3895	0.851	4350	5613*	0.850
Landing Metrics						
Peak Landing Force (N)	3690	1969*	0.626*	3489	2245*	0.332*

*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.

1837 Board #98 May 31 3:30 PM - 5:00 PM

Validity of a Commercially Available Inertial Measurement Unit for Vertical Jump Height MeasurementGregory A. Crisafulli, Jeffrey B. Taylor, Anh-Dung Nguyen, Kevin R. Ford, FACSM. *High Point University, High Point, NC.* (Sponsor: Kevin R. Ford, FACSM)

(No relevant relationships reported)

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 ± 0.9 yrs, 178.0 ± 6.5 cm, 80.5 ± 13.04 kg) 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 ± 5.4 cm, IMU: 45.9 ± 3.8 cm $p = 0.36$). However, during the DVJ, the IMU measurement was statistically underestimated (45.0 ± 3.7 cm $p = 0.001$) compared to 3D (48.7 ± 5.7 cm). Bland Altman plots and 95% LOA (Figure) illustrate a systematic error between the IMU and 3D during the DVJ where jump height was underestimated by the IMU. Interestingly, during both tasks, agreement between measurement methods seem to increase at higher jump heights. **CONCLUSIONS:** IMU technology 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.

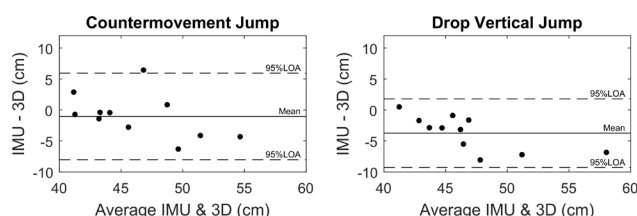
D-62 Free Communication/Poster - Mobile MonitoringThursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B1836 Board #97 May 31 3:30 PM - 5:00 PM
Reliability and Validity of a Wireless Inertial Sensor for Assessing Vertical Jump BiomechanicsJoseph J. DeVita, Ian J. Kremenic, Karl F. Orishimo, Malachy P. McHugh, FACSM. *Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, NY.* (Sponsor: Malachy P. McHugh, FACSM)

(No relevant relationships reported)

Title: Reliability and Validity of a Wireless Inertial Sensor for Assessing Vertical Jump Biomechanics

Authors: Joseph J DeVita, Malachy P McHugh FACSM, Karl F Orishimo, Ian J Kremenic

Purpose: Compare vertical jump metrics measured using force plates (FP) versus a wireless inertial sensor (IS).



1838 Board #99 May 31 3:30 PM - 5:00 PM
Reliability Of A Running Power Meter Between Trials Of Submaximal Running On Three Different Surfaces

Frank Lara, Lee Shearer, Mason Coppi, Nicholas Hayden, Jake Ogden, Scott Murr, Randolph Hutchison, Eric Sobolewski.
Furman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)
(No relevant relationships reported)

Running pace 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 ± 1.41 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 VO_{2max} 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. Intraclass correlations were run between trials 1 and 2 on all surfaces including treadmill, track and grass.

RESULTS: VO_2 , HR, and running power were all reliable between trials 1 and 2 on the 3 different surfaces (VO_2 : $r_{treadmill} = 0.980$, $r_{grass} = 0.876$, $r_{track} = 0.977$; HR: $r_{treadmill} = 0.938$, $r_{grass} = 0.978$, $r_{track} = 0.981$; Power: $r_{treadmill} = 0.995$, $r_{grass} = 0.999$, $r_{track} = 1.00$; Power: $r_{treadmill} = 1.00$, $r_{grass} = 1.00$, $r_{track} = 1.00$).

CONCLUSIONS: The results support that the Stryd running power meter can reliably measure power of submaximal running on three different surfaces including treadmill, grass, and track.

1839 Board #100 May 31 3:30 PM - 5:00 PM
Reliability Between Running Power Meter Footpods During Trials Of Submaximal Running On Three Different Surfaces

Lee Shearer, Nicholas Hayden, Frank Lara, Mason Coppi, Jake Ogden, Scott Murr, Eric Sobolewski, Randolph E. Hutchison.
Furman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)
(No relevant relationships reported)

Running pace 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, two Stryd running power meters were evaluated based on 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 ± 1.41 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 VO_{2max} 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. Interclass correlations were run between Power Meter 1 and Power Meter 2 on all surfaces including treadmill, track, and grass.

RESULTS: Running power values were reliable between the two power meters on trials 1 and 2 for the three different surfaces (Power: $R=0.998$).

CONCLUSIONS: The results support that the Stryd running power meter can reliably measure power of submaximal running on three different surfaces including treadmill, grass, and track.

1840 Board #101 May 31 3:30 PM - 5:00 PM

Differences In Wearable Running Power On Three Different Surfaces During Submaximal Running

Mason Coppi, Lee Shearer, Nicholas Hayden, Jake Ogden, Frank Lara, Scott Murr, Eric Sobolewski, Randolph Hutchison.
Furman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)
(No relevant relationships reported)

Running pace 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 differences in running power (RP) on different surfaces, a Stryd running power meter was evaluated based on 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 ± 1.41 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 VO_{2max} 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. 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 \pm SE: $RP_{treadmill} = 237 \pm 12.7$ W*, $RP_{grass} = 244 \pm 13.4$ W, $RP_{track} = 242 \pm 13.0$ 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.

D-63 Free Communication/Poster - Sports Performance and Injury

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

1841 Board #102 May 31 3:30 PM - 5:00 PM
Comparisons of Ankle and Knee Kinetics during Demi-Plié Ballet Movements

Morris Levy¹, Darren Dutto², LilaAnn White¹. ¹University of Minnesota, Duluth, MN. ²Eastern Oregon University, La Grande, OR.

(No relevant relationships reported)

The Demi-Plié (DP) and Demi-Plié Relevé (DP-R) movements are foundational to performance in Ballet. The DP and DP-R have similar downward phases with the main difference consisting of an upward phase in the DP-R when the dancer goes up on her/his toes, while extending ankle and knees. **PURPOSE:** The purpose of this study was to compare ankle and knee motion (kinetics) during the downward phase of the Demi-Plié and Demi-Plié Relevé, with a hypothesis that peak moments would increase during the DP-R. **METHODS:** Ten college ballet students (mass = 70 ± 14 kg) performed three sets of eight Demi-Plié and Demi-Plié Relevé movements. Full body kinematics were collected using a 12-camera Vicon motion capture system (Oxford, UK). Two Force plates (AMTI) were used to isolate the Ground Reaction Forces (GRF) of each foot. For each individual, average peak ankle/foot and knee moments in the sagittal and frontal planes were determined for each leg, using the average of values determined for each cycle of movement. Beginning of each movement was identified as initiation of knee flexion during the downward phase. Peak moments were compared between the two movements using t-tests. **RESULTS:** Ankle extension moments were greater in the DP-R (Left: DP = 0.60 ± 0.11 , DP-R: 0.76 ± 0.13 Nm/

kg, $p<0.05$). In the frontal plane, knee abduction moments were smaller for the DP-R (Left: $DP = 0.31 \pm 0.10$, $DP-R = 0.23 \pm 0.12$ Nm/kg, $p=0.11$), while ankle eversion moments tended to be larger (Left: $DP = 0.19 \pm 0.12$, $DP-R = 0.28 \pm 0.12$ Nm/kg, $p=0.10$). Knee extension moments were not different (Left: $DP = 0.66 \pm 0.30$, $DP-R = 0.69 \pm 0.31$ Nm/kg, $p=0.73$) between the two movements, although there was an additional 4° knee flexion during DP-R. **CONCLUSION:** During the DP-R, ankle moments are greater in the sagittal and frontal planes. While the movement during the downward phase is similar, the DP-R has the intervening upward phase consisting of ankle extension. This intervening upward motion of the DP-R appears to alter ankle control during the downward phase requiring greater sagittal and frontal plane moments. However, knee varus stress was reduced.

1842 Board #103 May 31 3:30 PM - 5:00 PM
Technical Note: Measuring Muscle Activity During Plyometric Exercise in Shallow Water
 Cordero Duvon Roche, Leland Barker, John A. Mercer, FACSM.
University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: John A Mercer, FACSM)
 (No relevant relationships reported)

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 (Cometa 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), bicep 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_z). Start of movement was first a_z 5% greater than baseline corresponding with burst of EMG and end of movement (standing still after landing from jump) was a_z 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 (55.9%) 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.

1843 Board #104 May 31 3:30 PM - 5:00 PM
Kinematic Comparison of Dolphin Kicking Performed in a Prone and Supine Body Position
 Mickey B. Scharbrough, Taylor L. Adams, Peter E. Robinson, Kali T. Rose, Scott P. McLean. *Southwestern University, Georgetown, TX.* (Sponsor: John Bartholomew, FACSM)
 (No relevant relationships reported)

Despite an increasing emphasis on underwater dolphin kicking in competitive swimming, little objective research exists to explain its preference over flutter kicking. **PURPOSE:** To examine kinematic characteristics of flutter and dolphin kicking performed in prone and supine body positions. **METHODS:** Ten collegiate swimmers (1.77 ± 0.07 m, 72.4 ± 7.6 kg, 19.8 ± 1.0 yrs) experienced with dolphin and flutter kicking completed eight 10 m maximal effort underwater kicking trials. Body position and kicking style were randomly varied between trials such that half of all trials were performed using each kicking style and each body position. A calibrated underwater camera was used to record each trial at 60 Hz. Six body landmarks were digitized for three complete kicking cycles to determine linear and angular kinematic measurements. Whole body speed was defined as horizontal hip velocity. Kicking amplitude and frequency were determined using vertical toe movements. The Strouhal number, a dimensionless index related to the efficiency of underwater undulatory movement, was computed using the kicking amplitude, frequency and velocity. Kinematic data were filtered using a fourth order Butterworth low-pass digital filter with cutoff frequencies individually determined for each coordinate. Linear velocities were computed using the first central difference method. Kinematic measures were compared between kicking style and body positions using a 2x2 (kick x position) repeated measures ANOVA. **RESULTS:** Dolphin kicking velocity (1.22 ± 0.18 m/s)

was faster ($p<0.001$, $\eta^2=0.88$) than flutter kicking velocity (0.99 ± 0.12 m/s). Dolphin kicking amplitude (0.58 ± 0.10 m) was larger ($p<0.001$, $\eta^2=0.93$) than flutter kicking amplitude (0.48 ± 0.08 m). Dolphin kicking frequency (1.85 ± 0.34 Hz) was lower ($p=0.002$, $\eta^2=0.68$) 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 ($p=0.001$, $\eta^2=0.71$) 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 form of underwater kicking. However, body position had little effect on the ability of these participants to perform the respective kicking style.

1844 Board #105 May 31 3:30 PM - 5:00 PM
Higher Vertical Stiffness Is Related To Greater Fifth Metatarsal Bone Mineral Density In Football Players
 Thomas J. Hockenjos, Kevin R. Ford, FACSM, Justin P. Waxman, Anh-Dung Nguyen, Audrey E. Westbrook, Michelle A. Aube, Jeffrey B. Taylor. *High Point University, High Point, NC.* (Sponsor: Kevin Ford, FACSM)
 (No relevant relationships reported)

Lower-extremity stiffness is suggested to contribute to lower-extremity injury risk. Specifically, lower 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 (K_{vert}). **METHODS:** BMD of the whole body (BMD_{WB}), dominant limb (BMD_{DL}) and second and fifth metatarsals (BMD_{Met2} and BMD_{Met5} , 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 (K_{vert}) 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 K_{vert} 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 K_{vert} than the low-stiffness group (0.28 ± 0.01 vs. 0.20 ± 0.02 $\text{kN} \cdot \text{m}^{-1} \cdot \text{kg}^{-1}$, $p<0.001$); 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 BMD_{Met5} compared to the low-stiffness group (0.44 ± 0.11 vs. 0.34 ± 0.11 g/cm^2 , $p=0.029$). Similar between-group differences in BMD_{WB} , BMD_{DL} , and BMD_{Met2} were not observed ($p>0.05$).

CONCLUSIONS: Athletes with relatively high K_{vert} also had greater BMD_{Met5} , indicating that relatively higher stiffness may impose stress on the bone that results in favorable adaptation (increased BMD). Continued work investigating the relationship between K_{vert} , BMD, and training load may elucidate the risk of bony injury in these athletes is warranted.

1845 Board #106 May 31 3:30 PM - 5:00 PM
The Influence Of Load On Preferred Countermovement Depth During Jump Squats
 Leland Barker, John Mercer, FACSM. *UNLV, Las Vegas, NV.* (Sponsor: John Mercer, PhD, FACSM, FACSM)
 (No relevant relationships reported)

ABSTRACT

The jump squat exercise is used in training to provide increased stress to the countermovement jump. However, it is not clear how load influences preferred countermovement depth during the jump squat.

PURPOSE

Compare preferred countermovement depth (PREF) to full and quarter depths (FULL, QTR) during the jump squat across a range of loads.

METHODS

On day one, participants (Male, $n=12$; 25.2 ± 3.9 yrs, 1.77 ± 0.7 m, 88.3 ± 15.7 kg) performed a 3 repetition maximum (3 RM) back squat, which was used to estimate the 1 RM back squat (1 RM = 3 RM/0.9). On the second collection 2-10 days later, jump squats were performed with barbell loads of 0%, 15%, 30%, 45%, 60%, and a return to 0% of 1 RM. Three trials at each load were performed with instructions being to jump as high as possible. Order between conditions was counterbalanced. Vertical ground reaction force (vGRF) was measured from a dual force platform setup ($f_s=1000$ Hz). Verbal cues were given for each depth. Acceleration was calculated from vGRF ($\Sigma F=m \cdot a$), velocity was integrated from acceleration, and position was integrated from velocity. Countermovement depth was calculated as the minimum position during the jump squat. Jump height was calculated as: $(\text{takeoff velocity})^2 / (2 \cdot 9.81)$. 3 (technique)

x 5 (load) repeated measures ANOVAs were performed on depth and jump height, followed by planned comparisons (1x5 and 1x3 ANOVAs) if an interaction was present ($\alpha=0.05$). A paired-samples t-test was used to compare first and last 0% loads to assess possible fatigue and/or potentiation.

RESULTS

Neither depth nor jump height were influenced by an interaction ($p>0.05$).

Countermovement depth was influenced by technique ($p<0.05$). Countermovement depth was significantly different among PREF (-0.33 ± 0.09 m), FULL (-0.44 ± 0.08), and QTR (-0.24 ± 0.06) regardless of load ($p<0.05$). Jump height was not influenced by technique ($p>0.05$), but there was a main effect for load ($p<0.05$) with jump height decreasing with load regardless of technique. Jump height was not different between the first and last 0% 1RM jump squat trials ($p>0.05$).

CONCLUSION

Countermovement depth was different among PREF, FULL, and QTR across loads, but jump height was not influenced by PREF, FULL, or QTR. These results demonstrate that verbal cues can elicit three distinct countermovement depths during jump squats.

1846 Board #107 May 31 3:30 PM - 5:00 PM The Relationship Between 2D and 3D Biomechanics Data in a Single Leg Hurdle Task

Gaelen Athanaze, Chelsey Roe, Samantha Price, Hayley Reed, Jessica Schilling, Brian Noehren, FACSM. *University of Kentucky, Lexington, KY* (Sponsor: Brian Noehren, FACSM)
(No relevant relationships reported)

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: 20 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 $24.8 \pm 9.0^\circ$ at initial contact and $59.8 \pm 9.2^\circ$ at peak knee flexion. Mean values for the 2D data were $28.0 \pm 6.8^\circ$ at initial contact and $66.0 \pm 8.9^\circ$ at peak knee flexion. There was a significant correlation at initial contact ($r=0.717$, $p=.001$) as well as for peak knee flexion angle ($r=0.617$, $p=.006$) 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.

1847 Board #108 May 31 3:30 PM - 5:00 PM Effects And Interactions Of Ncaa Di Basketball Participation On Measures Of Reactive Strength

Nile Banks¹, Dennis Dolny², Eadric Bressel², Talin Louder¹.
¹The University of South Dakota, Vermillion, SD. ²Utah State University, Logan, UT.
(No relevant relationships reported)

Measures 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 foci.

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%, 22%, and 28% greater in males performing depth 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 and RSK in RCM jumping ($p<0.05$). Sex by sport participation interactions were observed for the RSI and RSK, 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 (males>females). This result makes sense from the perspective that female athletes tend to sustain higher incidence of lower extremity injuries when participating in sport.

1848 Board #109 May 31 3:30 PM - 5:00 PM Identifying the Effects of Sex on Reactive Strength Scores using Receiver Operating Characteristic (ROC) Curves

Lara Boman, Jordan Preuss, Jake Rosburg, Nile Banks, Talin Louder. *The University of South Dakota, Vermillion, SD*.
(No relevant relationships reported)

Receiver operating characteristic curves are used as a technique to evaluate the sensitivity and specificity of a continuous variable to discrete, categorical variables. It is known that post-pubescent females tend to diverge from males in neuromuscular performance. Measures of reactive strength attempt to model lower extremity neuromuscular reactivity in agile movement tasks. It is likely that constructing ROC curves would reveal that reactive strength scores are sensitive and specific to the effects of sex on neuromuscular reactivity.

PURPOSE: The purpose of this study was to construct ROC curves to evaluate the sensitivity and specificity of the Reactive Strength Kinetic (RSK), Reactive Strength Index (RSI), and the Coefficient of Reactivity (CoR) to the effects of sex on neuromuscular reactivity.

METHODS: Fifty-nine young adults from the general community and 21 NCAA Division I basketball players performed depth jumps from heights of 0.51 m, 0.66 m, and 0.81 m. The RSK, RSI, and CoR were computed using tri-axial force platform data and two-dimensional videography. Multiple paired t-tests, Cohen's d effect sizes, and ROC curve analysis were used evaluate sex differences and the extent that reactive strength scores are sensitive and specific to sex ($\alpha=0.05$).

RESULTS: RSK, RSI, and CoR scores were greater in males versus females across all depth jump conditions ($p < 0.000 - 0.002$). ROC areas under the curve were larger for CoR (0.78 - 0.87) versus RSI (0.73 - 0.77) and RSK (0.69 - 0.77) across all three depth jump heights. Average sensitivity of all measures was largest in the 0.81 m condition (0.80 versus 0.73 (0.66 m) and 0.76 (0.51 m)).

CONCLUSION: Results suggest that all measures evaluated in this study were sensitive to differences in neuromuscular reactivity across sexes. ROC analyses suggested that the CoR may be the most sensitive measure of sex effects on lower extremity neuromuscular reactivity in depth jumping. Additional research using higher depth heights may confirm this. Additionally, the CoR is a field-test that may be easy to implement by strength and conditioning and clinical professionals.

1849 Board #110 May 31 3:30 PM - 5:00 PM Evaluating A Kinetic-based Assessment Of Reactive Strength

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(No relevant relationships reported)

The Reactive Strength Index (RSI) is the most commonly used reactive strength assessment and its assumed validity among researchers and practitioners is strong. The RSI is a spatiotemporal ratio that used to model a characteristic of strength. In addition, the RSI is computed using theoretical assumptions that are likely variable and inaccurate. There is a need to address the theoretical validity of the RSI, and consider adopting a kinetic-based assessment of reactive strength.

PURPOSE: The purpose of this study was to evaluate the validity of a new kinetic-based assessment of reactive strength, the Reactive Strength Kinetic.

METHODS: Eighty young adults (22.9 ± 2.2 years, 76.1 ± 14.9 kg, 175.9 ± 12.0 cm) completed one maximal effort depth jump from three incremental drop heights (0.51m, 0.66m, and 0.81m) and a single trial of five repetitive countermovement jumps (RCM). Using two-dimensional videography and tri-axial force platform dynamometry, the Coefficient of Reactivity (CoR), RSI, RSK, and RSKa (a=kinematic-adjusted) were computed for all jumping trials. Linear regressions were performed to assess the statistical association between the CoR, RSI, RSK, and RSKa.

RESULTS: Linear regressions detected the strongest association in the RSK v. RSI ($R^2=0.599, p<0.001$) and RSKa v. RSI ($R^2=0.636, p<0.001$) comparisons. Additionally, a linear regression performed on drop height v. measured impact velocity revealed marginal statistical association ($R^2=0.346, p<0.001$).

CONCLUSION: The proportion of explained variance in the comparisons of RSK v. RSI and RSKa v. RSI suggest that the RSI, RSK, and RSKa all attempt to model the construct of reactive strength. The CoR, RSI, and RSK all assume that drop height in depth jumping and flight time in RCM jumping perfectly predict impact velocity. 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 RSK.

1850 Board #111 May 31 3:30 PM - 5:00 PM
Previous Injury History and Landing Error Scoring System and Single-Leg Squat Scores in Collegiate Athletes

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 (No relevant relationships reported)

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 ± 1.4 y; 167.5 ± 9.4 cm; 67.2 ± 11.3 kg) 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 sides for the SLS was used for analyses. An injury history survey was completed to identify previous history of injury. Independent *t*-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 to 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 ($\chi^2=1.97$; $p=0.160$, OR=3.3, 95%CI=0.59-18.31). **CONCLUSION:** 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.

1851 Board #112 May 31 3:30 PM - 5:00 PM
Fatigability of Plantar Flexor Muscles After Remote Ischemic Preconditioning

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 (No relevant relationships reported)

Exposure to brief periods of circulatory occlusion and reperfusion before an exercise (i.e. ischemic preconditioning - IPC) has been suggested to decrease exercise-induced fatigability, but placebo effects are yet to be fully determined. It is also not known if IPC can alter perceived pain and effort during isometric contractions performed with the lower extremity muscles. **PURPOSE:** To determine if IPC can decrease fatigability, perceived effort and pain of the lower extremity muscles during isometric contractions. **METHODS:** 12 individuals (27 ± 4 years) were submitted to cycles of ischemia and reperfusion by inflating a cuff to the non-dominant leg and arm in 3 separate and randomized sessions: A) IPC that consisted of 3 cycles of ischemia and reperfusion of 5 minutes each; B) SHAM session where cuffs were inflated for only 1 minute (not sufficient to induce ischemia), but reperfusion and total times of intervention were similar to those of the IPC session; C) Control session with no cuffs involved. Placebo induction was performed by saying that both IPC and SHAM would improve performance compared to control. Nocebo avoidance was accomplished by telling individuals that IPC would be harmless despite circulatory occlusion sensations. In each session, isometric contraction of the plantar flexor muscle was performed at 20% of maximal voluntary contraction (MVC), with the dominant leg, until task failure. Pain and ratings of perceived exertion were assessed during contractions with a Visual Analogue Scale (0-10). **RESULTS:** Time to task failure was greater in the

IPC compared with SHAM and control sessions (25.1 ± 4 vs. 19.2 ± 2 vs. 20.3 ± 3 min respectively, session effect: $P=0.04$). MVC at task failure was $60 \pm 2\%$ lower than baseline (time effect: $P<0.001$) for all test sessions (session \times time: $P=0.31$). At 25 % of time to task failure, exercise-induced pain was lower in IPC compared with SHAM and control sessions (1.3 ± 1 vs. 1.9 ± 1 vs. 2.6 ± 2 respectively, $P=0.03$). Ratings of perceived exertion were similar between test sessions (session effect and session \times time: $P>0.05$). **CONCLUSIONS:** Compared with the control session, IPC increased time to task failure and decreased exercise-induced pain during fatiguing contraction of the plantar flexor muscles. Placebo effects induced in the SHAM session had minimal effects in these variables.

1852 Board #113 May 31 3:30 PM - 5:00 PM
Laboratory Assessment of Pristine and Used Soft-Shell Headgear for Girls' High School Lacrosse

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 (No relevant relationships reported)

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 blunt impacts after repeated use. **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 following ASTM standards (F1446-15b, F2220-15, and F3137-15) in the front, side, rear, rear and front boss, crown and one random locations. 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. **RESULTS:** A significant main effect for position was observed ($p<0.001$). With the exception of random location with side location, all other 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 in 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.

1853 Board #114 May 31 3:30 PM - 5:00 PM
Do Compression Socks Influence Muscle Activity of the Lower Extremities?

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 (No relevant relationships reported)

Compression 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) or rating of perceived exertion (RPE) during running. **METHODS:** Recreational runners ($n=5$; 1.65 ± 0.07 m; 67.48 ± 8.9 kg; 21.8 ± 3.25 yr) 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 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 L/XL 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 were 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

ANOVAs ($\alpha=0.05$). RESULTS HR and RPE were not significantly different between conditions ($p>.05$). Muscle activity for the Rectus Femoris (RF), Biceps Femoris (BF), and Gastrocnemius (GA) were not significantly different between conditions ($p>.05$). Muscle activity for the Tibialis Anterior (TA) was significantly different ($p=0.042$) during CS condition ($47.8\pm 2.2\mu\text{V}$) compared to RS condition ($63.0\pm 2.0\mu\text{V}$). This accounts for ~24% reduction in muscle activity while wearing compression socks. CONCLUSION Compression socks significantly decrease muscle activity of the TA during running but had no effect on the RF, BF, or GA. Partial funding for this project was provided by NIH/NIDDK STEP-UP (R25DK078382).

1854 Board #115 May 31 3:30 PM - 5:00 PM
Effects of Lumbar Spine Position on Hamstring Flexibility During Passive Straight Leg Raise
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(No relevant relationships reported)

The straight leg raise test and its variations are ubiquitous in clinical sports medicine practice to assess hamstring flexibility. According to the available literature, 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 lumbar spine blocked in slight extension to replicate a neutral lumbar spine and normal contra-directional lumbo-pelvic rhythm 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 right and left leg. RESULTS: A correlation between the average straight leg raise with and without a blocked lumbar spine was found to have a moderate to high correlation ($r=0.693$, $p\text{ value} < .001$). 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 = 9.4418, $t(24) = -14.71$, $p < .001$. CONCLUSION: Maintaining neutral lumbar spine position, replicating normal contra-directional lumbo-pelvic rhythm 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.

1855 Board #116 May 31 3:30 PM - 5:00 PM
Impact Control in High-Intensity Interval Training Can Be Improved by Creatine Supplementation
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(No relevant relationships reported)

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 phosphocreatine (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 adopted to test 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 (PI) 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 (VGFR) and Electromyography (EMG) data were recorded by Gaitway and Lynx-EMG Systems, respectively. Heart rate (HR), Rated Perceived Exertion (RPE – Borg's Scale) 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 VGFR 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 PI (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.

1856 Board #117 May 31 3:30 PM - 5:00 PM
Predictors of Meet Performance in Masters Weightlifters
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(No relevant relationships reported)

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 relation 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 using 85% of their 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 ($P<.001$, $R^2_{adj}=.84$) of meet performance included second pull time ($\beta=-.175$, $P=.013$), peak vertical second pull force ($\beta=.503$, $P<.001$), sex ($\beta=.326$, $P=.001$), and age ($\beta=-.412$, $P<.001$). 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.

1857 Board #118 May 31 3:30 PM - 5:00 PM
Stand And Deliver: Muscle Activity And Mechanical Energetics Of The Lower Limb During Cycling
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(No relevant relationships reported)

Cyclists tend to spontaneously switch from a seated to standing (non-seated) position when they need to produce high pedal torque and power (i.e. during steep climbs, accelerations and sprinting). Existing evidence shows that adopting a non-seated position can result in better economy at high power outputs and an increased level of peak power, yet the mechanisms underpinning these performance advantages remain unclear.

PURPOSE: To compare lower limb muscle activity, joint moments and joint mechanical energetics between seated and non-seated cycling at varying cadences. METHODS: Sixteen, male participants rode on an instrumented ergometer at 50% of peak power (above the reported threshold for sit to stand transition) under different position (seated: S and non-seated: NS), and cadence (70 rpm and 120 rpm) conditions, whilst we recorded electromyography from lower limb muscles, full body motion capture and crank radial and tangential forces. A scaled full-body OpenSim model was used to calculate joint kinematics, moments and mechanical energetics. Statistical comparisons were made using a repeated measures, two-way ANOVA (position x cadence). RESULTS: There was a main effect of position on the distribution of total work across the joints in comparing seated to non-seated conditions. This was demonstrated by a decrease in knee work ($S=1.74\pm 0.01$ vs. $NS=1.38\pm 0.01$ W.kg⁻¹, $p<0.05$) and an increase in hip ($S=2.33\pm 0.52$ vs. $NS=2.57\pm 0.53$ W.kg⁻¹, $p<0.05$) and ankle work ($S=0.85\pm 0.15$ vs. $NS=0.97\pm 0.17$ W.kg⁻¹, $p<0.05$) in the non-seated relative to the seated position. At 70rpm, the mean knee joint moment was reduced and ankle power increased in the non-seated condition. In contrast, at 120 rpm knee power was reduced in the non-seated position, while there was only a moderate increase in ankle power ($S=0.75\pm 0.24$ vs. $NS=0.85\pm 0.29$ W.kg⁻¹, $p<0.05$). CONCLUSION: These

results provide evidence for the theory that the non-seated position can decrease the mechanical requirements of the knee when cycling at high power output, but the benefits may be cadence dependent.

1858 Board #119 May 31 3:30 PM - 5:00 PM
Relationship Between Neurocognitive Testing and Saccadic Eye Movements in Symptom Free Division I Athletes

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(No relevant relationships reported)

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 antisaccade 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 antisaccade 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 monocular eye tracker (240Hz, Argus Science) synced 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., Matick, MA). Spearman rho correlations were used to assess the relationship between ImPACT variables and ocular metrics. **Results:** Significant negative moderate relationships ($r = -0.70, p = 0.02$) 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 ($r = -0.65, p = 0.03$) between RD (2.73 ± 1.03 pixels) and Impulse control composite score (6.4 ± 3.75). 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 antisaccadic eye movements. Due to the relationships exhibited between the ImPACT and SLT, it can be suggested that antisaccade eye movements contain a neurocognitive component.

1859 Board #120 May 31 3:30 PM - 5:00 PM
The Influence of Directional Compression Tights on Muscle Activity and Performance in Recreational Alpine Skiers

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(No relevant relationships reported)

INTRODUCTION Recent studies reported reduced muscle activity in competitive alpine skiers using directional compression (DC). 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 of the gluteus medius (GMED), 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 (%Δ) 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 (1969 ± 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 the DC condition. Further research should investigate the biomechanical influence of DC on skiing performance.

Table 1 % Δ RMS & MF	DC-RMS	TNC - RMS	DC-MF	TNC-MF
GMED	55.0 ± 126.7	-17.0 ± 75.3	11.9 ± 37.0	8.9 ± 36.5
RF	12.9 ± 88.6	-36.6 ± 48.0	-1.3 ± 16.9	-6.8 ± 23.6
ADL	12.7 ± 65.2	-2.9 ± 55.45	-2.5 ± 22.0	10.3 ± 36.1

1860 Board #121 May 31 3:30 PM - 5:00 PM
Narrowing The Gap In Movement Ability from the Perspective of the Female Athlete

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to assess movement ability from the female athlete's perspective before and after a novel field-based training program.

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. Movement ability was measured with a computer-adaptive test version of the Movement Ability Measure (MAM-CAT) at the start (pre) and end (post) of the training program. The MAM-CAT has 18 items, three for each of the six movement dimension of strength, flexibility, speed, accuracy, endurance and adaptability. Each item contains six statements representing six increasing movement ability levels addressing how they currently move and how they would prefer to move during activities of daily life and sports participation. The MAM-CAT software computes standardized current and preferred movement ability scores on a scale from 0 (cannot move) to 6 (moves competitively). Changes in summed current movement ability and current-preferred differentials (movement gap) were compared pre and post training with paired t-tests ($p = .05$). A self-assessment transition item of pre versus post movement ability with five Likert response options ("much better", "slightly better", "about the same", "slightly worse", and "much worse") was used to determine the minimal important difference (MID) by the mean change method between "slightly better" and "about the same" subgroups.

RESULTS: Twenty-one athletes completed pre and post MAM-CAT testing. At the end of the training program, 62% of the athletes reported "slightly better" movement ability and 33% reported "about the same." The MID for narrowing the movement gap was calculated to be 1.1. Group mean current movement ability scores increased 7% (pre, 29.2 ± 4.2 ; post, 31.8 ± 2.8 ; $t = 2.926, p = .008$). The current-preferred differentials decreased on average by 25% (pre, -6.0 ± 3.6 ; post, -4.5 ± 3.0 ; $t = 2.267, p = .035$) and exceeded the MID metric.

CONCLUSIONS: The novel field-based training program enhanced movement ability from the female athlete's point of view. Future studies are recommended to use the MAM-CAT as a tool to modify individual or group training programs by emphasizing the movement dimension with the largest current-preferred gap.

1861 Board #122 May 31 3:30 PM - 5:00 PM
Biomechanical and Physiological Differences Between Two Rowing Ergometers

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(No relevant relationships reported)

PURPOSE: To compare the biomechanical (force, handle velocity) and physiological (oxygen consumption, EMG) responses to rowing at equivalent power outputs on two rowing ergometers, Skillrow (TechnoGym, Italy) and Concept II (Model D, Concept II, UK). The hypothesis was that at the same power output peak force will be lower, and handle velocity more consistent, for the SkillRow than Concept II.

METHODS: Seven young, competitive on-water male rowers (age 24 ± 3 y; BW 89.5 ± 6.8 kg) volunteered to participate in this study. Participants performed a discontinuous submaximal incremental rowing protocol of two 5 min periods (one on each ergometer) at each power output (150, 180 and 210W; drag factor 130), in a counterbalanced order between participants. Handle displacement and velocity was measured with a calibrated linear draw wire displacement transducer and force with a calibrated high resolution strain gauge and force with a calibrated linear draw wire displacement transducer. These recordings were used to derive stroke kinematics (stroke rate, stroke length, drive phase duration, peak velocity) and kinetics measures during the drive phase of the stroke (peak force, average force, impulse) as well as plots of force, displacement and velocity over time during the rowing stroke. Surface EMG was recorded continuously from the bicep femoris long head, vastus lateralis,

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 (Vyntus, 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 ($P=0.006$) 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

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(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 be 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 ($F_{2,4}=43.9, p=.002$), with peak forces being lower in the 3P1 (210.7 ± 13.5 N) than the 3S (476.7 ± 50.5 N) or 1S (378.7 ± 2.6 N) conditions. Peak vertical forces in the RF also showed a main effect of drop ($F_{2,4}=20.3, p=.008$), with peak forces being lower in the 3P1 (1201.7 ± 39.8 N) than the 3S (1359.9 ± 105.8 N). Lastly, there was a main effect of drop for RF horizontal impulse ($F_{2,4}=55.7, p=.001$), 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

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(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 driver. 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 extensor torque was the largest torque produced by both groups. A main effect for leg was found for hip internal rotator torque ($p=.024$) with the largest torques produced by the trail leg. There was an interaction between the legs by groups for hip abductor torque ($p=.043$); the young group had larger torques for the lead leg, while the senior group had no difference between legs. Club head

velocity was significantly ($p<.05$) 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 ($r=.8$; $p=.001$).

Peak Hip Torque	Young (n=12)	Senior (n=10)
Trail - Extensor	10.13 ± 1.95	8.7 ± 1.28
Lead - Extensor	4.70 ± 1.76	3.32 ± 1.14
Trail - Adductor	3.23 ± 1.96	2.42 ± 1.03
Lead - Adductor	.68 ± .87	.7 ± .81
Trail -IR	2.17 ± .68	1.97 ± .50*
Lead-IR	1.90 ± 1.17	1.86 ± .84*
Trail - Flexor	4.70 ± 1.34	4.33 ± 1.10
Lead - Flexor	6.38 ± 1.96	5.85 ± .98
Trail - ER	2.76 ± .52	2.77 ± .7
Lead - ER	2.52 ± .94	2.21 ± .74
Trail - Abductor	4.61 ± 1.21	4.78 ± 1.23
Lead - Abductor	6.39 ± 1.68**	5.02 ± 1.34

Units in N*m/(BW*BH); * = between legs; ** = leg by group

CONCLUSIONS: Overall, hip torques in the trail leg were larger, which suggests their important contribution to the golf swing. These findings are similar to previous literature for healthy male golfers.

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, Joung Kyue Han², Doug Hyun Han³. ¹Kent state Univ, Kent, OH. ²Chung ang Univ, Seoul, Korea, Republic of. ³Chung 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 consistent 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: .09±.07 vs .04±.02, post: .05±.03 vs .05±.02, $F=5.27, p=0.03$). 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 vs .16±.07, post: .14±.09 vs .11±.06, $F=5.59, p=0.02$) and in swing time in the 5AD-BS section of the 5 m putt compared to the control group (pre: .07±.04 vs .05±.02, post: .04±.03 vs .04±.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 gyrus, 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).

1865 Board #126 May 31 3:30 PM - 5:00 PM
Reducing Lower Back Injury in Golf: Cross-sectional Assessment of Novel Swing Technique

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Reported Relationships: R. Weedon: Intellectual Property; Author and

conceptor of The Lower Body Golf Swing.

Lower back pain (LBP) in golf has been associated with repeated swing performance and high-speed spinal loads/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 48.0 \pm 13.6 yrs, Height 176.8 \pm 4.4 cm, Mass 82.1 \pm 5.3 kg) and seven lower body swing (Age 53.9 \pm 12.1 yrs, Height 182.9 \pm 6.1 cm, Mass 92.5 \pm 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 kinematic measures associated with LBP (high crunch factor and thorax to pelvis abduction velocity and acceleration, flexion velocity, thorax rotational velocity and acceleration). Cohen's *d* was calculated to determine the magnitude of effects. **RESULTS:** Significant differences with strong effects ($p < .05$; $d > .80$) were observed for: thorax to pelvis abduction acceleration (lower=358 \pm 334 $^{\circ}$ /s 2 , modern=1024 \pm 464 $^{\circ}$ /s 2), thorax to pelvis abduction velocity (lower=53 \pm 25 $^{\circ}$ /s, modern 107 \pm 24 $^{\circ}$ /s), thorax to pelvis flexion velocity (lower=-38 \pm 60 $^{\circ}$ /s, modern -113 \pm 42 $^{\circ}$ /s), thorax rotation velocity (lower=428 \pm 63 $^{\circ}$ /s, modern 550 \pm 68 $^{\circ}$ /s) and thorax rotation acceleration (lower=2432 \pm 535 $^{\circ}$ /s 2 , modern=3681 \pm 712 $^{\circ}$ /s 2). **CONCLUSION:** The lower body swing displayed favorable kinematics in comparison to the 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; however the physical characteristics contributing towards excessive contralateral trunk lean during the pitching kinetic chain have not been well described in collegiate level pitchers. **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 years of pitching experience (SD=3.23). Pitching kinematic analysis of fastball pitches was performed using 3-dimensional motion analysis techniques. **RESULTS:** Pearson correlations were performed to assess the association between functional assessments with trunk contralateral lean. The average degree of contralateral lean was 2.33 (SD=3.66). The average pitch speed was 80.3 (SD=5.40). No statistically significant correlations were found between any of the assessments and degree of contralateral lean. However, there was a moderate negative correlation between contralateral trunk lean and pitch speed ($r = -.494$, $p = .146$). **CONCLUSION:** The negative correlation between contralateral trunk lean and fastball pitch velocity and trunk assessments and contralateral trunk lean mean be a result of the small sample size (10 subjects) as previous studies of approximately 100 subjects have shown a positive correlation of contralateral trunk tilt of 10 degrees from neutral with an increase of only 0.5-1mph in pitch velocity.

1867 Board #128 May 31 3:30 PM - 5:00 PM
Sparta Testing and Vertical Jump Co-Predict Fastball Speed in Collegiate Pitchers
 William P. Lydon, J. Mark VanNess, John Mayberry, Joey Rossi, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*
 (No relevant relationships reported)

In competitive baseball, the most common pitch is the fastball; its velocity associates with strikeout rate and fielding-independent pitching values. The most effective predictors of pitch velocity are currently debated. Coaches and trainers are increasingly relying on advanced systems of assessment, such as Sparta Performance Science (SPS); fewer are relying on simple assessments, such as the vertical jump (VJ). Data supporting the added value of complex assessments are limited. **PURPOSE:** To test the effect of VJ and SPS performances on fastball velocity among collegiate pitchers.

METHODS: We enrolled 30 pitchers at a Division 1 athletics program in Northern California. Every pitcher on the team's roster between 2014 and 2017 was tested. During collection, heights and body weights were documented; an 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 \pm 2.5 inches, fastball velocity was 87.4 \pm 4.0 mph, SPS Load was 54.2 \pm 8.6, Explode was 51.5 \pm 8.4, and Drive was 54.2 \pm 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 Harwell³, Eileen Leek³, Geoben Johnson¹, David Nichols, FACS¹. ¹Texas Woman's University, Denton, TX. ²California State University Long Beach, Long Beach, CA. ³ManeGait Therapeutic Horsemanship, McKinney, TX. (Sponsor: David Nichols, FACS)

(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 therapy 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 ($p = 0.018$), 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

Subtest	Max	Pre-control	Post-control	Post-riding	Post-washout	Post-combination
Fine motor precision	14	6.0±4.9 ^a	6.0±4.7 ^a	6.1±4.9 ^a	6.2±4.5 ^a	6.4±5.2 ^a
Fine motor integration	10	4.4±3.2 ^a	4.2±3.0 ^a	4.4±2.9 ^a	5.0±3.3 ^a	4.8±3.1 ^a
Manual dexterity	9	2.2±2.1 ^a	2.6±2.0 ^{ab}	2.9±2.0 ^{bc}	3.3±2.4 ^c	3.2±2.4 ^{bc}
Bilateral coordination	7	3.4±3.0 ^a	3.7±2.7 ^a	4.0±3.2 ^a	4.0±3.0 ^a	4.7±2.9 ^a
Balance	8	4.0±3.1 ^a	3.9±2.9 ^a	3.4±2.8 ^a	4.1±2.7 ^a	4.3±2.7 ^a
Running speed and agility	10	4.0±3.6 ^a	4.0±3.4 ^a	3.9±3.3 ^a	4.0±3.4 ^a	4.8±3.2 ^a
Upper-limb coordination	12	4.7±4.4 ^a	3.9±3.8 ^a	5.2±4.2 ^a	4.7±4.1 ^a	6.0±4.1 ^a
Strength	18	3.6±3.3 ^a	4.4±3.3 ^a	5.1±3.6 ^a	4.7±3.3 ^a	5.2±3.0 ^a
Overall	88	32.4±21.6 ^a	32.5±21.9 ^a	35.4±22.9 ^{ab}	36.1±22.6 ^{ab}	39.1±22.2 ^b

Values are mean±s.d. Means with the same superscript are statistically similar ($p > 0.05$). BOT-2 = Bruininks-Oseretsky Test for Motor Proficiency (2nd edition); Max = maximum possible score.

1869 Board #130 May 31 2:00 PM - 3:30 PM Adherence and Continued Participation In A Student-led Wellness Program For Individuals With Disabilities

Megan E. Ware, Kathleen P. Demarrais, Kevin K. McCully, FACSM. University of Georgia, Athens, GA.

(No relevant relationships reported)

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 30602

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.

1870 Board #131 May 31 2:00 PM - 3:30 PM Static Standing Balance Before And After A Maximal Treadmill Test In Adults With Intellectual Disabilities

Miriam Guerra-Balic¹, Casimiro Javierre², Guillermo Oviedo¹.

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(No relevant relationships reported)

Introduction: Static standing balance (SSB) is essential for upright posture and for most functional activities. It has been shown that fatigue worsens SSB in general population. Adults with intellectual disability (ID) may have delayed responses to postural perturbations, especially with concurrence of fatigue. Little is known about SSB in individuals with ID. **Purpose:** To study the effects on SSB before and after a maximal treadmill test (MTT) in adults with ID. **Methods:** 92 adults (49 men) with mild to severe ID including Down syndrome (age: 43.6 ±12.0 y; weight: 72.45±15.0 kg; height: 159.8±11.1 cm) were recruited from an occupational day center. Participants performed a MTT until exhaustion. Immediately before and after the MTT, the center of pressure (COP) radial area, total travel distance (TTD), mean medium-lateral (MLD) and mean anterior-posterior (APD) displacements, and mean velocity sway (MVS) of the COP were measured with a pressure platform for 52sec at 100Hz, with open and closed eyes. Paired t-tests were applied to analyze differences between tests ($p < .05$). **Results:** After a MTT, a significant increase in APD with OE (3.7 vs 4.4mm; $p = 0.020$) was observed. Also, a significant improvement in the X axis position of the COP (MCOP X) with CE (9.9 vs 7.1mm; $p = 0.039$) was observed. The other variables showed no significant changes. **Conclusions:** Regular exercise may improve balance in persons with ID, but if fatigue appears, their postural motor system may be impaired. More research is needed, as balance is important to prevent falls.

Partially supported by: MEC (Ref: DEP2012-35335) & AGAUR (Ref: 2013FI_B2 00091)

Descriptive values of the studies parameters of the COP				
Variables	Pre-Treadmill test		Post-Treadmill test	
	OE	CE	OE	CE
TTD (mm)	225.0 (25.4)	264.1 (34.2)	236.5 (14.5)	242.1 (19.1)
COP radial area (mm ²)	608.4 (1419)	520.1 (156.5)	495.0 (79.3)	546.7 (130.0)
MVS (mm/s)	3.9 (0.4)	4.6 (0.6)	4.1 (0.3)	4.2 (0.3)
MLD (mm)	4.2 (0.6)	3.9 (0.6)	3.9 (0.3)	3.7 (0.3)
APD (mm)	3.7 (0.4)	3.6 (0.3)	4.4 (0.4)*	3.5 (0.3)
MCOP X (mm)	8.7 (1.8)	9.9 (1.8)	7.4 (1.8)	7.1 (1.7)**
MCOP Y (mm)	-9.4 (1.6)	-10.9 (1.5)	-11.8 (1.5)	-11.5 (1.5)

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; MCOPX: mean COP-X position; MCOPY: mean COP-Y position

* Significant difference ($p < 0.05$) between APD with OE

** Significant difference ($p < 0.05$) between MCOP X with CE

1871 Board #132 May 31 2:00 PM - 3:30 PM A Multilevel Patient Engagement Model for Recruiting Hard-to-Reach Populations into Exercise Training Studies

Emily S. Goodner¹, Whitney Neal², Tracy Tracy³, Tapan Mehta¹, Mohanraj Thirumalai¹, William H. Neumeier¹, Hui-Ju Young¹, James H. Rimmer¹. ¹University of Alabama at Birmingham, Birmingham, AL. ²Lakeshore Foundation, Birmingham, AL.

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(No relevant relationships reported)

Many of the current 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

replicated 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 300 interested participants since active 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

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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 activity [MVPA] bouts of ≥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 ANOVAs 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 ($P \leq 0.001$) and function improved ($P \leq 0.001$) 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 bouts MVPA and daily steps) after surgery. The lack of changes 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.

Physical Activity Pre- and Post-Surgery in PACE (n=6) & Delayed PACE (n=7)			
	Baseline	12 Weeks	26 Weeks
Bouted MVPA, min/week			
PACE	81.2±141.8	3.5±5.4	33.3±76.4
Delayed PACE	37.6±85.7	62.1±135.8	78.1±108.0
Steps/day			
PACE	5715.7±3098.0	4255.6±1687.8	4991.8±2910.2
Delayed PACE	6062.4±2817.6	4943.6±1653.2	6324.4±2201.3

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

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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 single 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 prompts or 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 videos. POS went from 50% correct to 87%; OP started at 42% and increased to 80% 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 will 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

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(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) or a nutrition and activity education+ behavioral intervention (NAE+BI), 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 LPA ($r = -0.938$, $p < 0.001$); and a weak 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+BI 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+BI 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 5R03DK70627-02.

1875 Board #136 May 31 2:00 PM - 3:30 PM

Influence of Pain and Mood on Physical Activity after Knee Replacement

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(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 waist. 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 \pm SD 64.7 \pm 6.4 yrs, 57% female, 79% white, 70.3 \pm 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 \pm 10.4% of the day in sedentary behavior, took 3352.1 \pm 1861.9 steps/day, and engaged in 36.8 \pm 53.5 min/week of MVPA. Over one week, participants provided 35.5 \pm 6.5 responses, 73% were in response to random prompts, with the remaining responses being self-initiated. Pain ranged from 1-4 (m \pm SD 2.9 \pm 1.2) and mood ranged from 1-9 (m \pm SD 6.9 \pm 1.5). A higher number of days since surgery was associated with less pain ($r=-0.28$, $p<0.001$) and better mood ($r=0.58$, $p<0.001$); however, neither pain nor mood influenced current or subsequent physical activity. The time since surgery was associated with subsequent physical activity 30 minutes later ($r=0.17$, $p=0.002$), but not current or activity 60 minutes later.

CONCLUSIONS: Knee replacement patients who had surgery within the last 12 months spend the majority of the day engaged in sedentary behavior. Participants who were further out from surgery experienced less pain and better mood; however pain and mood did not influence current or subsequent physical activity. Future studies are needed to explore alternative factors that may be influencing activity after surgery.

1876 Board #137 May 31 2:00 PM - 3:30 PM
Noncompliance Patterns In Accelerometer-based Research For Children And Adolescents With A Developmental Disability

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 (No relevant relationships reported)

An accelerometer is widely used to objectively assess physical activity (PA) levels in field-based research. Accelerometer-wearing compliance has been one of critical issues for a successful data collection because it directly affects the quality of accelerometer data. However, the noncompliance patterns are unknown in children and adolescents with a developmental disability (DD). **PURPOSE:** To assess the noncompliance patterns of children and adolescents with DD in accelerometer-based research. **METHODS:** Forty-eight children and adolescents with DD who could independently walk were recruited from 6 schools in the U.S. (30 from 4 schools) and Korea (18 from 2 schools). Participants were asked to wear a GT3X+ accelerometer (Actigraph, Pensacola, FL) from the time they wake up until going to bed for the next six consecutive days, except for water activities. Data inclusion criteria were >10 hours wear time from 8am to 10pm a day, and 20 consecutive minutes of zero counts as was considered non-wear time (Belton et al., 2013). Time of day was broken into four segments: (a) morning (8am-noon), (b) afternoon (noon-5pm), (c) evening (5pm-8pm), and (d) night (8pm-10pm). **RESULTS:** Seventeen participants met the inclusion criteria on all 6 days, followed by 25 participants on 5 days and 28 participants on 4 days. For further analysis, 3 weekdays/1 weekend day criteria ($n=27$) was added. A Wilcoxon Signed-ranks test indicated weekend non-wear time (Mdn = 167.50) was significantly higher than weekdays (Mdn = 98.75), $Z=-2.28$, $p=.02$. Mean non-wear time in each time segment over 6 days was 49.88, 23.91, 42.74, and 140.07 minutes in order. A repeated measures ANOVA with a Greenhouse-Geisser correction showed a significant difference of non-wear time between four time segments, $F(1,41, 36.72)=17.56$, $p<.001$, and post-hoc analysis using Bonferroni correction found a significant difference between night non-wear time and all other time segments (morning $p<.01$; afternoon, evening $p<.001$). One-way ANOVA and independent t-test revealed no difference of mean non-wear time between schools and between two countries. **CONCLUSIONS:** Future research efforts may be necessary to develop accelerometer wearing compliance strategies, particularly to improve wearing time on a weekend and a night period, for children and adolescents with DD.

1877 Board #138 May 31 2:00 PM - 3:30 PM
Feasibility of Underwater Treadmill Training to Improve Mobility: A Case Study of a Transtibial Amputee

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 (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 an infection coupled with Charcot neuroarthropathy. 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 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.

1878 Board #139 May 31 2:00 PM - 3:30 PM
Qualitative Assessment Of The Implementation Of A 12-week Game-based At-home Intervention For Young Children

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 (No relevant relationships reported)

PURPOSE: A 12-week game-based physical activity (PA) curriculum was developed for children ages 4-7 with and without Prader-Willi Syndrome (PWS), a rare genetic neurodevelopmental disorder leading to medical, motor, and behavioral challenges. This study evaluated preliminary findings on intervention completion and adherence and parent reflections on their participation.

METHODS: Parents (N=25) of children with (n=6) or without PWS (n=19) and their children were enrolled. At baseline parents received the curriculum training and the equipment and materials. During the 12-week intervention, parents reported the number of days/week they used the curriculum (two day minimum required) on-line or using paper logs (n=19). In the post visit, parents participated in a semi-structured interview reflecting on their experiences with the curriculum implementation and any changes perceived in their child. Each interview was transcribed and analyzed for common themes using hierarchical content analysis (preliminary analyses n= 15).

RESULTS: 19 families completed the baseline and post visits (76% retention), with 52.6% of participants adhering to completing twice a week sessions (PWS=80%, without PWS=42.9%). The challenges of implementation included: time management (e.g., challenges with scheduling), lack of motivation by the parent and the child (e.g., unmotivated, sick). Facilitators of implementation included: incorporating the program into their lives (e.g., making it a routine and scheduling it), making a commitment, fostering their child's motivation (e.g., children actively making choices, tailoring to their child's interests), social support and the equipment and curriculum (e.g., easy to use and child-friendly). Parent perceived outcomes included: improvement in child's motor skills, confidence, and motivation, improvement in parents' ability to teach motor skills as well as enjoyment and quality time with their child.

CONCLUSIONS: Implementation of an at home PA intervention with young children is challenging. Parent strategies such as scheduling, building a routine and engaging their child may help overcome difficulties. Nonetheless, parents perceived the PA routine implementation led to building motor skills and self-confidence in their children.

Funded by USAMRAA W81XWH-11-1-0765

1879 Board #140 May 31 2:00 PM - 3:30 PM
A Survey Of Parents Of Children With Mild Developmental Disabilities: Perspectives On Digital Health

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(No relevant relationships reported)

Youth with developmental disabilities have an equal if not higher prevalence of obesity than their typically developing peers, but little is known about parents' views on this issue in the context of digital health.

PURPOSE: The aim of this study was to assess concerns about obesity-related topics, as well as interest in and delivery medium preferences for digital programs focused on these areas, among parents of children with mild developmental disabilities.

METHODS: A survey of digital health perspectives was administered to parents of children who attended a special summer camp (i.e., campers) focused in part on health behaviors. Parents ($N=28$) responded to items about themselves and their camper(s) ($N=28$ campers; there were 31 total parent responses for select survey items about campers [3/28 parent responders had 2 campers, reflecting 6 campers and 6 responses; 6/28 parent responders comprised 3 pairs of parents, and each pair had 1 camper, reflecting 3 campers and 6 responses; 19/28 parent responders had 1 camper, reflecting 19 campers and 19 responses]). Data on health-related concerns and associated interest in digital programs targeting these concerns, as well as preferred program delivery medium and technology use were analyzed using descriptive statistics.

RESULTS: Most parents ($M_{BMI} = 27.2 \pm 4.4 \text{ kg/m}^2$, 82% female, 93% White) expressed concern about weight control (75%) and related topics (e.g., stress: 79%, diet: 75%, physical activity: 61%). Parent responses also highlighted concern about anxiety and depression (74%), diet (71%), and stress (71%) for their children ($M_{age} = 10.6 \pm 3.3 \text{ yr}$, 68% male). Interest in a tailored, digital-delivered program targeting assessed topics was also high (ranging from 54% for sleep to 75% for anxiety and depression). Email and YouTube were the top electronic platforms used by parents (100%) and children (87%), respectively, and 42% of children had a tablet. Email was the top cited preferred digital health-delivery platform for parents and children.

CONCLUSION: These findings suggest most parents of children with developmental disabilities 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.

1880 Board #141 May 31 2:00 PM - 3:30 PM
The Efficacy of Dynamic Cycling in an Individual with ALS: A Pilot Study

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(No relevant relationships reported)

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 (ALSFERS-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 for a duration of 30 minutes.

RESULTS: The 6MWT showed progressive improvement from baseline to after the last cycling session. The subject walked 306 m, 338 m, 370 m, 354 m, 354 m, 386 m, and 386 m respectively (a 21% improvement). The subject's ALSFRS-R score slightly improved from 41 to 42. **CONCLUSION:** The dynamic cycling paradigm proved to be effective in improving mobility and gait in our subject. 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.

1881 Board #142 May 31 2:00 PM - 3:30 PM
Cardiovascular Fitness and Body Composition in Spinal Cord Injured after a 36-session Exoskeleton Program

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(No relevant relationships reported)

Background: Spinal cord injury (SCI) disrupts motor recruitment patterns at or below the injury site resulting in diminution or loss of ambulatory function. Individuals with SCI exhibit reduced daily physical activity levels and an increased sedentary lifestyle. Cardiovascular risk factors are prevalent post-injury with increased adiposity, elevated triglyceride concentrations, insulin insensitivity, and reduced cardiovascular fitness. Technologic advancements have emerged to provide individuals with SCI an opportunity to ambulate in the community and increase daily activity level using exoskeletal robotic assist devices. **Purpose:** To examine cardiovascular fitness (as measured by peak VO_2) and body composition (as measured by DXA) in non-

ambulatory individuals with SCI before and after a 36-session exoskeleton walking program. **Methods:** Four males with a spinal cord injury greater than six months prior all requiring wheelchair use for community mobility, agreed to participate in a randomized six-month study (with a three month 36 session exoskeleton intervention phase) designed to examine multiple outcome measures. As part of the collected dataset, pre and post exoskeletal intervention assessments were determined for peak VO_2 (arm ergometry) and body composition (DXA). **Results:** Participants experienced the following changes after the 36-session exoskeleton intervention: **Participant 1**, peak VO_2 (20.73 to 20.89 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), body mass (64.5 to 68.1 kg), %body fat (13.3 to 17.6%); **Participant 2**, peak VO_2 (15.60 to 16.63 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), body mass (79.6 to 80.6 kg), % body fat (31.1 to 32.7%); **Participant 3**, peak VO_2 (26.11 to 27.19 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), body mass (60.5 to 61.9 kg), %body fat (5.2 to 5.7%); **Participant 4**, peak VO_2 (23.06 to 20.70 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), body mass (57.2 to 56.3 kg), %body fat (6.5 to 4.7%). **Conclusion:** In this preliminary group of four non-ambulatory chronic SCI individuals, a 36 session exoskeleton walking intervention failed to consistently improve cardiovascular fitness, body mass, and body composition (percent fat). Exoskeletal ambulation may not provide an adequate cardiometabolic stimulus to alter standard measures of cardiovascular health in this population.

1882 Board #143 May 31 2:00 PM - 3:30 PM
Getfit: An Interdisciplinary Approach To Exercise And Nutrition For Individuals With Autism Spectrum Disorder

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(No relevant relationships reported)

PURPOSE: GetFIT for All is an interdisciplinary exercise and nutrition program designed for individuals with a diagnosis of Autism Spectrum Disorder (ASD) and other developmental disabilities. The purpose of the GetFIT program is to improve participants' health and wellness, quality of life and socialization. OT, PT, Nursing, and Health Science students collaborate to educate and enhance the healthy habits of participants. Together these disciplines create a client-centered nutrition and fitness program. Get FIT for All addressed behaviors associated with ASD; restrictive eating habits, poor nutritional intake, and gross motor skill deficits that may lead to an unhealthy lifestyle and lack of participation and exercise. Adolescents diagnosed with ASD were two times more likely to be obese than adolescents without developmental disabilities. Young adults diagnosed with ASD were found to have a higher incidence of developing type 2 diabetes when compared to those without ASD. **METHODS:** Participants included 8 individuals with ASD who completed the pre-test; age range 16-42 with a mean age of 24 y.o. One participant dropped out, 2 others did not come to the final data collection session. Pre and post data were collected the first and last day of a 12 week session. The Sensory Profile 2 was used to identify sensory issues so that modifications could be made to the program. Social skills were measured using the Social Responsiveness Scale, 2nd ed. Data collected included anthropometric measures, vital signs, cardiovascular endurance, strength, flexibility, a nutritional screen, and a QOL measure. **Summary of RESULTS:** Percent change was used to assess data due to the sample size. Positive changes in health indicators including strength (plank +85%) (push-ups +35%), cardiovascular endurance (step test +49%), and balance (Stork +26%, right and +64%, left). Results indicated decreased waist (-8%) and hip (-5%) circumference and Timed up and Go (-13%). **CONCLUSION:** These results indicated improvement in overall fitness measures for participants with ASD involved in a 12 week client-centered fitness and nutrition education program. In addition, participants expressed their enjoyment in attending GetFIT and the social interaction with university students. Funded by a Doug Flutie Jr. Foundation Grant

1883 Board #144 May 31 2:00 PM - 3:30 PM
Accuracy Of Parent And Child Self-Reported Physical Activity In Children With Special Needs: A Pilot Study

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(No relevant relationships reported)

Physical activity (PA) is an essential component of health that necessitates accurate measurement. Parents of children with special needs (SN) have an increased involvement in their child's daily life; therefore, it would seem plausible that they could provide an accurate assessment of their child's PA. The accuracy of self-report measures in children with SN has not been established.

PURPOSE: Determined the accuracy of self-reported PA as compared to doubly labeled water (DLW) for children with SN. Furthermore, we assessed if child's age or diagnosis was related to the accuracy.

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; spina bifida-wheelchair n=9; Down syndrome n=9, and control n=9). PA energy expenditure by weight ($\text{kcal}\cdot\text{kg}^{-1}\cdot\text{day}^{-1}$) 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 ($\text{MET}\cdot\text{min}^{-1}\cdot\text{day}^{-1}$) was measured by an activity journal completed by parents and children ≥ 13 years for four weekdays and two weekend days. T-tests compared $\text{MET}\cdot\text{min}^{-1}\cdot\text{day}^{-1}$ 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 $\text{MET}\cdot\text{hrs}\cdot\text{day}^{-1}$; $p = 0.29$). Parent and child self-reported activity levels were moderately correlated to DLW ($r=0.63$, $p<0.001$; $r=0.74$, $p<0.05$, 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

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(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 camp. 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 63.1% (male=65.6%; female=58.8%) of participants learned to independently ride a bicycle. A significant increase in mastery was observed [$F(2,280)=23.699$, ($p<0.001$)], with significant increases observed pre- (23.03 \pm 4.64) to post-camp (25.44 \pm 4.60) ($p<0.01$), and post- to 30-days post-camp (26.61 \pm 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. More research needs to be completed on the psychological effects that learning to ride a bicycle has on self-esteem and/or mastery in the special needs population.

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

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(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 isothermal substitution models with multinomial regression was performed in older adult participants from the 2003-2006 National Health and Nutrition Examination Survey. A hip-worn accelerometer with counts per minute (cts/min) cut-points for SB (<100 cts/min), LPA (100-1951 cts/min), and MVPA (≥ 1952 cts/min) were used to estimate the odds of reporting 0, 1, or

2+ self-reported functional limitations when replacing SB with LPA and/or MVPA. Covariates included age, sex, race/ethnicity, body mass index, smoking, education, income, and marital status.

RESULTS: The analysis included a sample of 1971 older adults (60-85 years) averaging 583 ± 166 min-d-1 (mean \pm 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 2+ 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 2+ limitations was significantly reduced when replacing 60 min of SB with LPA (0.736, 0.679-0.798) or MVPA (0.074, 0.018-0.293). Lastly, the odds of transitioning from one to 2+ 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.

D-65 Free Communication/Poster - Physical Activity and Exercise in Children and Youth

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1886 Board #147 May 31 2:00 PM - 3:30 PM
Participation In Physical Education Classes And Physical Activity And Sedentary Behavior In Children

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(No relevant relationships reported)

PURPOSE: To examine the associations between participation in Physical Education (PE) classes and objective measures of physical activity (PA) and sedentary behavior (SB) in children from 12 countries at different levels of human and socioeconomic development. **METHODS:** This multinational, cross-sectional study included 5874 children aged 9-11 years from sites in Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, the United Kingdom, and the United States. PA and SB were measured over 7 consecutive days using a waist-worn accelerometer. Participation in PE classes was determined by questionnaire. Multilevel modeling analyses were used to account for the hierarchical nature of the data.

RESULTS: PE classes were not attended by 6.6% of the total sample, and in low- and middle-income countries this prevalence was higher than in high-income countries (8.4% vs. 4.7%, respectively, $p<0.01$). After adjusting for age, sex, parental education, and BMI z-score, results showed that children from low- and middle-income countries who participated in PE classes at least once a week were more likely to meet the moderate-to-vigorous physical activity (MVPA) recommendations (male - OR: 1.80; 95%CI: 1.17-2.77; female - OR: 2.17; 95%CI: 1.44-3.27), to spend more time at different PA intensities, and to have shorter SB time (male - OR: 1.61; 95%CI: 1.01-2.60; female - OR: 2.20; 95%CI: 1.38-3.50) than those who did not attend PE classes. In high-income countries, boys that participated in PE classes were more likely to meet the recommendations for PA (OR: 2.20; 95%CI: 1.29-3.76) and to have shorter SB time (OR: 2.42; 95%CI: 1.22-4.81). For girls in high-income countries, attending PE classes increased the likelihood of spending more time in MVPA, especially if they attended three or more classes per week (OR: 2.42; 95%CI: 1.22-4.80).

CONCLUSION: Attending PE classes is associated with a higher level of PA and lower level of SB in children from countries at various levels of human and socioeconomic development. PE classes should be compulsory in all countries as an important contributor to healthy movement behaviors of children.

1887 Board #148 May 31 2:00 PM - 3:30 PM

Difference In Physical Activity Between Children Without Siblings And With Siblings

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(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 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 (80.1±21.3) and waist circumference percentile (77.6±21.7) compared to non-singletons (55.7±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 percentile 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

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(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 parenting 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-appropriate cut-points. Parent PA practices were assessed via parent completion of the Activity Support Scale for Multiple Groups (ACTS-MG). A total of 169 parent (34.5 ± 8.1 yrs.; 30 males, 134 females, 5 unreported)/child (3.6 ± 0.7 yrs.; 80 boys, 89 girls) dyads had compliant PA and survey data and were used for analyses. Multiple multilevel mixed-effects linear regression analyses were utilized to identify parent PA practices that were significantly associated with PA intensities, including total PA (TPA). ACTS-MG individual item analyses were also completed by rescaling ACTS-MG item responses. Statistical significance was set at $p\leq 0.05$. **RESULTS:** Vigorous PA (VPA) ($p=0.02$) and moderate-to-vigorous PA (MVPA) ($p=0.04$) in boys was positively associated with the parent PA practice of using community resources and negatively associated with parents that reported "I take my child to places where he can be active" ($p=0.01$; $p=0.05$, respectively). VPA in boys was positively associated with parents that reported "I enroll my child in community-based programs (such as Girls and Boys Club, YMCA) where he can be active" ($p=0.05$). VPA in girls was positively associated with parents that reported "I limit how long my child plays video games" ($p=0.03$). **CONCLUSION:** Parent utilization of community resources and restricting sedentary activity, especially video game use, have been found to be

significantly associated 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.

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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(No relevant relationships reported)

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 difference in magnitude.

CONCLUSIONS: The results suggest an inverse relationship between ST and SLD. The children categorized with 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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(No relevant relationships reported)

Physical activity (PA), cardiorespiratory 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 (tPA), 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 tPA, PA intensity and CRF models were adjusted for adiposity, and additional adiposity 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

with some of these biomarkers independent of adiposity, whereas LPA and sedentary time appear associated with a small number of biomarkers. This suggests that improving CRF and increasing physical activity of at least moderate intensity may favourably affect lipoprotein metabolism in healthy children.

1891 Board #152 May 31 2:00 PM - 3:30 PM
Physical Activity does not Modify the Relationship between Asthma and Obesity in African American Youth

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(No relevant relationships reported)

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 MVPA (no symptom: 12.5±0.1min; ≥ one symptom: 13.6±0.1min, $p<0.001$) and more SED (no symptom: 758.3±1.2min; ≥ one symptom: 753.8±1.0min, $p=0.004$) compared to adolescents 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 ($\beta=0.6\pm0.2$, $p=0.004$). When MVPA and SED were included in the model, the relationship between asthma symptom score and BMI remained significant ($\beta=0.5\pm0.2$, $p=0.007$).

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 contribute 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.

1892 Board #153 May 31 2:00 PM - 3:30 PM
Cardiovascular Fitness, Body Composition, And ADHD Diagnosis Among Youth In NHANES1-2004

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(No relevant relationships reported)

Abstract

Purpose: The study investigated the relationship between cardiovascular fitness, body composition, and ADHD diagnosis. Obesity and ADHD are highly comorbid—ADHD children are twice as likely to become obese adults than typically developing peers. However, the role of physical fitness in this relationship remains unexplored. **Methods:** Youth age 12-19 years old (N=4,790) participating in the National Health and Nutrition Examinations Survey (NHANES) 2001-2004 were included. Parents reported demographics and whether their child had ever been diagnosed with ADHD. Children underwent examinations of body fat percentage via bioelectrical impedance and estimated VO2 max via a submaximal treadmill test. *Chi-square* analyses and *t*-tests assessed differences between ADHD and typically developing (TD) youth on fitness and composition. Significantly different variables entered a logistic regression analysis with ADHD diagnosis as the dependent variable and estimated VO2 max, percent body fat, age, race/ethnicity, gender, and household income as predictors. **Results:** Males were 3 times more likely to be diagnosed with ADHD than females (12% vs. 4%) ($\beta=1.109$, $\text{Exp}(B)=3.03$, $p<.001$). Non-Hispanic Whites were more likely to have been diagnosed with ADHD (13%) compared to Mexican Americans (4%) and Non-Hispanic Blacks (7%); they were also more likely to have seen a mental health professional in the last year (13%), compared to Blacks (8%) and Mexican Americans (6%). Children diagnosed with ADHD evidenced significantly higher VO2 max than typically developing peers (45.3 ml/kg/min vs. 42.0 ml/kg/min; $t=-5.00$, $p<.001$) and lower % body fat (26% vs. 29%; $t=4.83$, $p<.001$). In regression analyses age, gender, and estimated VO2 Max were related to ADHD, while body fat %, race/ethnicity, and household income were not. For each 1ml/kg/min increase in VO2 max odds of ADHD diagnosis increased by 2% ($\beta=.017$, $\text{Exp}(B)=1.02$, $p<.01$). **Conclusion:** The associations between ADHD, physical fitness and percent body fat

were in the opposite direction of hypotheses and previous literature. This may be a function of ADHD diagnosis as the outcome, rather than symptoms. Unfortunately low-income and racial/ethnic minority children are less likely to be diagnosed and more likely to be obese and unfit. Future studies should directly assess ADHD.

1893 Board #154 May 31 2:00 PM - 3:30 PM
Youth Participation in Competitive Sports Associates with Midlife Lean Body Mass and Physical Activity

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(No relevant relationships reported)

Benefits of life-long physical activity (PA) are widely recognized. Fewer studies have investigated how being young competing athlete reflects to later life body composition and PA. **PURPOSE:** To investigate the impact of participation in competitive sports in youth on the body composition and subjectively and objectively measured PA at middle-age. **METHODS:** The study participants are 47-to-55-year old Finnish women (n=985) attending to the Estrogenic Regulation of Muscle Apoptosis study (ERMA). Their participation in competitive sports at the age of 13-to-16 was assessed with retrospective self-report. Midlife lean body mass (LBM), skeletal muscle mass (SMM) and fat mass (FM) were measured with bioimpedance (Inbody 720) after overnight fast (n=866). Midlife PA included 7-scaled self-estimate that was reclassified to form sedentary, light, moderate and vigorous PA categories (n=985), a detailed assessment of leisure-time PA volume, duration and intensity (a modified Kuopio Ischemic Heart Disease Risk Factor Study Questionnaire, n=982) enabling calculation of mean daily metabolic equivalent (MET-h/day) index as a proxy of the previous 12 months PA and objectively measured total PA over seven-days by hip-worn accelerometer (Actigraph GT3X+ or wGT3X+, n=734). Statistical differences were tested using chi-squared test, independent samples t-test or Mann-Whitney U test. **RESULTS:** Participants were assigned into youth athlete (n=136) or non-athlete (n=849) groups based on their participation in competitive sports at the age of 13-to-16. Youth athlete group had 1.5 kg higher LBM ($p=0.002$) and 1.0 kg higher SMM ($p=0.001$) at middle-age, but no statistically significant difference in FM. Youth athletes reported more vigorous PA (32.4% vs. 20.3%, $p=0.007$) and higher leisure-time MET index (4.3 vs. 3.4 h/day, $p<0.001$) than non-athletes. No difference was observed in accelerometer-measured sedentary time, light PA, moderate-to-vigorous PA or total PA (counts) between groups. **CONCLUSION:** Participation in sport competitions as a teenager has long lasting health benefits that associates with healthier body composition and higher leisure-time PA later in life. However, the discrepancy between self-reports and objective measures needs further studies to delineate the benefits of different components of PA.

1894 Board #155 May 31 2:00 PM - 3:30 PM
Differences and Agreements in Physical Activity of Older Adolescents and Young Adults

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(No relevant relationships reported)

PURPOSE: To examine the differences in physical activity (PA) from older adolescence to young adulthood and the likelihood of meeting the aerobic component of the 2008 Physical Activity Guidelines (PAG) at both times.

METHODS: This study analyzed the Iowa Bone Development Study participants' moderate- and vigorous PA (MVPA) and vigorous PA (VPA) measured with accelerometers at ages 17 and 21 (N = 303). Questionnaire estimated living status (LS, with parents vs not), and student status (SS, enrolled in college/tech/junior college vs not) at age 21. Spearman correlation compared PA of age 17 and 21. Fisher's exact test identified the odds of meeting PAG at both ages. Wilcoxon test examined the effects of LS and SS on PA at age 21. Alpha was set at 0.05.

RESULTS: MVPA at age 17 was associated with MVPA at age 21 (males $r = 0.31$, females $r = 0.22$). VPA at age 17 was associated with VPA at age 21 (males $r = 0.29$, females $r = 0.18$). Table 1 shows participants' PA characteristics. Ninety-five percent of males and seventy-one percent of females who met PAG at age 17 also met corresponding PAG at age 21. Living with parents at age 21 decreased MVPA minutes in males by 17.7 and in females by 5.92; and VPA minutes in males by 2.48 and in females by 1.85 compared to living elsewhere. Being a student at age 21 increased MVPA minutes in males by 10.52 and in females by 11.46; and VPA minutes in males by 2.56 and in females by 3 compared to not being a student.

CONCLUSION: PA association between ages 17 and 21 were low but statistically significant.

Most participants who met PAG at age 17 also met PAG at age 21. The weak association between older adolescent and young adult PA suggests that PA is not an intractable behavior and that intervening during this transition time may successfully increase young adult PA.

The National Institute of Dental and Craniofacial Research R01-DE12101 and R01-DE09551, and the General Clinical Research Centers Program from the National Center for Research Resources, M01-RR00059 supported this work.

1895 Board #156 May 31 2:00 PM - 3:30 PM

Associations of Short Bout Sedentary Behavior and Physical Activity with Adiposity and Fitness in Children

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(No relevant relationships reported)

PURPOSE: Total duration of sedentary behavior (SB) is not consistently associated with adiposity and fitness in children. In adults, SB accumulated in long bouts has been positively associated with adiposity while short bouts are inversely related. We studied the effect of displacing long bout SB with short bout SB and physical activity in children.

METHODS: This cross-sectional study included 450 children aged 9-11 from New Zealand. Objective SB and activity were measured via wrist-worn accelerometer for ≥ 3 days. Activity was classified as long (≥10 min) and short (<10 min) bout SB, light, and moderate-to-vigorous physical activity (MVPA). Estimated cardiorespiratory fitness (mL/kg·min) was assessed using the 20 metre shuttle run test. Adiposity measures were World Health Organization BMI z-score (zBMI), waist circumference (WC) and Fat Mass Index (FMI). Isotemporal substitution estimated the effect of displacing long bout SB with short bout SB, light and MVPA (per SD) on adiposity and fitness in adjusted linear mixed models.

RESULTS: Children accumulated the following mean (SD) in min/day: 32 (17) long bout SB, 302 (42) short bout SB, 235 (27) light activity, and 131 (29) MVPA. Overall and in boys only, substituting long bout SB with short bout SB and physical activity was not associated with adiposity. Among girls, substituting with short bout SB (std. coef. = -0.84, p=0.038) and MVPA (std. coef. = -0.78, p=0.017) were inversely associated with FMI. Overall and by sex, substituting with MVPA was associated with higher fitness (std. coef.=2.08 mL/kg·min, p< 0.001). Substituting with short bout SB was associated with higher fitness in girls (std. coef. = 1.44 mL/kg·min, p=0.036). (Table 1)

CONCLUSIONS: As compared to long bouts, short bout SB (<10 min) was not adversely associated with outcomes and, in some cases, was related to more favorable f adiposity and fitness. SB pattern (long vs. short bout) may be important for clarifying health risks related to SB in children.

Table 1. Associations between Sedentary Behavior (SB), Light, and Moderate-to-Vigorous Intensity Physical Activity (MVPA), Adiposity, and Fitness among Children aged 9-11

		Boys (n=220)		Girls (n=230)		Overall (n=450)	
		std. coef.	P-value	std. coef.	P-value	std. coef.	P-value
zBMI	Short bout SB	0.08	0.717	-0.17	0.376	-0.05	0.749
	Light	0.13	0.294	-0.14	0.214	-0.02	0.843
	MVPA	-0.02	0.910	-0.13	0.375	-0.07	0.546
FMI	Short bout SB	0.25	0.540	-0.84	0.038	-0.31	0.285
	Light	0.28	0.248	-0.20	0.398	-0.01	0.985
	MVPA	-0.13	0.687	-0.78	0.017	-0.40	0.076
WC (cm)	Short bout SB	-0.02	0.988	-1.81	0.234	-0.84	0.437
	Light	0.35	0.706	-1.07	0.238	-0.46	0.490
	MVPA	-0.73	0.537	-1.65	0.168	-0.93	0.268
VO ₂ Max (mL/kg·min)	Short bout SB	0.15	0.864	1.44	0.036	1.09	0.052
	Light	-0.85	0.390	-0.33	0.416	-0.50	0.151
	MVPA	2.24	0.001	2.08	0.000	2.42	0.000

Standard coefficients (std. coef.) present change in dependent variable per 1 SD change in activity metric and are adjusted for accelerometer wear time, age, socioeconomic status, gender, and school.

1896 Board #157 May 31 2:00 PM - 3:30 PM

Associations Between School Transport And Obesity By Gender, Grade, Physical Activity, Ethnicity, And Economic Disadvantage

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(No relevant relationships reported)

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.

METHODS: Cross-sectional data on reported sociodemographic characteristics, school transport mode, and physical activity behavior were collected from the Texas School Physical Activity and Nutrition (SPAN) Survey, 2015-2016. Measured height and weight were used to calculate BMI and classify 4th, 8th, and 11th grade students by obesity status. The sampling frame had 14,976 students from 452 schools to provide weighted state-level estimates by grade. Descriptive statistics and associations were conducted between school transport modes and obesity. Interaction terms were included to test if school transport mode-obesity associations differed by gender, grade, physical activity, race/ethnicity, or economic disadvantage.

RESULTS: Participants were predominately Hispanic (69.8%), normal weight (55.8%), used passive school transport modes (90.9%), and did not meet physical activity guidelines (82.4%). Active and passive school transport modes were not significantly associated with obesity (all *ps*>0.05). Gender, race/ethnicity, physical activity, and economic disadvantage were significantly associated with obesity (all *ps*<0.05). Bike to school by race/ethnicity and walk to school by grade were significantly associated with obesity (all *ps*<0.05). Hispanic/AA students who biked to school were significantly more likely to have obesity compared to White/Other students who did not bike to school (OR=5.48, *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/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 DSHS with funds from the Title V MCH Block Grant to Texas, the CDC HHS Block Grant, and the Michael & Susan Dell Foundation.

1897 Board #158 May 31 2:00 PM - 3:30 PM

Freestyle Swimming Performance From Childhood To Adolescence Of Japanese Top-Class Swimmers.

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(No relevant relationships reported)

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 fastest records of each individual by independent t-test for each age group.

RESULTS: The table shows the matrix of correlation coefficient of male swimmers. In males, the correlation between the latest TIME and each age record for 10 years gradually became stronger from 16 years old, but there was not a clear tendency from 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.

CONCLUSION: These results suggest that there isn't a strong relationship between early childhood performance and latest TIME of Japanese top-class swimmers.

1898 Board #159 May 31 2:00 PM - 3:30 PM

Dose Response of Cardiorespiratory Fitness Interventions in Adolescents: A Systematic Review

Zezhao Chen, Jingyuan Zhu, Weimo Zhu, FACSM. University of Illinois at Urbana Campaign, Urbana, IL.

(No relevant relationships reported)

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).

RESULTS: The search yielded 50 studies, a total of 15 studies were included in the review. Most of the included studies employed a randomized control 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 $\dot{V}O_{2max}$, 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 found statistically significant for improving CRF (ES = 0.87, 95% CI 0.23 to 1.11, $p=0.04$). 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 significance 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 0.55-0.88), with high heterogeneity ($I^2 = 94\%$). 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.

1899 Board #160 May 31 2:00 PM - 3:30 PM
Dose-response Effects Of Exercises In Children With Asthma: A Review

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(No relevant relationships reported)

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: Fourteen 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% $\dot{V}O_{2max}$, 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.

1900 Board #161 May 31 2:00 PM - 3:30 PM
Exercise Interventions for Children with Autism: A Review

Samuel Streeter, Zezhao Chen, Weimo Zhu, FACSM. *University of Illinois at Urbana-Champaign, Champaign-Urbana, IL.*
(No relevant relationships reported)

Samuel Streeter, Zezhao Chen, and Weimo Zhu
 University of Illinois at Urbana-Champaign

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 is unknown. The purpose of this study was to determine the dose response of exercise interventions for children (aged <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. 4 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 at 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.

1901 Board #162 May 31 2:00 PM - 3:30 PM
Differences in CVD Risk Factor Status and Micronutrient Intakes by Physical Activity Level in Youth

Jeanette M. Ricci, Joseph J. Carlson, Erich Petushek, Karin A. Pfeiffer, FACSM. *Michigan State University, East Lansing, MI.*
(No relevant relationships reported)

Physical inactivity is an independent CVD risk factor. In 5th graders few reports show associations between moderate to vigorous physical activity (MVPA) and multiple CVD risk factors, or between MVPA and micronutrient intakes that contribute to cardiovascular health. **PURPOSE:** To determine if high PA youth have a better CVD risk factor status and higher intakes of micronutrients linked to cardiovascular health, compared to low PA youth. **METHODS:** In a cross-sectional analysis of data from 5th grade students (N=947, 11 ± 0.5 yr; 58.2% females; 58.4% white), trained research assistants collected height, weight, percent body fat (%BF) via bioelectrical impedance, resting blood pressure (SBP,DBP), and non-fasting blood samples by finger prick for total cholesterol (TC), low density lipoprotein (LDL), high-density lipoprotein cholesterol (HDL-C) and TC:HDL levels. Micronutrient intakes were derived from the Block Kids Food Frequency Questionnaire. MVPA groups were determined by median split (High PA≥5days, Low PA<5days). One-way ANCOVAs were used to determine if CVD risk factors and micronutrients differed between High- and Low PA- groups, when controlling for age and gender. **RESULTS:** High PA youth had lower %BF (23.1 vs. 25.3, $F(1,926)=14.98$, $p<0.05$) and higher HDL-C (49.7 vs. 46.5, $F(1,667)=9.12$, $p<0.05$) compared to Low PA, with no differences in TC, TC:HDL, or BP measures. Micro-nutrient intakes were assessed per 1000 kcals. High PA youth reported higher intakes of K+ (1.38 g vs. 1.29 g, $F(1,890)=19.98$, $p<0.05$), Mg+ (136 mg vs. 128 mg, $F(1,890)=26.27$, $p<0.05$), vitamin A (353 mcg vs. 332 mcg, $F(1,890)=5.04$, $p<0.05$), vitamin C (79 mg vs. 67 mg, $F(1,890)=12.37$, $p<0.05$), vitamin E (3.6 mg vs. 3.3 mg, $F(1,890)=6.64$, $p<0.05$) and lower Na+ (1.48 g vs. 1.52 g, $F(1,890)=4.19$, $p<0.05$) compared to Low PA, with no differences in calcium or vitamin D. **CONCLUSIONS:** The better CVD risk factor status in High PA compared to Low PA youth parallels previous cross-sectional findings. The higher intakes of cardioprotective micronutrients in High PA youth may have contributed to better CVD risk status.

Funding source: Blue Cross Blue Shield Foundation of Michigan, Supplemental Nutrition Assistance Program-Nutrition Education, USDA

D-66 Free Communication/Poster - Population-Based Surveillance

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

1902 Board #163 May 31 2:00 PM - 3:30 PM
Research on Relationship between Chinese Female Students' Height and Geographical Meteorological Indexes

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(No relevant relationships reported)

PURPOSE: This study explores the trend and relationship of Chinese 7-17 year old female students' height and major geographical meteorological indicators in the six Chinese major geographical regions from 1979 to 2014. Then, uses the map visualization method to show the visualization characteristics of the students' Height change trend.

METHODS: Using the principal component analysis method and the spatial interpolation technique in the geographic information system, the spatial structure of the Chinese students' physique has been reflected. Based on the mathematical statistics method and the regional comparison method, the height data of urban girls aged 7-17 years in China from 1979 to 2014 were divided and the height maps were mapped. The horizontal and vertical comparative analysis about meteorological indexes and the height was carried out according to the geographical division.

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 a 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.

1903 Board #164 May 31 2:00 PM - 3:30 PM
Thirty Years Secular Trend Of Rest Heart Rate In An Epidemiological Transition Society
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 (No relevant relationships reported)

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 Mixed-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. Statistic 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 $p < .01$ was taken as significant. **Results:** Mean RHR was 81.3 bpm in the 1978 decade, of 85.2 bpm in 1988 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 to 1978 ones. It was also noted a increase of 11.4 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 Board #165 May 31 2:00 PM - 3:30 PM
Knowledge of the Adult and Youth 2008 Physical Activity Guidelines for Americans
 Eric T. Hyde, John D. Omura, Kathleen B. Watson, Janet E. Fulton, FACSM, Susan A. Carlson. *Centers for Disease Control and Prevention, Atlanta, GA.*
 (No relevant relationships reported)

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 ConsumerStyles* survey 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. Prevalence of knowledge of the adult guideline was estimated among all respondents (n=3,910), and of the youth guideline among respondents with school aged children (n=1,288). Differences by demographic characteristics, body mass index (BMI) categories, and physical activity levels were tested using adjusted chi-square tests. **RESULTS:** Overall, 2.4% (95% confidence interval (CI): 1.9, 3.1) of adults were knowledgeable of the adult guideline and 22.9% (95% CI: 20.5, 25.7) of parents were knowledgeable of the youth guideline. Knowledge of the adult guideline differed significantly 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, 3.0) 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.

1905 Board #166 May 31 2:00 PM - 3:30 PM
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 $0.12 \pm 0.01\%$ was reported 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 ($2.29 \pm 0.04\%$), with a continuous decrease until quartile four ($-1.38 \pm 0.02\%$). 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 $R^2 = 0.632$). 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 Board #167 May 31 2:00 PM - 3:30 PM
Improving the Operationalization of Neighborhood Built Environment Exposures in Physical Activity Research: Houston TRAIN Study
 Deborah Salvo¹, Casey P. Durand², Abiodun Oluyomi³, Kelley Pettée Gabriel, FACSM¹, Alexandra van den Berg¹, Adriana Pérez¹, Harold W. Kohl III, FACSM¹. ¹The University of Texas Health Science Center at Houston - School of Public Health (Austin), Austin, TX. ²The University of Texas Health Science Center at Houston - School of Public Health (Houston), Houston, TX. ³Baylor College of Medicine, Houston, TX.
 (No relevant relationships reported)

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.

PURPOSE: 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 (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 Freedson 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 (R^2) and statistical significance. Models were adjusted for sex, age, education, marital status and race/ethnicity. **RESULTS:** Data were available for 337 adults. For park access, significant ($p < 0.05$) associations were observed at buffer sizes 2250m and 2500m. The 2500m scale had the best fit ($R^2 = 0.15$). Each additional park in the 2500m 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 R^2 (0.16) was at 2000m. Each additional transit

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 ($\geq 2000\text{m}$, i.e. $\geq 24\text{ min walk}$) 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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(No relevant relationships reported)

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 7.3 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 41.6%, 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 MVPA 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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(No relevant relationships reported)

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 analyses.

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 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

David Q. Thomas, FACSM, Lea J. Anderson, Monica N. Tyler, Rachel M. Sherman, Jennifer Spring, *Illinois State University, Normal, IL.*

(No relevant relationships reported)

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 than 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 technological 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. CDC, Atlanta, GA. (Sponsor: David R. Brown, FACSM)

(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, patrols by police or security, 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.

D-67 Free Communication/Poster - Energy Availability and Expenditure

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1911 Board #172 May 31 2:00 PM - 3:30 PM

Lower Energy Availability Is Associated With Low Resting Energy Expenditure In Japanese Female Athletes.

Kuniko Moto¹, Rie Ishizawa¹, Machiko Otaka¹, Suguru Torii¹, Akira Namba², Motoko Taguchi¹. ¹Waseda University, Saitama, Japan. ²Saitama Medical University, Saitama, Japan.

(No relevant relationships reported)

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. **PURPOSE:** To investigate the relationship between EA and resting energy expenditure (REE) in Japanese female 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 (DXA).

RESULTS: Subjects with lower EA (<25 kcal/kg FFM/day) had lower REE/FFM than those with normal EA (23.2±3.1 vs. 27.0±2.4 kcal/kg FFM/day, $p<0.05$), and had lower triiodothyronine (T₃) levels (80±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.

1912 Board #173 May 31 2:00 PM - 3:30 PM
Predicting Energy expenditure in Males And Females During High-intensity Functional Training

Jesse A. Stein¹, Yuri Fietto, FACSM², Katie M. Heinrich¹. ¹Kansas State University, Manhattan, KS. ²Kennesaw State University, Kennesaw, GA.

(No relevant relationships reported)

PURPOSE: Researchers report improved body composition after high-intensity functional training (HIFT), which may result from high energy expenditure (EE) during training sessions. Incorporating predictive models for EE during HIFT may benefit practitioners, yet no investigation has attempted to predict EE during HIFT, which is likely different between sexes. Our study aimed to compare EE between sexes and predict EE using anthropometric, physical fitness and performance characteristics during a HIFT session. **METHODS:** Participants with ≥ 4 weeks of HIFT were recruited (n = 98; age = 31.3 ± 7.2 years; 41% female). Height (HT) and weight (WT) were determined using a stadiometer and electronic physicians scale, respectively. Level of experience (LVL) was assessed via self-reported time on a popular HIFT workout. Dual Energy X-Ray Absorptiometry (DEXA) was used to determine percent body fat (%BF). Participants completed a graded exercise test to determine peak oxygen consumption (VO_{2peak}). Participants returned after one week to perform a HIFT session while wearing a portable calorimetry system to determine EE. Participants completed as many rounds as possible of a 250-meter row, 20 kettlebell swings, and 15 thrusters in 15 minutes. Independent-samples t-test was used to compare EE between females and males, and multiple linear regression with stepwise selection was used to predict EE for females and males based on age, HT, WT, LVL, VO_{2peak}, and %BF.

RESULTS: Mean EE was significantly different between females (48.9±18.2 kcal/min) and males (71.2±20.0 kcal/min; $p<.001$). For females, greater LVL ($\beta = 9.92$) and WT ($\beta = 0.94$), and lower %BF ($\beta = -1.03$) predicted 67% of the variance in EE, $f(3, 40) = 24.9$, $p<.001$. For males, greater LVL ($\beta = 15.50$) and height ($\beta = 0.96$), and lower %BF ($\beta = -0.69$) predicted 70% of the variance in EE, $f(3, 58) = 43.3$, $p<.001$. **CONCLUSIONS:** During a HIFT session, males exhibit higher EE than females, and anthropometric and experience measures predicted EE. It is promising for

practitioners that greater experience along with decreased %BF are related to increased EE. However, since HIFT utilizes different exercises in each session, EE likely varies. Future research could assess EE across a variety of HIFT sessions and continue to translate findings to practical applications for practitioners.

1913 Board #174 May 31 2:00 PM - 3:30 PM
Effect Of Training Periods On Energy Deficiency And Physical Activity Level In Male Runners

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(No relevant relationships reported)

PURPOSE: 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±2.7 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±6.3 cm; body weight, 59.1±4.9 kg; BMI, 19.9±0.8 kg/m²). The evaluation index for energy deficiency was energy balance (EB), 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.

1914 Board #175 May 31 2:00 PM - 3:30 PM
Water Induced Thermogenesis

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(No relevant relationships reported)

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° [H] C) and two volumes of distilled water (7 and 21 mL H₂O/kg body mass) on metabolism. **METHODS:** 10 subjects (age 22.3 ± 1.3 yr, ht. 1.74 ± 15.2 m., body mass 75.1 ± 18.5 kg, 4♂) reported to the lab in a euhydrated state and refrained from 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 trials, respectively. Subjects served as their own control in the randomized assignment of trials. **RESULTS:** Statistical analysis by factorial ANOVA revealed NSD ($p>.05$) among trials for energy cost. The greatest deviation from baseline RMR was a NSD of 4.4%, 6%, -4.2%, and 4.3% for C7, C21, H7, and H21, respectively.

VO ₂ mL/min	PRE	T1	T2	T3	T4
C7	252 ± 46	263 ± 47	248 ± 50	260 ± 52	249 ± 50
C21	266 ± 67	262 ± 55	272 ± 66	282 ± 66	272 ± 62
H7	260 ± 58	257 ± 66	257 ± 74	249 ± 69	258 ± 62
H21	258 ± 67	269 ± 67	264 ± 67	264 ± 66	267 ± 58

CONCLUSION: Despite the ingestion of water in the range of common temperatures and volumes that are suggested to alter metabolic rate, none of these four conditions elicited a significant change in RMR. Although water ingestion can maintain euhydration, water does not enhance caloric expenditure in a significant manner.

1915 Board #176 May 31 2:00 PM - 3:30 PM
Lessons Learned From Tennis Coaches' Limited Disordered Weight Control Behaviors And Disordered Eating Knowledge

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(No relevant relationships reported)

Irrational fears of food and weight gain are the foundation for Disordered Weight Control Behaviors (DWCB), methods of weight control deemed unhealthy (e.g. severe Caloric restriction). Those extreme behaviors serve as clinical diagnostic criteria for Eating Disorders (ED). Adolescence is the time when DWCB and ED are likely to originate, especially in athletes. DWCB is linked to nutrition misinformation. The most frequently athlete cited source of nutrition information is equally misinformed coaches. **PURPOSE:** To assess high school tennis coaches' knowledge in 5 domains: (1) Macronutrients/Energy, (2), ED Etiology (3) Symptoms (4) Scope of Practice, and (5) ED Treatment. **METHODS:** The Nutrition & Eating Disorders in Tennis Survey (NETS) was created through modification of Turk et al.'s survey as no survey specific to all of the domains existed. An expert panel confirmed the Face and Construct Validity of the NETS before it was piloted. A link to Qualtrics survey and informed consent form was emailed to Indiana High School coaches. The criterion for "Adequate Knowledge" (AK) was set at 80%. Mean knowledge scores were calculated for each question and the 5 domains. A three - way ANOVA tested for any significant differences ($p < 0.05$) between means of total knowledge scores and demographic variables. **RESULTS:** Seventy-nine coaches (male = 61, female = 18) ages 24 to 71 (43.97, ± 11.97) completed every question, which corresponds to a 23% rate of return, 90% statistical power according to Insel, G.D. The most cited source of nutrition knowledge was "experience as an athlete" (48.1% or 38 of 79) and the least was a Registered Dietitian (1.3% or 1 of 79). Data analysis revealed that the coaches lacked knowledge: the mean total score was 17.65 correct out of 25 or 70.6% ($\pm 10.9\%$), falling below the established AK criterion. The lowest mean scores were 57.0% ($\pm 22.4\%$), 60.0% ($\pm 21.7\%$), 63.6% ($\pm 22.9\%$), for domains 1, 3, and 5, respectively. There was no significant differences between knowledge scores and education. **CONCLUSION:** The low knowledge scores suggest that the coached athletes are at a higher risk of DWCB. Likewise, they are likely to be misinformed about the importance of correct energy intake. The common notion that experience as an athlete or taking a nutrition course makes one a qualified nutrition educator, must be questioned.

1916 Board #177 May 31 2:00 PM - 3:30 PM
Macronutrient Intake and Resting Metabolic Rate in Middle and Long Distance Recreational Female Runners

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(No relevant relationships reported)

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 \pm 1.19) and 9 long distance (age 24.4 \pm 1.3), who completed a 3- day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5 \pm 6.1 miles weekly and long distance runners averaged 30.5 \pm 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. Subjects were also given the BSQ-16A self-report questionnaire of body shape preoccupation typical of eating disorders.

RESULTS: There was a significant difference in body fat % between the middle distance and long distance runners (31 \pm 4.3 vs 25.1 \pm 3.73, $p=0.004$) and in lean body mass % (63.8 \pm 4.2 vs 71.2 \pm 3.8). There were no significant differences in body mass index (21.4 \pm 2.0 vs 23.6 \pm 3.3, $p=0.11$). RMR was approaching a significance difference between groups with the long distance runners having a lower RMR and the middle distance runners demonstrating a higher RMR (1242.4 kcal \pm 190.4 vs 1462.8 kcal \pm 281.2, $p=0.06$). Energy intake was similar between both long distance runners and middle distance runners, with both groups only eating minimally above their RMR (284.5 \pm 120.7 kcal above RMR vs 121 \pm 281.2 kcal above RMR). Results from the BSQ-16A revealed neither group suffered from body shape concern.

CONCLUSIONS: Both middle distance runners and long distance runners demonstrated caloric restriction. Despite having significantly more lean body mass, long distance recreational runners had a lower RMR. This may have been due to the greater energy deficit and increased energy expenditure found in the long distance runners.

1917 Board #178 May 31 2:00 PM - 3:30 PM
Current Energy Availability Is Not Associated With The Menstrual Status Among Japanese Female Athletes

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(No relevant relationships reported)

PURPOSE: Energy availability (EA) is defined as dietary total energy intake (TEI) minus exercise energy expenditure (EEE) normalized to fat-free mass (FFM). It is well known that chronic reduction in EA, below 30 kcal/kg FFM/day, is associated with impairments of a variety of body function such as menstrual disorder, endocrine dysfunction and decreased bone mineral density (BMD). Little is known regarding EA and the physiological parameters of Japanese female athletes classified according to menstrual status. Therefore, this study aimed to determine the current EA status, hormonal status and BMD in Japanese female athletes.

METHODS: Eighteen female collegiate athletes were classified into two groups; the eumenorrheic group (EU, 22 \pm 1 years, $n = 7$) and the menstrual disorder group (MD, 20 \pm 1 years, $n = 11$). The ovulation status was checked before the experimental period using an ovulation test kit, and the date were collected during the early follicular phase in EU group. TEI was assessed using 7-days dietary records, EEE was measured via HR-VO₂ methods, and hormonal status was measured from a fasting blood sample. Body composition and BMD were measured by dual energy X-ray absorptiometry. The eating attitude test (EAT-26) was used to assess susceptibility to eating disorders.

RESULTS: EA was not significantly different between EU and MD groups (32.2 \pm 9.6 kcal/kg FFM/day vs 32.6 \pm 8.1 kcal/kg FFM/day). Further, no significant differences were observed in terms of body composition, BMD, and EAT-26 score between the two groups. However, triiodothyronine (T₃; 84 \pm 14 ng/dL vs 114 \pm 21 ng/dL, $p<0.01$) and progesterone (P₄; 0.2 \pm 0.1 ng/mL vs 0.4 \pm 0.1 ng/mL, $p<0.05$) were significantly lower in MD group than those in EU group.

CONCLUSIONS: The results of the present study suggested that the menstrual status is not associated with current EA, but may be related to chronic energy deficiency among Japanese female athletes.

1918 Board #179 May 31 2:00 PM - 3:30 PM
Effect Of Low Energy Availability During Three Consecutive Days Of Endurance Training On Muscle Glycogen Contents And Serum Hepcidin Levels In Male Long Distance Runners.

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(No relevant relationships reported)

PURPOSE: Hepcidin is a crucial mediator of iron homeostasis and may be associated with iron deficiency in response to exercise training. Exercise-induced interleukin-6 (IL-6) elevation stimulates hepcidin synthesis after exercise. Low energy availability induced by insufficient dietary energy intake during strenuous endurance training period in athletes, and it may elicit depletion of muscle glycogen contents. Moreover, lowered muscle glycogen content augments exercise-induced IL-6 elevation probably leading to increase in hepcidin levels. We investigated that effect of low energy availability during three consecutive days of endurance training on muscle glycogen contents and hepcidin levels.

METHODS: Seven male long distance runners participated in the present study (mean \pm standard error, age: 19.8 \pm 0.4 yrs; height: 1.75 \pm 0.02 m; body mass: 61.4 \pm 2.0 kg). The present study was a repeated-measures crossover design. All subjects completed two exercise trials consisting of low energy availability (LEA) trial or neutral energy

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 $\dot{V}O_{2max}$) 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 ^{13}C -MRS.

RESULTS: Average energy intake was $2,081 \pm 61$ kcal / day in LEA trial and $3,967 \pm 90$ kcal / day in NEA trial ($p < 0.001$). Muscle glycogen content were decreased in LEA trial during days 2-4 ($p < 0.05$, vs. day1) 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 ± 7.0 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.

1919 Board #180 May 31 2:00 PM - 3:30 PM

Development Of A Validated Energy Expenditure Prediction Equation In Asian Adults

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(No relevant relationships reported)

Knowledge of energy expenditure (EE) is an important factor for weight management and helps fitness professionals more appropriately design exercise programs for obesity reduction in the obesity prevalence of Asian.

PURPOSE: The aim of this study was to develop a regression equation to predict EE during walking or running corrected for one mile in normal weight and overweight Asian adults and to cross-validate the equation. **METHODS:** Eighty-five subjects, including normal weight walkers (NWW) (fat percentage ≤ 25 for males, ≤ 30 for females), overweight walkers (OW) (fat percentage > 25 for males, > 30 for females) and runners (R), participated to test EE through indirect calorimetry. Analysis of variance was used to test overall significance with post hoc Scheffé test employed to compare energy expenditure in three groups (NWW, OW, and R). Multiple regression analysis was employed for EE prediction and differences between the measured and predicted EE in the cross-validation group was compared by a dependent t-test. Also, regression coefficients generated from cross-validation group were compared to the original equation's coefficients using the Chow statistical test. **RESULTS:** There was not significantly different absolute EE among three groups ($p > 0.05$). When EE was expressed relative to body weight, R group (1.7 ± 0.03 kcal·mile $^{-1}$ ·kgBW $^{-1}$) was found to expend significantly more energy than the other two groups (NWW: 1.5 ± 0.04 kcal·mile $^{-1}$ ·kgBW $^{-1}$; OW: 1.4 ± 0.03 kcal·mile $^{-1}$ ·kgBW $^{-1}$, $p < 0.05$). However, when EE was expressed relative to fat free mass, there was significant difference between NWW (2.0 ± 0.05 kcal·mile $^{-1}$ ·kgFFM $^{-1}$) and R groups (2.3 ± 0.05 kcal·mile $^{-1}$ ·kgFFM $^{-1}$, $p < 0.05$). Predicting EE (kcal) during walking or running corrected for one mile yielded the following equation: $EE = 0.933 \text{body weight} - 4.127 \text{Gender} (M=1, F=2) + 47.256$ (standard error of estimate, SEE = 12.1 kcal·mile $^{-1}$). The dependent t-test revealed no significant difference between measured EE (101.4 ± 4.3 kcal) and predicted EE (100.0 ± 2.8) ($p > 0.05$). Also, the coefficients for body weight and gender between the original equation and the predicted equation in the cross-validation group were not significantly different ($p > 0.05$). **CONCLUSION:** These results provide a validated equation for predicting EE in Asian adults during walking or running.

1920 Board #181 May 31 2:00 PM - 3:30 PM

The Effects of Wearing Cold Garments on Energy Expenditure

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(No relevant relationships reported)

Stimulation of brown adipose tissue (BAT) by cold exposure purportedly upregulates energy expenditure and has been suggested as a method to reduce adiposity. BAT in humans is located primarily in the upper torso. Manufacturers have developed garments that contain ice packs and are designed to be worn over these areas. Two such products are the Cool Fat Burner and the Cool Gut Buster. The Cool Fat Burner places ice packs against the shoulders and neck, while the Cool Gut Buster targets BAT around the abdomen. **Purpose:** This study was designed to determine changes in energy expenditure and heart rate when wearing the Cool Fat Burner and the Cool Gut Buster. Twenty subjects (12 males; 8 females) sat quietly for a total of 90 minutes while heart rate and $\dot{V}O_2$ were recorded. Data collection was separated into three 30-minute phases: rest, low-intensity, and high-intensity. Subjects sat quietly during the rest phase, wore both the Cool Fat Burner and the Cool Gut Buster during the low-intensity phase, and wore both garments and drank cold water during the high-intensity phase. **Results:** Average $\dot{V}O_2$ increased significantly across all three phases

(rest: 295.6 ± 69.1 ml/min; low intensity: 333.0 ± 83.2 ml/min; high intensity: 372.8 ± 87.5 ml/min). Average heart rate decreased significantly across all three phases (rest: 67 ± 8.2 bpm; low intensity: 65 ± 7.1 bpm; high intensity: 59 ± 6.8 bpm). When $\dot{V}O_2$ was converted to caloric expenditure, it was found that 11.2 additional kcals were burned in the 30-min low-intensity phase compared to rest, and that 23.1 additional kcals were burned during the 30-min high-intensity phase compared to resting values.

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.

1921 Board #182 May 31 2:00 PM - 3:30 PM

Test of Two Distinct Protocols in Indirect Calorimetry

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(No relevant relationships reported)

Andressa F de Abreu; Anderson Santana; Domingos R Pandelo Jr.. High Performance Center (CAP). Federal University of São 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

	RMR (sitting and lying)	% Fat Sitting Lying		% CHO Sitting Lying	
1	1885,0	48,82	41,03	51,18	58,97
2	1777,3	16,83	15,38	83,17	84,62
3	1279,8	73,25	71,28	26,75	71,25
4	1332,8	5,09	12,81	94,91	87,19
5	1502,6	21,47	20,40	78,53	79,60
6	1526,0	43,22	46,31	56,78	53,69
7	1958,8	24,63	28,59	75,37	71,41
8	1958,7	34,78	36,80	65,22	63,20
9	1516,6	74,83	72,00	25,17	28,00
10	1311,6	42,23	37,82	57,77	62,18
Mean	1604,9	38,52	38,24	61,14	61,76
SD	268,5	22,98	20,78	22,98	20,78

1922 Board #183 May 31 2:00 PM - 3:30 PM

Extending Traceable Validation To Metabolic Carts

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(No relevant relationships reported)

PURPOSE: Metabolic carts (MC) measure O_2 consumed ($\dot{V}O_2$) and CO_2 produced ($\dot{V}CO_2$) to estimate energy expended. There is little information on the absolute accuracy of MC. We adapted NIST traceable gas infusions used widely for "Room" calorimeter (RC) systems to MC.

METHODS: Blended CO₂ and N₂ simulated VO₂ by displacing O₂, and added CO₂ represented VCO₂. 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 infusions (Low: VO₂ = 230, VCO₂ = 170 ml/min, EE = 1.1 kCal/min, RQ = 0.74; High: VO₂ = 330, VCO₂ = 287, EE = 1.6, RQ = 0.87) were made for 10 min followed by a null test. Gases were delivered into tubing connected to the MC mixing chamber. VO₂ and VCO₂ calculated by MC were averaged for 7 min. Average errors were differences between simulated and measured VO₂ and VCO₂.

RESULTS: Infusions were made without leaks despite differences in MC design. 57 infusions were run on the TrueOne 2400. High infusion error was 2.6% (Range: 1.7 to 3.9%) for VO₂ and 1.8% (Range: -0.3 to 2.3%) for VCO₂. Low infusion error was 6.5% (Range: 4.3 to 8.6%) for VO₂ and 1.7% (Range: -1.7 to 2.9%) for VCO₂. 104 infusions were run on the Max II: High infusion error was 7.4% (Range: 0.5 to 13.4%) for VO₂ and -3.2% (Range: -8.9 to 3.0%) for VCO₂. Low infusion was 8.9% (Range: -6.2 to 17.8%) for VO₂ and -3.2% (Range: -15.4 to 5.7%) for VCO₂. Variations were seen in baseline O₂ and CO₂ readings taken at the beginning of the test then every 5 min: O₂ (20.85 - 20.94 vol%), CO₂ (0.037 - 0.12 vol%).

CONCLUSIONS: Gas infusions are an independently traceable standard providing calibration and validation for most RC across a wide range of VO₂ and VCO₂. 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.

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(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.; 67.8 ± 3.3 kg; 168.1 ± 5.3 cm)] using the ParvoMedics 2400 metabolic system (PV) following established protocols. Additionally, 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, η^2 = 0.59), where a greater (*p* = 0.01) predicted RMR was observed in ME (1646 ± 241 Kcals) was lower compared to HB (1733 ± 271 Kcals, *p* = 0.01) and ME & NE (1839 ± 322, *p* = 0.04). No differences were observed between the equations and PV. Moderate intra-class correlations were found PV and HB (ICC = 0.63, 95%CI = -0.10 - 0.94), ME (ICC = 0.52, 95% CI = -0.14 - 0.91), and NE (ICC = 0.73, 95%CI = 0.07 - 0.96). **CONCLUSION:** These results suggest that even though significant differences exist between each of the predictive equations, individually, each equation has good agreement with the values measured by indirect calorimetry.

1924 Board #185 May 31 2:00 PM - 3:30 PM

Priming Whole-room Calorimeters With CO₂ To Improve Performance And Reduce Test Time

Michael Busa¹, Eric Rudd², Erica Wohlers-Kariesch², 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 CO₂ into the chamber prior to measurement reduced the time before measurements are within error specifications. We hypothesized that priming the chamber to 0.2% CO₂ will significantly reduce the time to get valid measurements of VO₂ and VCO₂.

METHODS: We used a precision gas blender to infuse pure gases (N₂ and CO₂) into a 32,500 L metabolic chamber (MEI Research Ltd, Edina, MN). Five different infusion profiles constructed to mimic VO₂ and VCO₂ associated with 1.1 METS in 50, 70, 90, 110, and 130 kg individuals with an RQ of 0.74, with and without infusing CO₂ to

bring the chamber to 0.2% CO₂ 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 for the chamber to reach 0.2% CO₂, i.e. enter the validated range, was found experimentally. A pairwise t-test was used to compare the time before both VO₂ and VCO₂ to exhibit error of less than 4% in CO₂ primed vs. ambient (~0.04% CO₂) conditions, α = 0.05. For the human data, the time it took for the chamber to reach 0.2% CO₂ is reported. No statistical comparison was made for the human data.

RESULTS: Priming the chamber to 0.2% CO₂ 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% CO₂ 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% CO₂ when the participant entered a chamber with ambient CO₂ levels.

CONCLUSIONS: Priming a metabolic chamber to a CO₂ 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.

D-68 Free Communication/Poster - Energy Balance and Weight Management

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

Room: CC-Hall B

1925 Board #186 May 31 2:00 PM - 3:30 PM

The Effects Of Aerobic, Concurrent, And Resistance Exercise On Compensatory Eating Behaviors

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(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 ± 1.3 yrs) 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_{2max}. 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 difference in total caloric (CON: 2,145 ± 807.9kcal, AE: 2,040 ± 657.2kcal, CE: 1,973 ± 764.8kcal, RE: 2,354 ± 1,077.0kcal, *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: 89 ± 53.4g, RE: 99 ± 46.4g, *p* = 0.942), HR (CON: 77 ± 10.3bpm, AE: 151 ± 21.9bpm, CE: 153 ± 16.2bpm, RE: 136 ± 15.8bpm, *p* = 0.122), or RPE (CON: 6 ± 0.0, AE: 11 ± 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 caloric 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.

1926 Board #187 May 31 2:00 PM - 3:30 PM

Leptin And Ghrelin Concentrations Differ At Fasting, Post-prandial, And Post-exercise In Active And Inactive Females

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(No relevant relationships reported)

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.

METHODS: Using a cross-sectional design, blood was collected at three different time points: fasting, immediately following plain bagel consumption (T1), and immediately following a 30-minute steady-state submaximal VO_2 treadmill test (T2) in both groups. Leptin and ghrelin were measured using enzyme-linked immunosorbent assay. Fat mass (FM) was determined by dual-energy X-ray absorptiometry. Repeated measures ANCOVA (time x group) compared differences in leptin and ghrelin across time.

RESULTS: Body mass index differed between runners ($19. \pm 1.4 \text{ kg/m}^2$) and inactive females ($22.6 \pm 2.8 \text{ kg/m}^2$; $p = .004$). FM also differed between groups (runners: 10.76 kg ; inactive: 18.32 kg , $p \leq .001$). Baseline fasting leptin was lower in runners ($3.3 \pm 1.5 \text{ ng/mL}$) than the inactive females ($11.1 \pm 6.7 \text{ ng/mL}$; $p = .003$). Therefore, FM and baseline leptin levels were used as covariates. The time by group interaction was significant ($p = .035$; $F = 4.598$) with no differences between groups. In both groups, fasting leptin ($7.4 \pm 4.08 \text{ ng/mL}$; p) was higher at baseline (fasting) than T1 ($6.2 \pm 3.5 \text{ ng/mL}$; $p \leq .001$) and T2 ($6.1 \pm 3.2 \text{ ng/mL}$; $p \leq .001$). Ghrelin also differed across time ($p \leq .001$) with no interaction between groups. In both groups combined, fasting ghrelin ($744.2 \pm 303.6 \text{ pg/mL}$) did not differ from baseline to T1 ($708.9 \pm 243.8 \text{ pg/mL}$). However, following the treadmill test (T2) ghrelin ($452.4 \pm 111.6 \text{ pg/mL}$; $p \leq .001$) was lower than fasting and following bagel consumption.

CONCLUSION: Fasting leptin was lower in collegiate runners than inactive females due to lower levels of FM. Leptin concentrations decreased across time in both groups following food intake and exercise. Ghrelin was highest at fasting and immediately following food intake, and decreased only after exercise. Leptin and ghrelin concentrations change in a similar manner between female runners and inactive females.

1927 Board #188 May 31 2:00 PM - 3:30 PM
The Effect Of Resistance Training On Morphology Of Rat Skeletal Muscle During Food Restriction

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(No relevant relationships reported)

PURPOSE: Skeletal muscle is critical for muscle strength and exercise performance. Severe food restriction observed among athletes for rapid weight loss (i.e. fasting or skipping meals) activates autophagy-lysosomal pathway and protein breakdown and that causes muscle atrophy. It is well known that resistance exercise stimulates protein synthesis and muscle hypertrophy. Resistance exercise also attenuates skeletal muscle protein breakdown via the autophagy-lysosomal pathway, hence it may prevent the food restriction-induced muscle atrophy. To investigate the effect of resistance training (RT) on skeletal muscle mass and muscle fiber cross sectional area during muscle atrophy-inducing food restriction in rats. **METHODS:** Eleven weeks old male Sprague-Dawley rats were divided into four groups: normal fed group (C), normal fed and resistance training group (TR), 7 days of 70% food restriction group (FR) and 7 days of 70% food restriction and resistance training group (FR-TR). In training group (TR and FR-TR), rats were subjected to 6 exercise sessions and then were killed 72 hours after final exercise session. Resistance exercise was conducted by percutaneous electrical stimulation in right gastrocnemius muscle three times per week. Hematoxylin-eosin staining was used to measure the gastrocnemius muscle fiber cross-sectional area (CSA). **RESULTS:** Body weight, gastrocnemius muscle wet weight, liver wet weight, epididymal fat weight and fiber CSA were significantly reduced by 70 percent with food restriction ($p < 0.05$). Although no significant difference in fiber CSA among normal fed groups (C and TR), FR-TR group tended to show a reduced fiber CSA compared with FR group ($p < 0.09$). **CONCLUSIONS:** This study suggests that resistance training during atrophy-inducing food restriction did not attenuate muscle atrophy in rat skeletal muscle.

1928 Board #189 May 31 2:00 PM - 3:30 PM
Post-exercise Whole Body Cryotherapy Treatment Increases Energy Intake Among Well-trained Athletes

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 (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: Thirteen male athletes (20.5 ± 0.2 years, $174.8 \pm 5.2 \text{ cm}$, $66.6 \pm 1.4 \text{ kg}$) 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 -140°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: $31.6 \pm 0.2^\circ\text{C}$, immediately after WBC: $7.1 \pm 4.1^\circ\text{C}$), 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 ($1371 \pm 139 \text{ kcal}$) than that in CON trial ($1106 \pm 130 \text{ kcal}$, $P = 0.007$).

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

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(No relevant relationships reported)

Transgenic mouse for the Monocarboxylate Transporter 1 (MCT1) gene (*SLC16A1*) 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, $80.7 \pm 10.5 \text{ kg}$) and 84 men (39.6 ± 8.2 years, $96 \pm 10.7 \text{ kg}$) 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 90% 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

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(No relevant relationships reported)

F0F1-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 F0F1-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

0% grade. Mitochondria of heart, brain and gastrocnemius were isolated to detect the changes of RCR and ROS. The content of PHB1 protein in mitochondria was detected by Western blot. ATP content in the organs and F0F1-ATP synthase activity were measured by spectrophotometer. **RESULTS:** 1. Compared with resting control group, ATP content decreased in the brain(-76%, $p<0.05$), heart(-77%, $p<0.01$) and skeletal muscle (-55%, $p<0.05$) after exercise. 2. F0F1-ATP synthase activity declined significantly in the brain(-26%, $p<0.05$), heart(-58%, $p<0.01$) and skeletal muscle(-55%, $p<0.01$) after exercise. 3. Mitochondrial respiratory control ratio (RCR) was reduced in the brain(-52%, $p<0.05$), heart(-43%, $p<0.05$) and muscle (-39%, $p<0.05$) in response to exercise. 4. ROS generation in mitochondria of brain(-64%, $p<0.01$), heart(-42%, $p<0.05$) and muscle (-44%, $p<0.05$) decreased significantly after exhaustive exercise. 5. Exercise decreased PHB1 content in the mitochondria of muscle(-30%, $p<0.01$) and brain(-37%, $p<0.05$) but had no effect on PHB1 in the heart. 6. ATP content was positively correlated with PHB1 level in the brain($r=0.836$, $p<0.05$), heart ($r=0.909$, $p<0.05$) and muscle($r=0.913$, $p<0.05$) after exercise, whereas F0F1-ATP synthase activity was positively correlated with PHB1 in the brain($r=0.896$, $p<0.05$), heart ($r=0.909$, $p<0.05$) and muscle($r=0.955$, $p<0.05$). 7. ROS generation was positively correlated with muscle PHB1 level ($r=0.874$, $p<0.05$) but there was no such correlation in the heart or brain. **CONCLUSIONS:** An acute bout of exhaustive exercise reduced the expression of PHB1 in the mitochondria of organs examined and decreased mitochondrial bioenergetics. Supported by NSFC(No. 31470061).

1931 Board #192 May 31 2:00 PM - 3:30 PM
Effects Of A Ketogenic Or A Whey Protein Supplement On Metabolism, Appetite And Energy Intake

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(No relevant relationships reported)

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 energy intake when compared to a protein based breakfast smoothie. **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, 30.11 yrs; body fat 29.3±5.7%) participated in this randomized, double blind, crossover study. After a 12-hr fast, resting oxygen consumption (VO_2) 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 54g WP (40% kcal protein) or 52g 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 (VO_2) 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 VO_2 ($p<0.001$) and RQ ($p=0.001$). WP elicited a greater VO_2 compared to KS at 45, 105 and 165 min (WP: 4.05±0.59, 3.86±0.53, 3.57±0.55 vs. KS: 3.66±0.59, 3.43±0.60, 3.26±0.45 ml/kg/min). 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 ($p=0.022$), F ($p<0.001$) and DE ($p=0.02$) but not PC ($p=0.107$). 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 marked 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 - 3:30 PM
Changes In 6-Minute Walk Performance Is Associated With Weight Loss Following A 6-Month Weight Loss Program

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(No relevant relationships reported)

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 this 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±4.5 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 at baseline to 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.

1933 Board #194 May 31 2:00 PM - 3:30 PM
Dietary Fat and Carbohydrate Intake and Physical Activity Independently Predict Android Fat in College Women

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(No relevant relationships reported)

PURPOSE: It is well established that abdominal or android obesity is a risk factor for numerous metabolic diseases. Dietary intake, expressed as both energy intake and quality of the diet, and physical activity (PA) are known to influence risk for android obesity. Specifically, the role that relative macronutrient intake (% energy intake) plays in risk for android obesity is of interest. Although college students are relatively healthy, their dietary and PA habits can predispose them to an increased risk for abdominal obesity. These health behaviors are of special interest given the transition to college and the establishment of health behaviors at this time of life. The aim of this study was to examine the contributions of energy intake, relative macronutrient intake (i.e., % of energy intake), and moderate-vigorous PA (MVPA) relative to android fat (%AFat) in female college students. **METHODS:** Female college students (n = 336; 18.7 ± 1.2 yo; BMI = 24.4 ± 4.7 kg/m²; %AFat = 38.6 ± 11.7%) were assessed for dietary intake using 3-day dietary records. Outcomes of interest included daily energy intake (KCAL), and relative daily energy intake of carbohydrate (%CARB), fat (%FAT) and protein (%PRO). MVPA was measured using accelerometry (NL-1000; 4 valid, 10-h days of wear). %AFat was determined via DXA using standard software designations (iDXA, Lunar, GE). A multiple linear regression model was utilized to predict %AFat from the dietary and MVPA variables.

RESULTS: Daily MVPA ($\beta = -0.25$, $p < 0.001$), %CARB ($\beta = 0.57$, $p < 0.001$), %FAT ($\beta = 0.64$, $p < 0.001$) significantly predicted %AFat, explaining 92.1% of the variance ($p < 0.001$). Neither KCAL ($\beta = -0.07$, $p = 0.21$) nor %PRO were significant predictors of %AFat ($\beta = 0.05$, $p = 0.41$).

CONCLUSIONS: Our results suggest that carbohydrate and fat content of the diet along with MVPA independently contribute to the risk for abdominal obesity whereas total caloric intake and protein content of the diet is less important in college-aged women.

1934 Board #195 May 31 2:00 PM - 3:30 PM
Weight Gain and Changes in Cardiovascular and Metabolic Risk Factors Throughout the First Year of College

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(No relevant relationships reported)

PURPOSE: It is well documented that the first year of college is associated with many physical changes. Of these, it is common for students to gain weight, which is often times referred to as the "Freshman 15." Although most "Freshman 15" studies report weigh gain, it is typically much less than 15 lbs. Despite some weight gain it is not well know if these changes in body weight are also associated with changes in both cardiovascular and metabolic risk factors. Thus, the purpose of this study was to evaluate morphological and physiological changes in students throughout their first year of college. **METHODS:** Twenty-seven Freshman college students (female n = 15, males n = 12) were recruited for this repeated measures design study. Throughout the 10 month study participants logged their eating and exercise habits and were tested on four separate occasions (each approximately 2.5 months apart). Each testing session consisted of body composition screening, oxygen consumption test (VO₂max), fasting blood analysis, and an oral glucose tolerance test (OGTT). Repeated measure ANOVA was used on all data sets. All values were expressed as the mean + SE and p < .05 set for statistical significance. **RESULTS:** There was no difference in exercise (118 ± 101 min/wk) over the 10 months, but there was a non-significant decrease (2.5 ± 2.2 ml/kg/min) in VO₂max by the end of the study. Compared to the start of their Freshman year, weekly caloric intake was significantly increased each testing session thereafter (1,268 ± 677, 1,702 ± 972, and 1,091 ± 608 kcals respectively). At the conclusion of the study there was a significant increase in body weight (2.5 ± 2.1 kg) which translated to an increase in percent body fat (1.5 ± 2.4%) but not muscle mass (0.2 ± 2.1%). In addition, the blood glucose and plasma insulin response to an oral glucose challenge did not change throughout the study, nor did fasting triglycerides, total cholesterol, and high density lipoprotein (HDL cholesterol). **CONCLUSION:** Although participants gained weight throughout their first year of college it was less than that predicted by the "Freshman 15". This added body weight was also not associated with increased risk of cardiovascular or metabolic diseases. Further research is needed to evaluate weigh gain and the development of risk factors in college students.

1935 Board #196 May 31 2:00 PM - 3:30 PM
Weight Loss, Physical Activity, And Conception In Obese Infertile Women

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(No relevant relationships reported)

PURPOSE: To compare weight loss and physical activity in obese infertile women who did or did not become pregnant following completion of a weight loss program. **METHODS:** Obese infertile women, referred by a reproductive endocrinologist, completed the University of Kansas Weight Management Program (KWMP). This program included reduced energy intake (portion controlled entrees, low calorie shakes), increased moderate-to- vigorous physical activity (MVPA) targeting 300 min•wk. and lifestyle strategies were provided. Participants were asked to monitor weekly MVPA (self-report) and pedometer step counts. Height and weight were assessed by trained staff in the clinic. The cumulative average of MVPA and steps over the last 3-wks. of participation were used in the analysis. Pregnancy outcomes were obtained from a review of medical records. The Kruskal-Wallis nonparametric test was used to compare differences in percent weight loss, physical activity (MVPA min•wk.⁻¹, steps•wk.⁻¹), and time in the KWMP between women who did, or did not become pregnant. **RESULTS:** Obese infertile women (n = 14, BMI=40.0 ± 5.9 kg•m², age = 33.4 ± 4.5 yrs.) completed an average of 17 wks. of the KWMP. Eight of 14 women (57%) became pregnant. Weight loss was greater in women who became (-15.4 ± 7.7 %) compared with those who did not become pregnant (-10.9 ± 11.3 %); however, the differences were not statistically significant (p = 0.17). Physical activity assessed by pedometer was significantly higher in women who became pregnant (64,774 ± 13,798 steps•wk.⁻¹) compare with those who did not (51,207 ± 5,060 steps•wk.⁻¹, p = 0.02). Self-reported MVPA was not significantly higher in women who became pregnant (212 ± 89 min•wk.⁻¹) compared with those who did not (175 ± 106 min•wk.⁻¹, p = 0.37). Women who became pregnant participated in the KWMP 11 wks. longer than those who did not (p = 0.016). **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.

1936 Board #197 May 31 2:00 PM - 3:30 PM
The Affect Of Exercise On Hypothalamic Kiss-1 And Gpr54 In The Puberty Development Of Male Rats

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(No relevant relationships reported)

The affect of exercise on hypothalamic kiss-1 and GPR54 in the puberty development of male rats

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Abstract:

Kisspeptin ,in addition to reflects its ability to inhibit cancer metastasis, which have been implicated in the regulation of GnRH secretion with its receptor GPR54, play an essential role in normal reproduction and pubertal development. **PURPOSE:** To explore the moderate-intensity treadmill training (MIT) in modulating the hypothalamic expression of kiss-1 and its G protein coupled receptor -GPR54 mRNA relative expression in the different time of puberty.

Methods: 3 weeks male Sprague-Dawley rats (weight:62.03±3.13) were randomly assigned to two experimental groups (n=36): control group (n=18) and the MIT group (n=18). MIT group did the 60%-70%V(-)O₂max treadmill training (5 days/week,1 hour/day). All the rats were used to detect the hypothalamic expressions of kiss-1 and GPR54 mRNA, animals in the both groups were sacrificed , which on the week of 5 weeks, 6 weeks, and 8 weeks.

Result: Compared with C group, every weeks of the rats' MIT group had lower hypothalamic expression of kiss-1 mRNA and GPR54 mRNA. Especially the kiss-1 mRNA. After moderate-intensity treadmill training, compare with the control groups , the 5 weeks(0.22±0.09 vs 2.28±0.49, p<0.01), 6 weeks(1.09±0.13 vs 1.73±0.18, p<0.01), 8 weeks(0.69±0.21 vs 2.82±0.79) kiss-1 mRNA had significant reduced. All the MIT groups' hypothalamic expression of GPR54 mRNA had lower than C groups, especially at the age of 6 weeks(0.58±0.1 vs 0.79±0.23, p<0.05).

Conclusions:MIT could reduce the hypothalamic expression of kiss-1 and its receptor GPR54mRNA in the puberty development of male rats, and kiss-1mRNA are more affected.

1937 Board #198 May 31 2:00 PM - 3:30 PM
Patient Experience on Weight Management Advice Prior to Pregnancy from Physicians and Dietitians

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(No relevant relationships reported)

PURPOSE: More women are entering pregnancy with a pre-pregnancy body mass index (BMI) ≥30 kg/m², increasing the risk of pregnancy complications. Many women, however, will seek support from healthcare professionals pre-conceptually to try to lose weight. Using a mixed-methods approach, we determined if women seek support from physicians and/or dietitians for weight related issues and whether they found this experience helpful. **METHODS:** Data were reviewed from a Weight and Health History Questionnaire (n=206) completed by pregnant women with BMI of ≥30 kg/m² on intake for obstetrical care. This questionnaire included information regarding the type of health provider (physician or dietitian) accessed for weight loss advice pre-pregnancy and whether that experience was helpful (with explanation). A thematic analysis was conducted to determine the underlying reasons for these experiences.

RESULTS: Of 206 women, 147 saw a physician (n=80) or dietitian (n=67). The number of women that found their experience helpful was significantly greater with a dietitian (51/67) than with a physician (34/80; p<0.05). Women who rated their experience with a physician as helpful noted referral to a dietitian or exercise professional (n=25) and receiving nutritional information (n=6) as important factors. The top helpful experiences with dietitians included new information being provided (n=21) and realistic goal setting (n=16). **CONCLUSION:** Women receiving weight loss support from physicians pre-pregnancy found their experience helpful when the physician offered support from dietitians and exercise professionals and when the physician provided nutritional information. Initiatives and resources like 'Exercise is Medicine', www.eatrightontario.ca or the Society of Obstetricians & Gynecologists of Canada's 'Nutrition is hard' can help bridge the gap between physicians and allied health care professionals and educate physicians on addressing lifestyle behavior, especially for obese women seeking weight management advice before pregnancy. Funding sources: CIHR and CHRI

D-69 Free Communication/Poster - Exercise Psychology- Cancer

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1938 Board #199 May 31 3:30 PM - 5:00 PM
The Relationship Of Cognitive Scores With Muscle Power, Strength, And 6-minute Walk In Breast Cancer Survivors

Rachael Hunt, Ashley Artese, Jeong-Su Kim, Lynn Panton, FACS. *Florida State University, Tallahassee, FL.* (Sponsor: Lynn Panton, PhD, FACS)

(No relevant relationships reported)

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 (processing speed), TMTB (executive function)), Digit Span Forward (attention) and Backward (working memory), and Controlled Oral Word Association Test (COWAT (executive function)) to assess cognitive domains. Lower body isokinetic (ISK) power and strength were assessed by the Biodex™. Endurance was assessed by the 6MW. Pearson product-moment correlations were used to evaluate relationships between cognition and anaerobic fitness. Significance was accepted at $p \leq 0.05$. **RESULTS:** Faster TMTA and TMTB scores were correlated with greater ISK average power for extension at 60 degrees/sec (TMTA: $r = -0.40$; TMTB: $r = -0.31$) and 180 degrees/sec (TMTA: $r = -0.45$; TMTB: $r = -0.30$) while TMTA 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.

1939 Board #200 May 31 3:30 PM - 5:00 PM
Perceptions on Exercise is Associated with Self-Reported Physical Activity in Hematopoietic Stem Cell Transplant Patients

Melanie Potiaumpai, Tamia Medina, Stacy E. Cutrono, Denise Pereira, William F. Pirl, Krishna V. Komanduri, Joseph F. Signorile. *University of Miami, Miami, FL.* (Sponsor: Kevin Allen Jacobs, FACS)

(No relevant relationships reported)

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 symptomatology, 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 ± 8.4 years), enrolled in an in-patient physical activity intervention, were administered the Exercise Barriers and Benefits Survey (EBBS), and the International Physical Activity Questionnaire- Short Form (IPAQ) prior to their admission for HSCT. The benefits and barriers scale were scored separately. Higher scores on the Benefits Scale indicate a more positive perception of exercise while a higher score on the Barriers Scale indicates greater perception of barriers to exercise. Time spent walking (WALK) and time spent sitting (SIT), recounted in minutes, were reported on the IPAQ for the seven days 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 ($r(21) = .44$, $p = .04$). There was also a significant negative correlation between the benefits score and patient-reported SIT ($r(21) = -.49$, $p = .02$). There was no significant correlation between the Barriers scale and WALK ($r(21) = .23$, $p = .30$) or SIT ($r(21) = -.18$, $p = .42$). **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.

1940 Board #201 May 31 3:30 PM - 5:00 PM
Structured Exercise in the Cancer Patient Improves Insomnia and Fatigue, but Not Depression

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(No relevant relationships reported)

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 effect 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 Index, 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 improvements 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.

D-70 Free Communication/Poster - Perception of Effort, Pain and Fatigue

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1941 Board #202 May 31 3:30 PM - 5:00 PM
Perceived Exertion Responses While Wearing Tight- and Loose-Fitting Powered Air-Purifying Respirators

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(No relevant relationships reported)

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 ($n = 22$).

	Exer Eval	Baseline	PAPR-T	PAPR-S	PAPR-M	PAPR-L
LOW	8.0	7.1	7.2	7.5	7.5	7.8*
MODERATE	11.5	11.0	11.7	11.9*	12.3*	12.5*
HIGH	15.3	14.4	15.9*	15.9*	16.5*	16.5*

* $P < 0.01$ compared to Baseline

CONCLUSIONS: RPE while using PAPRs were greater compared to the same energy expenditures while not using a PAPR at baseline. Compared to baseline, RPE using a tight-fitting PAPR were lower compared to loose-fitting PAPRs. The lower RPE for baseline results compared to the exercise evaluation may be attributed to a learning effect where outliers were observed from the exercise evaluation. Trends in the RPE difference between loose-fitting PAPRs at the same energy expenditure appear to be related to hood size or dead space.

1942 Board #203 May 31 3:30 PM - 5:00 PM
Moderate-vigorous Intensity Run Vs. Walk On Hemodynamics, Metabolism And Perception Of Effort
 Patrick M. Davitt, Troy Hartman, Steven Estremera, Phil Barone, Jillian Grassano, Gregory Muy, Olivia Akers-Goodwin, Andrew Marrero, Astrid Mel. *Mercy College, Dobbs Ferry, NY.* (Sponsor: M. Allison Williams, FACSM)
(No relevant relationships reported)

The ability to use an alternative (i.e., walking) to running would provide great benefit to those who are uncomfortable running or can't run, in order to meet minimum activity recommendations. **PURPOSE:** We compared two exercise modalities (Run, Walk) matched for VO₂, on HR, RPE, and a visual analog scale (VAS). **METHODS:** Active, college-aged males ($n=7$; weight = 72.5 ± 3.9 kg; $BF\% = 17.9 \pm 1.2$; $VO_{2max} = 51.5 \pm 1.36$ mL/kg/min) participated in a crossover-designed study, and studied on each of 2 occasions: Walk (W) and Run (R). Subjects completed a body composition and VO₂max test. (R) = 60-min on a treadmill at 0%grade and speed equal to 65% VO_{2max} (694.4 ± 26.1 kcal). (W) = 60-min at 3.3mph and a steep incline equal to 65% VO_{2max} (677.9 ± 20.9 kcal). Pulmonary gas exchange (VO₂, RER, respiratory rate (RR)) was assessed within the first 10 min of exercise, with HR and RPE recorded every 15 min. A VAS was used to assess overall perceived effort (0-100mm). RM ANOVAs were used for statistical analysis. Values were calculated as mean \pm SE. **RESULTS:** There was no significant difference in VO₂ (Run, 33.2 ± 1.1 ; Walk, 32.7 ± 1.1 mL/kg/min; Con, $p=0.59$), RPE (Run, 11.1 ± 0.8 ; Walk, 11.7 ± 0.8 , $p=0.28$), VAS (Run, 51.2 ± 5 ; Walk, 48 ± 5 mm, $p=0.54$), or %VO_{2max} (Run, 64.6 ± 1.2 ; Walk, $63.5 \pm 1.2\%$, $p=0.56$) between the groups. There was a significant difference in HR (Run, 167.0 ± 4.9 ; Walk, 157.3 ± 4.9 BPM), RR (Run, 35.1 ± 2.3 ; Walk, 30.5 ± 2.3 BPM), and RER (Run, 0.86 ± 0.02 ; Walk, 0.9 ± 0.02) between the groups. There was no significant difference in the amount of sleep (R, 6.6; W, 6.8hr) between the two groups ($p=0.68$). 5 out of 7 subjects complained about their legs "burning" or "hurting" during the W trial. **CONCLUSION:** Walking and Running, even when matched for intensity, via VO₂, led to the R having a significantly higher HR and breathing rate for 60-min in active males, but a significantly lower RER. Despite the subjects complaining of their legs being sore (W), RPE did not reflect a difference in perception, nor did the VAS post-exercise. These results indicate that a walk can be recommended for a moderate-vigorous intensity, and elicit a similar metabolic and hemodynamic response, without causing a significant increase in perceived effort. This promotes the use of "steep" walking as energetically beneficial for those not able or desiring to run at higher intensities.

1943 Board #204 May 31 3:30 PM - 5:00 PM
Music With and Without Lyrics Improves Motivation, Affect, And Arousal During Moderate-intensity Cycling
 Daniel Marshall, Scott B. Martin, FACSM, Ryan L. Olson.
University of North Texas, Denton, TX. (Sponsor: Scott Martin, FACSM)
(No relevant relationships reported)

Music is used to distract, energize, and entertain during exercise by producing positive psychological and physiological responses. Previous investigations suggest that listening to music during exercise enhances performance, increases motivation, improves affect, and optimizes arousal. Researchers have identified several elements of music that may moderate the music-performance relationship, including lyrics. However, few studies to date have examined the influence of motivational lyrics on psychological and physiological responses during exercise. **PURPOSE:** The primary purpose of this study was to investigate the effects of lyrics in music on motivation, affect, arousal, and perceived exertion during moderate intensity cycling. **METHODS:** Thirty (Mage = 21.0 ± 2.9 years old) college-aged individuals performed three, 8-min acute bouts of moderate-intensity exercise on a cycle ergometer during music with lyrics (ML), music without lyrics (MNL), and no music control (MC) conditions. Measures of motivation, affect, arousal, and perceived exertion were taken before and after a 6-min warm-up, every 2-min during the exercise bout, and following a 2-min

cool-down. **RESULTS:** For ML and MNL conditions, participants reported higher motivation (ML: 5.11 ± 0.35 ; MNL: 5.14 ± 0.36), affect (ML: 2.51 ± 0.23 ; MNL: 2.47 ± 0.23), and arousal (ML: 3.32 ± 0.19 ; MNL: 3.23 ± 0.18) during exercise relative to the MC (motivation: 4.10 ± 0.43 ; affect: 1.94 ± 0.27 ; arousal: 2.84 ± 0.23) condition. As expected, RPE increased throughout the exercise period, $F(6,24) = 42.24$, $p < .001$, with no between condition differences observed. Additionally, there were no differences in primary outcome variables between the ML and MNL conditions ($ps > .05$). **CONCLUSION:** The results suggest that music, regardless of whether lyrics are 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.

1944 Board #205 May 31 3:30 PM - 5:00 PM
Does Body-weight Circuit Training Have The Ability To Induce Hypoalgesia?
 Panagiotis Koutakis¹, Kelsey Uno², Emily Pritchett², Timothy Michael², Nicholas Hanson², Michael Miller². ¹*Baylor University, Waco, TX.* ²*Western Michigan University, Kalamazoo, MI.*
(No relevant relationships reported)

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 currently 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 through bodyweight exercise circuit training.

METHODS: Thirty (11 men, 19 women; age 22.8 ± 3.3 years, height 169.71 ± 10.44 cm, mass 75.74 ± 21.56 kg) healthy recreationally active individuals volunteered for this study. Subjects were asked to come to the 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, 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, and 10, 15, 20, 25 and 30 min post) ANOVA was performed for each site.

RESULTS: There was only a significant main effect of condition seen in the upper trapezius ($p < .05$). 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; (mean \pm 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 can 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.

1945 Board #206 May 31 3:30 PM - 5:00 PM
Concurrent Validity Of The Children's Omni Scale Of Perceived Exertion In A Field Setting
 Timothy J. Michael, FACSM, Erin Berner, Carol Weideman, Nicholas Hanson, Sangwoo Lee, Michael Miller. *Western Michigan University, Kalamazoo, MI.*
(No relevant relationships reported)

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 contains pictorial, numerical and verbal descriptors positioned along an inclined line. 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 use 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. **Recess:** HR \pm SE (157.9 \pm 2.8; 170.1 \pm 2.2; 173.8 \pm 2.2; 173.9 \pm 2.4; 179.7 \pm 2.1; 185.6 \pm 2.2). RPE \pm SE (4.3 \pm 0.2; 5.2 \pm 0.2; 5.8 \pm 0.2; 6.3 \pm 0.2; 6.8 \pm 0.2; 7.4 \pm 0.2). **PE:** HR \pm SE (148.8 \pm 2.4; 153.9 \pm 1.8; 160.3 \pm 1.7; 164.9 \pm 1.9; 167.3 \pm 1.9; 168.3 \pm 1.9). RPE \pm SE (3.6 \pm 0.2; 4.2 \pm 0.2; 4.9 \pm 0.2; 5.2 \pm 0.2; 5.3 \pm 0.2; 5.6 \pm 0.2). Pearson correlational analysis indicates a significant relation between Heart Rate and RPE during recess ($r = .381$; $p < 0.001$) and PE ($r = .552$; $p < 0.001$). **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.

1946 Board #207 May 31 3:30 PM - 5:00 PM
The Effect of Movement Speed on Mental Workload During a Simple Visually Guided Task
 E. Daniel Syrett, Matthew E. Holman, Tanu Bhargava, Benjamin J. Darter. *Virginia Commonwealth University, Richmond, VA.*
(No relevant relationships reported)

Mental workload (MW) is a subjective measure of the cognitive effort required to complete a task. Factors such as task speed and the use of feedback can affect the perceived MW and ability to correctly perform an activity. **PURPOSE:** 1) Determine the effect of task speed on perceived MW during a wrist movement pattern guided by visual feedback (VF); and 2) Determine if MW is different for those who correctly perform the task (Performer: *P*) compared to those who do not (Non-performer: *NP*). **METHODS:** Twelve healthy young subjects were recruited and asked to flex and extend their right wrist to match two different speeds of a target sine wave: 0.7 Hz (*FAST*) or 1.0 Hz (*SLOW*). VF of wrist movement and the target pattern were provided concurrently on a screen. Five 20-second trials with two-minute rest intervals were completed at each speed. During rest periods the Raw NASA-TLX (RTLX), a tool used to assess perceived workload, was administered. RTLX categories representing purely MW include: mental demand (MD), temporal demand (TD), and frustration (FR). Cross-correlation analysis of task performance was computed for each subject's 5th trial at both speed conditions in order to categorize individuals as either *P* ($r \geq 0.8$) or *NP* ($r < 0.8$). 2x2 mixed model ANOVAs compared the change in perceived MD, TD, and FR from trial one to five between speed conditions (*FAST* vs. *SLOW*) and the two groups (*P* vs. *NP*). Post hoc Tukey HSD tests were used to compare differences. Positive changes in MD, TD, and FR denote improvements in MW. **RESULTS:** Significant speed x group interactions were observed for MD ($p = 0.008$) and TD ($p = 0.005$). No significant interaction or main effects were found for FR ($p = 0.204$). Post hoc tests revealed significant differences in changes in MW between *FAST* and *SLOW* speeds among *P* (MD *FAST*: 31.4, *SLOW*: 11.4, $p = 0.027$; TD *FAST*: 30.0, *SLOW*: -0.71, $p = 0.022$) and between *P* and *NP* during the *FAST* speed (MD *P*: 31.4, *NP*: -2.0, $p = 0.044$; TD *P*: 30.0, *NP*: -8.0, $p = 0.031$). **CONCLUSIONS:** *P* and *NP* showed similar changes in MW from trial one to five during the *SLOW* speed, whereas only *P* experienced improved MW during the *FAST* speed. These results suggest MW is affected by movement speed in accordance with subject performance.

1947 Board #208 May 31 3:30 PM - 5:00 PM
Compression Sleeve Does Not Speed DOMS Recovery When Compared to Placebo Garment
 Molly R. Winke, Celeste Harris. *Hanover College, Hanover, IN.*
 (Sponsor: Bryant Stamford, FACSM)
(No relevant relationships reported)

Wearing compression garments during recovery from delayed onset muscle soreness (DOMS) is known to attenuate decreased range of motion (ROM) and muscular performance and lessen muscle swelling and pain perception. However, whether a placebo effect is present when wearing compressive clothing, and to what extent recovery may be influenced by this effect, is poorly understood. **PURPOSE:** To determine the effects of a placebo sleeve (PLA) compared to a compression sleeve (CS) during a 5-day recovery period from DOMS of the elbow flexors. **METHODS:** Eight untrained female college students participated in this crossover design study. Upper and lower arm circumference was measured to determine muscle swelling; pain during elbow flexion and elbow extension was measured using a 0 - 100mm visual analog scale to determine muscle soreness; flexion and extension ROM were measured to determine joint mobility; elbow flexion torque production 60° and 180° per second was measured to determine muscular performance. A brief questionnaire measured perceived effectiveness of the garments. The muscle-damage protocol consisted of 4 sets of 25 repetitions of isokinetic concentric elbow flexion followed by eccentric elbow extension. Immediately following the protocol, subjects wore either the PLA (cooling sleeve) or the CS continually for five days. Swelling, ROM, pain, and torque production were measured pre- and post-exercise, and daily during the recovery period. Subjects rested for 7 days before completing another muscle-damage protocol and the remaining treatment. Repeated measures ANOVA was used to determine differences between treatments. **RESULTS:** There were no significant differences between trials in any measured variables indicating that recovery from DOMS was similar in both treatments ($p > 0.05$). Thus, the "true" compressive garment was no more effective at reducing pain, swelling, ROM losses, or strength losses that

accompany DOMS. Subjects preferred PLA or rated the sleeves equally 62% of the time. **CONCLUSION:** These findings suggest that PLA was just as effective as CS at alleviating the symptoms of DOMS in untrained subjects. Subjects indicated a preference for PLA despite the higher compression provided by the CS (15-20mmHg CS vs 5 mmHg PLA).

1948 Board #209 May 31 3:30 PM - 5:00 PM
Relationship Between Perceived and Actual Hydration Levels in Recreationally Active College Students
 Seth M. Sievers, Jason D. Wagganer, Jeremy T. Barnes, Thomas J. Pujol, FACSM. *Southeast Missouri State University, Cape Girardeau, MO.* (Sponsor: Dr. Thomas J. Pujol, FACSM)
(No relevant relationships reported)

Maintaining adequate hydration status is important to safely maintaining a physically active lifestyle. Most individuals are unable to accurately predict internal (i.e., perceived) hydration status. Urine Specific Gravity (USG) is a criterion measure (i.e., actual) of hydration status, and can be used to accurately and objectively gauge the hydration status of an individual. **PURPOSE:** To examine the relationship between perceived and actual hydration status in recreationally active college students. **METHODS:** A total of 58 participants (20 Male, 38 Female, Age=22.8 \pm 4.2yr, Ht=1.72 \pm .22m, Wt=73.40 \pm 14.25kg) were assessed for various hydration-related indicators. Perceived hydration was assessed via a survey upon arrival at the laboratory. Participants provided a mid-stream urine sample in a sterile, clear container. Self-perceived hydration was assessed using the urine color (UC) eight-point scale. Actual hydration status was assessed utilizing using a pen refractometer (Atago model 3749, Bellevue, WA) and UC. A Pearson Product Moment Correlation was used to analyze relationships between perceived and actual hydration values using Statistical Package for the Social Sciences (v24.0). **RESULTS:** A weak but significant correlation was shown between perceived hydration status and USG ($r = 0.284$; $p < 0.05$). Perceived hydration status and UC had a strong correlation ($r = 0.776$; $p < 0.01$). **CONCLUSIONS:** The relationship between USG, urine color, and perceived hydration indicate a strong sense of internal hydration status in participants. The findings of this study are supported by past research on competitive athletes, suggesting that a high level of physical activity (and the associated high hydration demands) correlates with a strong sense of hydration status. Future research should assess the relationship between activity level and perceived compared to actual hydration status.

1949 Board #210 May 31 3:30 PM - 5:00 PM
Setting, Age, & Intensity Influence Psychological and Physiological Processes in Young Female Endurance Runners
 Elizabeth Queathem, Kayla Morrissey. *Grinnell College, Grinnell, IA.*
(No relevant relationships reported)

Exercise has tremendously 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 what 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 Queathem (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 response to exercise as they mature, or only those girls who respond positively to exercise continue to run competitively as they age.

1950 Board #211 May 31 3:30 PM - 5:00 PM
Affective States of Active and Inactive Individuals While Sitting

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 (No relevant relationships reported)

Arousal levels are affected by activity levels such that increased sedentary behavior is associated with lower levels of vigor and higher levels of fatigue. Individuals who meet minimum physical activity guidelines have higher levels of vigor and vitality regardless of prolonged sedentary behaviors; however, the assessment of feeling states during prolonged sitting have not been explored. **PURPOSE:** To determine if there is a difference in affective states of fit vs unfit individuals and if fitness influences affective states during prolonged periods of sitting. **METHODS:** A total of 9 females and 5 males (age = 19.9±1.9 y; body mass index 23.2±2.7 kg·m⁻²) underwent submaximal exercise testing to determine maximum oxygen uptake (VO_{2max}) and to include a heterogeneous group relative to fitness (range: 30.7 to 55.9 ml·kg⁻¹·min⁻¹). Affective states were assessed hourly using the Activation Deactivation Adjective Check List (ADACL) which subscales of energy, tired, tension, and calmness. Each group completed two separate 4-h sitting bouts whereas one bout was continuous and the other was interrupted by 13 min·h⁻¹ of standing. **RESULTS:** In both conditions, a decline in energy levels occurred from baseline (~2.0±1.0) to 2 h (~1.4±0.8) (main effect for time, p<0.05), whereby the metrics of tiredness, tension, or calmness were neither altered by time nor by allowing subjects to interrupt sitting (p > 0.05). With no standing permitted, significant inverse correlations were observed between energy and VO_{2max} the second (tau = -0.56, p = 0.009) and third hour of sitting (tau = -0.49, p = 0.028). With fitter participants, decline in energy occurred over time regardless of the interruption. **CONCLUSION:** Fit compared to less fit individuals experience greater declines in energy levels as a result of prolonged sitting. Standing 13 min·h⁻¹ is insufficient to attenuate the declines in energy levels associated with bout of sitting 2 h and beyond.

1951 Board #212 May 31 3:30 PM - 5:00 PM
Exercise Performance and Perception of Breathlessness after Caffeine Ingestion in Trained Cyclists

Erica M. Larson, Jayvaughn T. Oliver, Jonathon L. Stickford, Kimberly S. Fasczewski, R. Andrew Shanely. *Appalachian State University, Boone, NC.* (Sponsor: David C. Nieman, FACSM)
 (No relevant relationships reported)

Caffeine (CAF) is commonly ingested as an ergogenic aid among cyclists, in part, due to its effect on pain perception. CAF also may improve exercise performance by altering the perceptions related to ventilatory work and dyspnea. **PURPOSE:** The purpose of this study was to compare exercise performance and the rating of perceived breathlessness (RPB; Likert Scale) after ingestion of a moderate dose of CAF or placebo (PLA) in trained cyclists. **METHODS:** Six male cyclists completed pulmonary function testing and a peak aerobic capacity test (age: 31.8±10.4 y; VO_{2max}: 61.2±6.1 ml·kg⁻¹·min⁻¹). During the second visit, cyclists completed a fixed-work familiarization time trial (TT) equivalent to a distance of 20km. Subsequently, and on separate days, subjects completed in a randomized, counterbalanced order, TTs with ingestion of a placebo (TT_{PLA}) or caffeine (TT_{CAF}; 5 mg·kg⁻¹) 60 min prior. Elapsed time, power output, perceptual responses, and ventilatory parameters were measured every 2 km during each TT. **RESULTS:** Subjects displayed normal pulmonary function during baseline testing. Elapsed time did not significantly differ between TT_{CAF} and TT_{PLA} trials (33.4±4.3 vs. 34.3±4.23 min, p=0.095). Ventilation and mouth pressure did not differ at 50% (133±31.8 vs. 123±22.0 L·min⁻¹, p=0.190; -107±26.5 vs -100±18.4 cmH₂O·min⁻¹, p=0.237) and 100% (175±42.3 vs. 176±48.8 L·min⁻¹, p=0.901; -149±45.5 vs -133±78.3 cmH₂O·min⁻¹, p=0.506) of TT_{CAF} compared with TT_{PLA}. RPB did not differ at 50% (4.5±2.1 vs. 3.2±2.5, p=0.017) and did not differ at 100% (7.3±2.4 vs. 6.6±2.2, p=0.250) of TT_{CAF} compared with TT_{PLA}. Rating of perceived exertion (RPE) did not differ at 50% (13.1±2.9 vs. 12.1±2.4, p=0.266) and 100% (17.5±1.8 vs. 17.8±1.8, p=0.380) of TT_{CAF} compared with TT_{PLA}. **CONCLUSIONS:** Exercise performance, ventilation, and RPB did not differ in trained cyclists during 20km time trials after ingestion of CAF or PLA. Supported by the Office of Student Research and Graduate Student Association Senate at Appalachian State University.

1952 Board #213 May 31 3:30 PM - 5:00 PM
Attitude toward and Perceived Discomfort from Neuromuscular Electrical Stimulation

Jennifer A. Jasso, Lindsay E. Kipp, Joni A. Mettler. *Texas State University, San Marcos, TX.* (Sponsor: Tinker Murray, PhD, FACSM)
 (No relevant relationships reported)

Neuromuscular electrical stimulation (NMES) is commonly used to improve muscle function in physical rehabilitation settings. However, reasons for limited use as 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 pre-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.

1953 Board #214 May 31 3:30 PM - 5:00 PM
Exercise Effects On Depressive and Anxiety Symptoms, Fatigue And Pain in Rheumatoid Arthritis: A Meta-Analysis

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 (No relevant relationships reported)

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 3±1 weekly sessions, 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 (Q₁₉=26.72; p>0.10), and consistency was low across effects (I²=32.63%). 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 (Q₆=2.46; p>0.87), and consistency was low across effects (I²=0%). For pain, seven of 16 effects (44%) were >0. The mean effect size Δ was 0.04 (-0.14-0.21; p>0.69). The effect was heterogeneous (Q₁₅=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 (-0.20-0.19; p>0.93). The effect was heterogeneous (Q₁₀=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.

D-71 Free Communication/Poster - Endocrinology/Immunology I

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1954 Board #215 May 31 3:30 PM - 5:00 PM

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

Travis Anderson, Suzanne Vrshek-Schallhorn, James A. Janssen, Maria Ditcheva, Gail M. Corneau, Laurie Wideman, FACSM. *University of North Carolina at Greensboro, Greensboro, NC.* (Sponsor: Laurie Wideman, FACSM)

(No relevant relationships reported)

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 ± 1.8 y, 72.1 ± 19.5 kg) 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 sample. Salivary samples were collected each morning, immediately after waking (C_w) and 30 mins later (C_{30}) and were analyzed in duplicate for cortisol ($\text{ng}\cdot\text{ml}^{-1}$) using DELFIA. CAR and CAR_% were calculated as the difference between C_{30} and C_w and the percentage increase from C_w , respectively. Only subjects with two complete days of data were included in the current analysis. Differences 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_% ($R^2 = .13$, $p = 0.04$), while the Day 2 CAR_% by Band model was significant ($R^2 = 0.15$, $p = 0.02$). Ratio models further elucidated these relations, with a significant model for Q•CAR_% by Q•Bands_% ($R^2 = 0.15$, $p = 0.02$). **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.

1955 Board #216 May 31 3:30 PM - 5:00 PM
Effect Of Acute High-Intensity Interval Exercise Vs. Continuous Moderate-Intensity Exercise On The BDNF, Lactate, And Cortisol Responses In Obese Individuals

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(No relevant relationships reported)

PURPOSE: Obesity may attenuate the expression of brain-derived neurotrophic factor (BDNF), thereby increasing the risk of cognitive dysfunction. High-intensity interval exercise (HIIE) has been shown to be as or more effective than continuous moderate exercise (CME) in promoting the expression of BDNF in normal weight individuals. Therefore, the purpose of this study was to compare the effect of acute HIIE and CME on BDNF expression in obese individuals. **METHODS:** Twelve male subjects (6 obese and 6 normal-weight) participated in a randomized and caloric equated experiment: HIIE (30 minutes, 4 intervals of 4 minutes at 80% - 90% of $\text{VO}_{2\text{max}}$ with 3 minutes rest between intervals) and CME (38 minutes at 50% - 60% $\text{VO}_{2\text{max}}$). Blood samples were collected for measurements of serum BDNF, blood lactate, and plasma cortisol prior to and following exercise. **RESULTS:** The BDNF response to acute HIIE was greater than CME in obese subjects when compared to normal-weight subjects. Similarly, although acute HIIE induced greater lactate and cortisol levels than CME, obese subjects produced less lactate, but no difference in cortisol than normal-weight subjects. **CONCLUSIONS:** Acute HIIE may be an effective protocol to upregulate BDNF expression in an obese population, independent of increased lactate and cortisol levels.

1956 Board #217 May 31 3:30 PM - 5:00 PM

Hormonal, Steroidal and Inflammatory Responses in Collegiate Male Soccer Players and Female Cross-Country Runners

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(Sponsor: Douglas J. Casa, FACSM)

(No relevant relationships reported)

PURPOSE: To examine hormonal, steroidal and inflammatory responses in collegiate male soccer players (M_{soc}) and female cross-country runners (F_{xc}) over the course of a competitive season. **METHODS:** 22 M_{soc} (mean \pm SD; age, 20 ± 1 y; height, 181.2 ± 6.5 cm; body mass, 79.4 ± 6.9 kg; $\text{VO}_{2\text{max}}$, 50.9 ± 4.4 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) and 11 F_{xc} (mean \pm SD; age 19 ± 1 y; height 168.4 ± 7.7 cm; body mass, 58.7 ± 9.6 kg; $\text{VO}_{2\text{max}}$, 53.5 ± 2.0 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) participated in this study. Participants provided a blood sample at 4 time points: before preseason (PS_{pre}), following preseason (PS_{post}), week 4 (W4, F_{xc}), week 8 (W8, M_{soc}), and following the competitive season (RS_{post}). Blood samples were assessed for the following biomarkers: testosterone (T), cortisol (C), testosterone:cortisol ratio (T:C), human growth hormone (HGH), estradiol (E), progesterone (P), insulin-like growth factor-1 (IGF-1), Interleukin-6 (IL-6) and Vitamin D (VitD). Significant differences were assessed via repeated measures ANOVA and subsequent post hoc testing ($p < 0.05$). **RESULTS:** Compared to PS_{pre} (M_{soc} , 23.71 ± 13.16 $\text{pg}\cdot\text{ml}^{-1}$; F_{xc} , 21.19 ± 1.38 $\text{pg}\cdot\text{ml}^{-1}$), IL-6 was significantly lower at PS_{post} (M_{soc} , 20.44 ± 11.58 $\text{pg}\cdot\text{ml}^{-1}$; F_{xc} , 15.41 ± 3.47 $\text{pg}\cdot\text{ml}^{-1}$) and W4 (16.68 ± 4.71 $\text{pg}\cdot\text{ml}^{-1}$) ($p < 0.05$). IL-6 was significantly greater at RS_{post} (20.27 ± 4.97 $\text{pg}\cdot\text{ml}^{-1}$) compared to PS_{post} for F_{xc} only ($p = 0.04$). In M_{soc} , C was significantly greater at PS_{post} (84.76 ± 15.70 $\text{ng}\cdot\text{ml}^{-1}$) and W8 (84.34 ± 16.68 $\text{ng}\cdot\text{ml}^{-1}$) compared to PS_{pre} (74.59 ± 14.65 $\text{ng}\cdot\text{ml}^{-1}$) ($p < 0.05$). VitD was significantly lower at RS_{post} (55.86 ± 26.20 $\text{ng}\cdot\text{ml}^{-1}$) compared to both PS_{pre} (74.30 ± 33.28 $\text{ng}\cdot\text{ml}^{-1}$) and PS_{post} (68.26 ± 33.18 $\text{ng}\cdot\text{ml}^{-1}$) for M_{soc} ($p < 0.05$), with no significant differences in VitD in F_{xc} at any time point ($p > 0.05$). P, HGH, IGF, C (F_{xc}), T (M_{soc}), T:C (M_{soc}) and E (F_{xc}) were not significantly different at any time point ($p > 0.05$). **CONCLUSION:** Our results detected a reduction in IL-6 following preseason in M_{soc} and F_{xc} that 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.

1957 Board #218 May 31 3:30 PM - 5:00 PM

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 without premenstrual syndrome (nPMS), in pre-game 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.

METHODS: Fifty-two eumenorrheic 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 cortisol and cytokines IL-1 β , IL-6, IL-8, IL-10, IL-15, IL-17 and TNF- α were performed in urine and quantified by Flow cytometry method. Study approved by the Ethics Committee in Research from Universidade Federal de São Paulo (Brazil) (No.1604/10). ANOVA and Pearson correlation with significance level of 5% were used for data analysis.

RESULTS: No statistical significant results were found in cortisol and cytokines IL-1 β , IL-8, IL-10, IL-15, IL-17 and TNF- α between groups PMS and nPMS. The concentration of IL-6, in pre-game during the luteal phase, showed an increased in the group with PMS ($p = 0.04$) compared to the nPMS group. The results of correlation between cortisol and the cytokines evaluated also showed positive correlations in the pre-game of the luteal phase with IL-17 ($p < 0.001$, $r = 0.77$), IL-1 β ($p < 0.001$, $r = 0.63$) and IL-6 ($p < 0.001$, $r = 0.55$).

CONCLUSIONS: Our results allow us to conclude that female soccer athletes PMS carriers, even in the pre-game period, presented an increased inflammatory status. The increase of proinflammatory cytokines is of great importance, since it is associated with an increased incidence of musculoskeletal lesions and a decrease in aerobic

capacity. Therefore, the importance of our work is to alert female athletes, coaches and team physicians about the effects of PMS on health and performance, in order to provide these athletes with adequate training in the premenstrual period.

1958 Board #219 May 31 3:30 PM - 5:00 PM
Cd28 Expression On Cd4+ T Cells Is Not Affected By Strenuous Exercise In Untrained Individuals

Samantha A. Bianchi, Alexander K. Holbrook, Allyson Ihlenfeldt, Brad W. Macdonald, Hunter D. Peterson, Eric C. Bredahl, Michael A. Belshan, Jacob A. Siedlik. *Creighton University, Omaha, NE.* (Sponsor: Joseph P. Weir, FACSM)
 (No relevant relationships reported)

Optimal T cell activation requires a two-signal 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 x 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 conducted through negative selection using a Human CD4⁺ T cell enrichment kit. CD4⁺ T cells were plated at 1.5×10^6 cells/ml in 200 μ l 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 RMANOVAs. **RESULTS:** There were no significant differences in CD28 expression between the exercise and control conditions in either the stimulated ($p = .27$) or non-stimulated ($p = .62$) samples. These data suggest that suppression of CD4⁺ 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. Supported by an award through the Dr. George F. Haddix President's Faculty Research Fund at Creighton University.

1959 Board #220 May 31 3:30 PM - 5:00 PM
Neutrophil Extracellular Traps Engaged in Strenuous Exercise Induced Hyperfunction of Innate Immunity System

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 (No relevant relationships reported)

There is robust evidence that strenuous exercise is pro-inflammatory and inclined to impair the function of innate immunity. Neutrophil extracellular traps (NETs) is a novel cell death pathway through which neutrophils release chromatin and granule enzymes to capture and kill invaders. However, the components of NETs can also be harmful to host cells. Overproducing cell-free DNA (cf-DNA) and reactive oxygen species (ROS) through strenuous exercise are commonly proved. Much less is known about the origin of cf-DNA and whether ROS participate in strenuous exercise induced NETs formation. **Purpose:** Based on the doubt, we hypothesize that 1) strenuous exercise increase NETs formation and the high level of NETs is related to the imbalance of immunity function; 2) mitochondrial antioxidants suppress strenuous exercise induced NETs formation and reduce the adverse consequences to host. **Methods:** 24 C57/bl mice were divided to three groups: Control group (C, n=8), strenuous exercise group (E, n=8) and mitoTempo+ strenuous exercise group (ME, n=8). E group and ME group were adapted to the treadmill for three days with a low speed. 30 minutes before formal experiment, ME group were injected with mitochondrial antioxidant mitoTempo (0.7mg/kg), then E group and ME group perform 90 minutes 85% VO₂max speed running exercise. Immediately after exercise, 3 groups of mice were anesthetized and the circulating blood was collected into anticoagulant tube. Plasma cf-DNA, MPO-DNA complexes, IL-6, IL-10 and TNF- α were tested according to the manufacture introduction of Elisa Kit; innate immunity cell function, such as phagocytosis and oxygen burst were test by flow cytometry. **Results:** Plasma cf-DNA and MPO-DNA complexes were two-fold increase in E group compared to C group ($P < 0.05$), while there is no difference between C group and ME group; IL-6 and TNF- α level in E group were higher than C group and ME group, IL-10 level show the adverse result. Monocytes and neutrophils in E group show a stronger phagocyte and

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.

1960 Board #221 May 31 3:30 PM - 5:00 PM
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 1×10^4 4T1 murine mammary carcinoma cells in the mammary fat pad. Both EX groups were given access to running wheels for 4 weeks, 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⁺Ly6G⁺ 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 ($15.3\% \pm 7.1\%$) were significantly higher ($p < 0.05$) than SED ($0.8\% \pm 0.2\%$) indicating tumor-dependent expansion of MDSCs. EX+TUM ($10.1\% \pm 0.7\%$) was not significantly different from EX ($0.5\% \pm 0.1\%$) or SED ($0.8\% \pm 0.2\%$) 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 ($5.6\% \pm 1.7\%$) was significantly lower ($p < 0.05$) than EX ($13.1\% \pm 1.1\%$) and SED ($13.4\% \pm 0.9\%$) indicating a tumor-induced suppression of immune function. In contrast, EX+TUM ($7.7\% \pm 1.0\%$) was not significantly different from EX ($13.1\% \pm 1.1\%$) or SED ($13.4\% \pm 0.9\%$). **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.

1961 Board #222 May 31 3:30 PM - 5:00 PM
Acute Effects of Exhaustive Exercise and Cardio-Respiratory Fitness on Regulatory T Cell Homeostasis.

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(No relevant relationships reported)

Regulatory T (T_{reg}) 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 T_{reg} cell populations can result in a state of immunosuppression, as has been shown in tumor-induced immunosuppression, whereas dysfunction of T_{reg} 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 T_{reg} cell homeostasis and to examine whether there is a direct link between cardiovascular fitness status (VO_{2 peak}) and T_{reg} cell population.

Methods: A total of 20 middle-aged healthy female subjects (age of 55 ± 5 , 7) were asked to perform a spiroergometry on a cycle ergometer. The spirometry 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 VO_{2 peak} served as a parameter of the healthy subjects' cardiovascular fitness. Before (T0) and after (T1) spiroergometry test, venous blood was collected. The T_{reg} cell evaluation was assessed using antibodies against CD3, CD4, CS25 and CD127 through multicolor flow cytometry.

Results: The T_{reg} cell population significantly decreased after single exercise load (T0 vs T1, $p = .001$). There was a positive correlation found between VO_{2 peak} and T_{reg} cell frequency ($p = .005$).

Conclusion/Significance: The T_{Reg} proportion decrease indicates an acute effect of intense physical exercise on T_{Reg} cell homeostasis. This could represent a rapid distribution to other tissues or a compensatory attempt to restore immune homeostasis and limit excessive damage. The correlation between peak oxygen uptake and T_{Reg} proportions could be seen as a chronic response of the anti-inflammatory capacity of healthy subjects to repeated bouts of exercise (short-term inflammatory stimuli).

D-72 Free Communication/Poster - Concussion II

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

Room: CC-Hall B

1962 Board #223 May 31 3:30 PM - 5:00 PM

Fatigue Influence On King-devick Test

Adrian Aron, Rachel Andrews, Erica Boggs, Andrea Stanley, Olivia Willson, Brent Harper. *Radford University, Radford, VA.* (Sponsor: Trent Hargens, FACSM)

(No relevant relationships reported)

One of current sideline, post-injury assessment tools used for screening concussion include the King-Devick 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-Devick 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 75 bpm with an increase of one bpm every two minutes until 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 dizziness, 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 (44.8 ± 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 categorized as positive for K-D ($P = 0.01$ compared to baseline). **CONCLUSIONS:** The present data demonstrate that whole-body fatigue may worsen the K-D scores, questioning its construct validity and limiting its use as a sideline screening for concussion. Scoring definitions can also be improved to better depict the positive results. The K-D test can show an improved validity when used in conjunction with pre-concussion symptom history.

1963 Board #224 May 31 3:30 PM - 5:00 PM
Differences in Reporting: The Concussed Student Versus the Concerned Parent

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(No relevant relationships reported)

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 concerned parent is less likely to participate in the downplaying. An accurate portrayal of symptoms may require both perspectives. Data comparing the reporting by parents and students are needed and limited. **PURPOSE:** To evaluate differences in the reporting of concussion symptoms between those who suffer them and the parents who observe them. **METHODS:** Over a 7-year period, 80 students were admitted for psychiatric evaluation owing to persistent post-concussion symptoms. Our study sample consisted of 72 of patients who completed the Behavior Assessment System for Children, 2nd Edition (BASC) as a component of their evaluation. The BASC assesses emotional, social, and behavioral functioning via self-report forms that are completed by adolescents and their parents. There are 13 questions that are unique to adolescents, 18 that are unique to parents, and 7 that are asked in both. The overlapping questions address atypicality, anxiety, depression, somatization, hyperactivity, anger control, and internalizing problems. We performed paired-samples t-tests on these domains to measure equivalence in reporting between students and parents. We used multiple linear regression to identify variables that explained differences in reporting.

RESULTS: Student/parent differences were found in atypicality ($p=0.002$), 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 modestly 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.

1964 Board #225 May 31 3:30 PM - 5:00 PM

Depression Severity in Adolescent Male and Female Athletes Following Sports-Related Concussion

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(No relevant relationships reported)

PURPOSE: Concussions are a growing concern in adolescent sports medicine. However, there is no prospective data demonstrating an association between sustaining a sports-related concussion (SRC) and depression in adolescents. This study prospectively assessed changes in depressive symptoms in high school athletes following an SRC. **METHODS:** This longitudinal cohort study consisted of 1701 adolescent athletes (grades 9-12) who were monitored for SRC. 99 athletes sustained a concussion during the study period (38 females, 61 males). Participants completed the Patient Health Questionnaire-9 (PHQ-9) survey to measure depressive symptoms at baseline (enrollment, pre-SRC), 24-72 hours post-SRC, and 7 days, 3 months, and 6 months post-SRC. Clinically relevant depressive symptoms were defined as a PHQ-9 score ≥ 4 , or some depressive symptoms most days and most of each day. To evaluate changes in PHQ-9 scores from baseline, linear mixed-effect models adjusting for sex and time were used; least-square means and standard errors are reported. GEE models assuming a binomial distribution and logit link were used to model the association between depressive symptoms and time since concussion, stratified by sex. **RESULTS:** When compared to baseline, females reported PHQ-9 scores that were, on average, 1.53(0.56) points higher at 24-72 hours post-SRC and 1.62(0.57) points higher at 7 days post-concussion than at baseline ($p=0.007$; $p=0.004$). PHQ-9 scores were lower (i.e. better) than baseline for both males and females at 3 months post-SRC (M: -1.19(0.48); $p=0.01$, F: -1.14(0.66); $p=0.09$). Females were 7.6 times more likely to have a PHQ-9 ≥ 4 at 24-72 hours post-concussion (95% CI: 1.47, 39.08) than they were at baseline ($p=0.02$) and 10.36 times more likely at 7 days post-concussion (95% CI: 1.90, 56.59) than at baseline ($p=0.007$). By 3 months, no difference from baseline is noted. There is no evidence to suggest that males experience increased depressive symptoms post-SRC. **CONCLUSIONS:** In the week following an SRC, athletes experience a transient increase in depressive symptoms, with females being more likely to experience clinically relevant depressive symptoms compared to male athletes at the same time points. We found no evidence that SRCs have a long-lasting impact on depression symptoms in adolescent athletes.

1965 Board #226 May 31 3:30 PM - 5:00 PM
Are Subconcussive Impacts Harmless in Youth Soccer Players?

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(No relevant relationships reported)

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 cerebrum 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 ± 9.1 g). 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 in word

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.

1966 Board #227 May 31 3:30 PM - 5:00 PM
No Relationship Between Head Impact Kinematics and Concussion Clinical Assessment Performance
 Thomas A. Buckley¹, Katherine M. Breedlove², Melissa S. DiFabio¹, Jessie R. Oldham¹. ¹University of Delaware, Newark, DE. ²University of Wisconsin - Eau Claire, Eau Claire, WI.
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, RHIs 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 concussions assessment.

METHODS: Eleven male collegiate ice hockey players (age: 20.3 ± 0.8 years, Ht: 1.79 ± 0.06 m, 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 test 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/sec². There was no relationship between head impact kinematics and SAC (change: 0.7 ± 2.0 , $p=0.067$), BESS (change: 4.9 ± 10.5 errors, $p=0.607$), Trails A (change: 9.2 ± 7.3 sec, $p=0.951$), Trails B (change: 13.7 ± 12.7 sec, $p=0.370$), TG (change: 2.0 ± 2.4 sec, $p=0.986$), 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 repeat 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 Board #228 May 31 3:30 PM - 5:00 PM
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.* (Sponsor: Eric Hall, FACSM)
(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.

1968 Board #229 May 31 3:30 PM - 5:00 PM
Ninds/nih And Dod Sport-related Concussion Common Data Elements: A Common Language For Clinical Research
 Anthony P. Kontos¹, Steven Broglio, FACSM², Kathryn Schneider³, Elisabeth Wilde⁴, Kristen Joseph⁵, Sherita Ala'i⁵, Joy Esterlitz⁵, Katelyn Gay⁵, Patrick Bellgowan⁶. ¹University of Pittsburgh, Pittsburgh, PA. ²University of Michigan, Ann Arbor, MI. ³University of Calgary, Calgary, AB, Canada. ⁴Baylor College of Medicine, Houston, TX. ⁵Emmes Corporation, Rockville, MD. ⁶National Institute of Neurological Disorders and Stroke, Bethesda, MD. (Sponsor: Steven Broglio, FACSM)
Reported Relationships: A.P. Kontos: Contracted Research - Including Principle Investigator; GE-NFL Head Health Initiative, EIMindA, Ltd, Abbott Laboratories.

Purpose: In 2016, the National Institute of Neurological Disorders and Stroke (NINDS)/National Institutes of Health (NIH) and the Department of Defense (DOD) began development of Sport-related Concussion (SRC) Common Data Elements (CDEs) to develop data standards for all funded clinical research in neuroscience with goal of increasing the effectiveness of clinical research studies and treatment by facilitating data sharing across studies. The purpose of this abstract is to report the findings from the SRC-CDEs. **Methods:** The initial NINDS Traumatic Brain Injury (TBI) CDE recommendations created in 2010 included limited sport-related brain injury recommendations. In August 2016, a new SRC-specific CDE working group (WG) began developing and identifying CDEs, template case report forms (CRFs), data dictionaries and guidelines to assist investigators initiating and conducting SRC-specific clinical research studies. Comprised of 34 experts from around the world, the WG met regularly to review current collection of SRC data. The WG was divided into three subgroups to examine SRC over time: (1) Acute Subgroup (time of injury until 72 hours); (2) Subacute Subgroup (after 72 hours to 3 months); and, (3) Persistent/Chronic Subgroup (3 months and greater post-concussion). **Results:** The SRC CDEs were released to the NINDS CDE website in June 2017. The recommendations include Core and Supplemental - Highly Recommended CDEs for cognitive measures and symptom checklists, as well as other outcomes and endpoints (e.g., vestibular, oculomotor, balance, anxiety, depression) and sample case report forms (e.g., injury reporting, demographics, history of concussion, concussion history) across acute, sub-acute and persistent/chronic. **Conclusion:** NINDS encourages the use of SRC CDEs by the clinical research community to standardize data collection and reporting. The NINDS CDEs are a continually evolving resource, and these newly developed SRC CDEs serve as valuable starting points for investigators to streamline research that informs treatments for SRC. This material is based upon work supported by the U.S Army Medical Research and Materiel Command's Combat Casualty Care Research Program and funded by NIH contracts HHSN271201700064C and HHSN271201200034C.

1969 Board #230 May 31 3:30 PM - 5:00 PM
Cardiovascular and Cerebrovascular Responses to Central Hypervolemia in Recently Concussed College Athletes
 Blair D. Johnson, Morgan C. O'Leary, James R. Sackett, Zachary J. Schlader, John J. Leddy. *University at Buffalo, Buffalo, NY.*
(No relevant relationships reported)

Many concussion patients demonstrate exercise intolerance which has been posited to be due to dysfunctional cerebral blood flow regulation. Lower body positive pressure (LBPP) increases central blood volume and blood pressure in healthy controls and challenges cerebral blood flow regulation. **PURPOSE:** Test the hypothesis that recently concussed college athletes (CA) have exaggerated cardiovascular and cerebrovascular responses to LBPP versus healthy controls (HC). **METHODS:** Three symptomatic CA (age: 20 ± 1 years; 1 woman) within 6 days of a diagnosed concussion and three HC (age: 22 ± 3 years; 1 woman) underwent 5-min of LBPP (20 mmHg). Heart rate (HR; ECG), mean arterial pressure (MAP; photoplethysmography), end-tidal carbon dioxide tension (PETCO₂; capnography), and middle cerebral artery blood velocity (MCAv; transcranial Doppler) were measured continuously. Cerebral

vascular conductance (CVC) was calculated. Mean values were obtained over 60 s intervals. Data are expressed as the mean \pm SD as a change from baseline. **RESULTS:** Baseline HR (CA: 54 \pm 6; HC: 63 \pm 10 bpm; $P = 0.27$), MAP (CA: 87 \pm 5; HC: 90 \pm 11 mmHg; $P = 0.75$), PETCO₂ (CA: 44 \pm 3; HC: 47 \pm 1 mmHg; $P = 0.20$), and CVC (CA: 0.48 \pm 0.13; HC: 0.69 \pm 0.09 cm/sec/mmHg; $P = 0.09$) did not differ between groups. Baseline MCAv was lower in CA (41 \pm 11 vs. 61 \pm 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 increase from baseline (peak increase: 6 \pm 2 mmHg; $P = 0.16$), whereas MAP increased in HC at the 4th (9 \pm 9 mmHg; $P = 0.02$) and 5th min (10 \pm 9 mmHg; $P < 0.01$) of LBPP. PETCO₂ did not change across time ($P = 0.57$) and was not different between groups ($P = 0.29$). MCAv was greater in CA throughout the entire LBPP protocol (peak difference at 5th min: 11 \pm 3 vs. -13 \pm 7 cm/sec; $P < 0.01$). CVC was greater in CA throughout the entire LBPP protocol (peak difference at 5th min: 0.10 \pm 0.09 vs. -0.19 \pm 0.04 cm/sec/mmHg; $P < 0.01$). CVC decreased in HC at the 3rd (-0.17 \pm 0.03 cm/sec/mmHg; $P = 0.05$) and 5th min (-0.19 \pm 0.04 cm/sec/mmHg; $P = 0.02$) of LBPP. **CONCLUSIONS:** Despite blunted MAP responses to LBPP, CA exhibit exaggerated increases in MCAv and CVC during LBPP. These preliminary data indicate that CA who are symptomatic demonstrate abnormal cerebral blood flow regulation during central hypervolemia.

1970 Board #231 May 31 3:30 PM - 5:00 PM
Concussion Knowledge and Understanding in Guardians Following Administration of Standardized Education Form.
 Tamerah N. Hunt, FACSM, Chloe Salway, Steve Patterson, Jody Langdon. *Georgia Southern University, Statesboro, GA.*
Reported Relationships: T.N. Hunt: *Royalty; SLACK Inc.*

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 $p \leq 0.05$. **Results:** No statistically significant differences were found between groups on knowledge ($t(100) = 1.74$, $p = 0.085$), understanding ($t(100) = .83$, $p = .41$), and total scores ($t(100) = 1.88$, $p = .06$). The Pearson correlation revealed a non-significant weak correlation between concussion knowledge and understanding ($r = .03$; $p = .76$). **Conclusions:** Guardians of high school student-athletes displayed moderate knowledge and understanding of concussion regardless of additional educational experiences. Despite a clinicians' 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.

1971 Board #232 May 31 3:30 PM - 5:00 PM
Differences in Serial DTI Between 72 hours and 2 Weeks Following Sports Related Concussion
 Sophia Pollalis¹, Michael Torry¹, Wen Liu², Dzung Dinh², Michael Zagardo², Lawrence Jiang², Cristin Rassi¹, Peggy Flannigan². ¹*Illinois State University, Normal, IL.* ²*OSF HealthCare Saint Francis Medical Center, Peoria, IL.*
 (No relevant relationships reported)

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 the 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-DTI 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-DTI scalars of FA and MD taken serially between acutely (<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.

1972 Board #233 May 31 3:30 PM - 5:00 PM
Effect of Soccer Headgear on Likelihood and Severity of Non-concussive Injuries in High School Athletes
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 (No relevant relationships reported)

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, as well as 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 (21.9%) 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 ($p = 0.21$). **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.

1973 Board #234 May 31 3:30 PM - 5:00 PM
Neuromechanical Factors Associated with Self-Reported Concussion History among Elite Athletes
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Reported Relationships: G.B. Wilkerson: *Consulting Fee; Traq Global, Ltd.*

PURPOSE: This study assessed various indices of neuromechanical responsiveness for possible identification of persisting concussion effects. **METHODS:** A cohort of 48 Olympic athletes (34 males: 23.8 \pm 4.4 years; 14 females: 25.4 \pm 4.5 years) performed 3 different 60-s visuomotor reaction time (VMRT) tests involving rapid manual contact with 64 randomly illuminated target buttons arranged in a pattern of 5 concentric rings on a height-adjustable board, and a whole-body reactive agility (WBRA) test requiring side-shuffle movements in response to 20 randomly presented left or right visual targets. An initial VMRT test trial was limited to manual button contacts, immediately followed by trials that involved 2 different dual-task conditions. A centrally located screen displayed scrolling text (VMRT+ST) that the athletes orally recited while also performing the basic VMRT test. The other dual-task condition displayed the Eriksen flanker test (VMRT+FT), which required the athletes to orally state the right or left direction indicated by the center arrow of a 20 5-arrow displays (10 congruent and 10 incongruent arrow sets). Measurements of WBRA reaction time, speed, acceleration, and deceleration were derived from a motion analysis system. **RESULTS:** Concussion occurrence was reported by 21 athletes at 2.0 \pm 2.3 years prior to testing (range: 2 weeks to 7.5 years). Strong univariable associations were found for VMRT+FT left minus right VMRT difference ≥ 15 ms (OR = 7.14; 90% CI: 2.44, 20.90), VMRT+ST outermost 2-ring to innermost 3-ring average VMRT ratio ≥ 1.28 (OR = 4.58; 90% CI: 1.51, 13.92), and WBRA speed asymmetry $\geq 7.7\%$ (OR = 4.67; 90% CI: 1.63, 13.36). A large VMRT+FT X VMRT+ST interaction effect was identified (OR = 25.00; 90% CI: 6.00, 103.32), which had 88% positive predictive value (14/21) and 78% negative predictive value (25/32). Recursive partitioning identified a 3-way

VMRT+FT X VMRT+ST X WBRA interaction that had 100% positive predictive value (8/8) for identification of athletes with concussion history, whereas negative status on all 3 factors provided 90% negative predictive value (21/23).

CONCLUSIONS: Metrics derived from the VMRT and WBRA tests provided clear evidence of neuromechanical responsiveness deficiencies among Olympic athletes who reported a history of at least one concussion.

1974 Board #235 May 31 3:30 PM - 5:00 PM
Preliminary Normative Baseline Data for the Sport Concussion Assessment Tool 5 (SCAT 5) in Adolescent Athletes

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(No relevant relationships reported)

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 evaluated for 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 \pm 1.2 years old). The average total number of symptoms reported was 1.79 \pm 2.9 and the average symptom severity score was 2.93 \pm 6.4. The average scores of the individual components of the SAC included an: orientation score of 4.96 \pm 0.2, immediate memory score of 19.97 \pm 3.4, concentration score of 3.00 \pm 1.2 and delayed recall score of 6.88 \pm 1.7, equaling an average total SAC score of 34.80 \pm 5.2. Finally, the average mBESS score was 3.21 \pm 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.

1975 Board #236 May 31 3:30 PM - 5:00 PM
A Portrait of the Concussed Student-Athlete: Grade and Sex Affect Presentation of Symptoms

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(No relevant relationships reported)

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 the effect of age and sex on the presentation of SRC symptoms in student-athletes undergoing prolonged recovery. **METHODS:** A sample of athletes from middle school to college (n=76) were evaluated for persistent symptoms of SRC. Cognitive function was measured using the ImpACT test; behavior and attitudes were collected via the Behavior Assessment System for Children (BASC) questionnaire. Independent-samples t tests, chi-squared tests, and multivariate analyses with a Bonferroni correction measured differences between sexes and scholastic grades on cognitive, behavioral, and functional assessments. **RESULTS:** Subjects were 16.2 \pm 2.3 years of age; 56.6% of patients were male. Men and women expressed no differences in age (p=0.780), number of previous concussions (p=0.231), or duration of current symptoms (p=0.445). Men tested higher in verbal memory (p=0.036), visual motor speed (p=0.003), and cognitive efficiency (reaction time and accuracy; p=0.007). Women reported better attitudes toward school (p=0.005) and teachers (p=0.043). College athletes sustained more previous concussions (2.6) than middle school (1.0) and high school (1.0) athletes (p=0.016), but high school athletes expressed a trend for more co-occurring diagnoses (1.4) than middle school (0.9) and college (0.6) athletes (p=0.057). The difference between high school and college was significant (p=0.029). Regarding performance,

there was a difference between grade levels in the cognitive efficiency index with middle school athletes scoring significantly lower than high school and college athletes (p=0.022). **CONCLUSIONS:** When youth athletes experience SRC, the sex and age of the athlete is associated with important differences in attitudes, memory, and functional capacities. Proper evaluation of a concussed athlete must consider the role that age and sex play on the diagnosis of injury severity and the expectations of recovery.

1976 Board #237 May 31 3:30 PM - 5:00 PM
Single and Dual-Task Tandem Gait Performance Throughout Concussion Recovery

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(No relevant relationships reported)

Impaired postural control is common following concussion and is traditionally assessed with the Balance Error Scoring System (BESS); however, the BESS has been criticized for numerous limitations. Alternatively, tandem gait (TG) is a clinically feasible dynamic postural control assessment recommended by The Sport Concussion Assessment Tool- 3rd Edition (SCAT3). Single-task (ST) and dual-task (DT) standard gait assessments have successfully identified postural control impairments following concussion; however, there is minimal literature on the translation to ST and DT TG. **PURPOSE:** To evaluate ST and DT TG performance throughout concussion recovery. **METHODS:** Eighteen NCAA Division I student-athletes (Age: 20.3 \pm 1.3 years; Height: 173.6 \pm 8.9 cm; Weight: 70.1 \pm 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 \pm 3.0 seconds; Acute: 15.4 \pm 4.7 seconds; Asymp: 12.5 \pm 2.8 seconds; RTP: 11.3 \pm 2.0 seconds) compared to ST TG (BL: 10.3 \pm 1.4 seconds; Acute: 10.9 \pm 2.1 seconds; Asymp: 9.8 \pm 1.9 seconds; RTP: 9.2 \pm 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.

1977 Board #238 May 31 3:30 PM - 5:00 PM
The Relationship Between Patient-Reported Visual Symptoms and Visual Deficits After Concussion

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(No relevant relationships reported)

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 (PCSI). 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

($p < 0.001$), but were not significantly more likely to have abnormal scores before injury ($p = 0.509$) or abnormal findings on NPC ($p = 0.309$) or accommodation testing ($p = 0.179$).

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.

1978 Board #239 May 31 3:30 PM - 5:00 PM
Reliability of Five Novel Reaction Time and Cognitive Load Protocols

Kelsey Picha, Carolina Quintana, Amanda Glueck, Nicholas Heebner, John Abt, FACSM, Scott Lephart, FACSM. *The University of Kentucky, Lexington, KY.*
(No relevant relationships reported)

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 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 for the third session (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 attention on identifying optimal intervention windows and how effective the Dynavision D2 system is for rehabilitation purposes.

1979 Board #240 May 31 3:30 PM - 5:00 PM
Normative Values and Effects of Fatigue on the King Devick Test in Wheelchair Athletes

Angela Mickle, J.P. Barfield. *Radford University, Radford, VA.*
(Sponsor: Hank Williford, FACSM)
(No relevant relationships reported)

The King-Devick (KD) test of rapid eye movement is a common assessment of concussion in able-bodied (AB) sport but data are unavailable on disability sport athletes. **PURPOSE:** The purpose of this study was to establish normative KD values for wheelchair rugby and wheelchair basketball sport participants. The secondary purpose was to examine the effect of submaximal and maximal effort on baseline values. **METHODS:** Fifty wheelchair rugby ($n = 22$) or wheelchair basketball ($n = 28$) players (47 males, 3 females) completed baseline KD assessments via an iPad application approximately 10 minutes before a scheduled practice or competition. Because some athletes had limited or impaired grip, iPads were placed on music stands at a standardized height and distance from each participant. To assess the effect of submaximal effort on baseline score, 24 athletes completed a general warm-up, a sport-specific warm-up, and a 6-set sprinting session of 30 meters (15 down, 15 back) starting every 30 sec. To assess the effect of maximal effort, 18 different participants completed sprints until an RPE of 18 was reached (level between "very hard" and "extremely hard"). Final measurements of perceived exertion using the Borg RPE scale and a final KD test completed within 30 sec of the last sprint. **RESULTS:** Mean KD baseline score was 51 sec and no significant difference on mean KD baseline score existed between sports, impairment types, or gender. Specific to submaximal effort, mean KD score decreased by 3.5% after 6 maximum effort sprints (Post-test RPE = 13; perceived between "light" and "somewhat hard" effort). Specific to maximal effort (Post-test RPE = 18), mean KD score increased by 1.7% despite the fact that 8 of 12 players demonstrated an improvement. **CONCLUSIONS:** KD normative scores were meaningfully higher than previously reported norms in AB sport. Consistent with AB sport, exertion typically caused an improvement (decrease) in KD score time.

D-73 Free Communication/Poster - Exercise-Clinical Populations

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1980 Board #241 May 31 3:30 PM - 5:00 PM
The Effect of Intradialytic Exercise Training on Cardiac and Arterial Health in Hemodialysis Patients

Jin hee Jeong¹, Pei-tzu Wu², Annabel Biruete¹, Brandon Kistler³, Peter Fitschen⁴, Hae Ryong Chung⁴, Emily Tomayko⁵, Bo Fernhall, FACSM⁶, Kenneth Wilund¹. ¹University of Illinois at Urbana-Champaign, Urbana, IL. ²University of California at Los Angeles, Los Angeles, CA. ³Ball State University, Muncie, IN. ⁴Clayton State University, Morrow, GA. ⁵Oregon State University, Corvallis, OR. ⁶University of Illinois at Chicago, Chicago, IL. (Sponsor: Bo Fernhall, FACSM)
(No relevant relationships reported)

Introduction and Aims:

Patients with kidney failure undergoing chronic hemodialysis (HD) treatment have excessively high rates of cardiovascular (CV) morbidity and mortality. Exercise training as a part of a comprehensive treatment program has been shown to reduce the risk of CV events in patients with established CV disease. However, much less is known about the CV effects of exercise training in HD patients. The aim of this study was to determine the effect of 12 months of intradialytic exercise with concomitant protein supplementation on CV health in HD patients.

Methods:

This is a secondary analysis of CV parameters measured from a subset of patients participating in the IHOPE trial (NCT#01234441). 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 EE' 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.

1981 Board #242 May 31 3:30 PM - 5:00 PM
Predictors Of Performance At Anaerobic Threshold (AT) In Patients With Chronic Liver Disease (CLD)

Jillian K. Price¹, Carey Escheik², Patrick Austin³, Lynn Gerber², Zobair M. Younossi³. ¹George Mason University, Herndon, VA. ²Inova Health System, Falls Church, VA. ³Inova Fairfax Hospital, Falls Church, VA. (Sponsor: Walter R. Frontera, FACSM)
(No relevant relationships reported)

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 (HYP), 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,

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 (3 NAFLD, 1 HCV), 100% had both SBP and DBP outside of the normal ranges. The non-CLD group was significantly younger ($p=.0001$), had higher VO₂ ($p=.019$) and METs ($p=.020$) at AT than NAFLD, scored higher on HAP sub-measures ($p=.001-.004$), and had exercised longer at AT onset than both NAFLD ($p=.010$) and HCV ($p=.027$) cohorts. Per stepwise regression age (AT HR $r=.816$, $p=.014$, AT exercise duration $r=.728$, $p=.007$) and age with elevated AST (AT HR $r=.971$, $p=.001$) was most predictive of AT performance in the NAFLD cohort. In the HCV cohort, HTN was most predictive of AT performance (AT VO₂ $r=.857$, $p=.029$, AT metabolic equivalents (METs) $r=.864$, $p=.027$, and AT exercise duration $r=.900$, $p=.014$). **CONCLUSION:** Regardless of formal hypertension diagnosis, elevated blood pressures were common in the HCV and NAFLD 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 NAFLD subjects.

1982 Board #243 May 31 3:30 PM - 5:00 PM

Long-term Effects of Tai Chi on Muscle Strength and Physical Function in Patients with Peripheral Neuropathy

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(No relevant relationships reported)

An estimated 20 million people in the U.S. suffer from peripheral neuropathy (PN). Patients with PN develop gait abnormalities, and foot pain is one of the factors affecting walking ability. As a result, a large number of individuals with PN suffer from a reduction in daily physical activity. Tai Chi appears to be safe and effective in promoting strength and functional capacity in older patients with PN and other chronic disabilities. **PURPOSE:** To assess the long-term effects on muscle strength and physical function among patients with PN enrolled in a Tai Chi exercise program. **METHODS:** Eleven participants (men=5, women=6; age: 73 ± 6.96 years) participated in this study. These participants have been engaged in a Tai Chi exercise program over the past one and a half years. The progressive Tai Chi (i.e., Yang Style) program was offered 2 times per week, 60 minutes each time. Before and after training, muscle strength [One repetition maximum (1RM) for leg extension and leg curl], and physical function [i.e., six-minute walk test (6MW) and 8-foot up-and-go] were evaluated. **RESULTS:** After the 18 months of training, muscle strength increased significantly [leg extension: pre = 24.33 ± 16.88 ; post = 34.71 ± 18.66 kg; leg curl: pre = 29.81 ± 16.50 ; post = 37.81 ± 16.46 kg; ($p < 0.05$)]. The performance of 6MW was improved significantly by 26.16% [pre = 367 ± 118 ; post = 463 ± 159 m, ($p < 0.05$)]. Finally, the time of 8-foot up-and-go decreased significantly by 21% [pre = 11.98 ± 5.52 ; post = 9.46 ± 3.84 sec, ($p < 0.05$)]. **CONCLUSIONS:** These findings demonstrate that long-term Tai Chi exercise program is capable of increasing lower extremity muscle strength and physical function among patients with PN. Interestingly, the exercise training program was able to reduce the risk for loss of functional mobility (i.e., decreased 8-foot up-and-go time) among the participants with PN.

1983 Board #244 May 31 3:30 PM - 5:00 PM

Muscular Impairment In Brazilian Adults With Neurofibromatosis Type 1

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(No relevant relationships reported)

Neurofibromatosis type 1 (NF1) is a genetic neurocutaneous disorder, autosomal dominant, with multisystemic manifestations, including a predisposition to tumor formation, bone dysplasias, neuromuscular and exercise capacity impairment and motor deficits, such as poor coordination, low muscle tone, and easy fatigability. Recent studies have illustrated a primary role for the *NF1* gene product in muscle growth, strength and metabolism.

PURPOSE: To evaluate body composition and muscle strength in Brazilian individuals with NF1.

METHODS: 26 individuals with NF1 (14 male), aged 18-45 years, were compared to 26 controls, matched by sex, age, body mass index (BMI) and physical activity level. The following anthropometric parameters were measured: weight, height and waist circumference. Body composition was assessed by dual energy X-ray absorptiometry (DXA). The muscular strength was evaluated by the handgrip test using a dynamometer and presented as maximum muscle strength (Fmax) and per unit area (Farea). The physical activity level were evaluated by IPAQ short form. Statistical analyses used: Kolmogorov-Smirnov and T of Student paired.

RESULTS: The mean age was 34.31 ± 6.05 and 32.92 ± 6.14 years old in the NF1 and control groups, respectively ($p=0.316$). Stature was lower in individuals with NF1 (1.61 ± 0.10 vs. 1.68 ± 0.08 meters, $p=0.003$). There were no differences in weight, BMI, waist circumference, fat mass, fat percentage and body fat index. Appendicular lean mass adjusted by BMI was lower in the NF1 group (0.743 ± 0.190 vs. 0.828 ± 0.161 , $p=0.048$). Individuals with NF1 also presented reduction of Fmax (31.09 ± 12.20 vs. 37.47 ± 10.66 kg, $p=0.035$) and Farea (13.26 ± 4.17 vs. 15.62 ± 3.58 kg, $p=0.028$).

CONCLUSION: The NF1 group in this study have lower lean mass adjusted for BMI and lower maximal muscle strength. It may indicate an early sarcopenia in this population, which requires further investigation about the mechanisms of these changes and the role of nutrition and exercise on these results.

Supported by CAPES and FAPEMIG Grant (APQ-00928-11)

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

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(No relevant relationships reported)

High intensity interval training (HIIT) is safe and improves cardiorespiratory fitness and other health characteristics in people living with chronic diseases. 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 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 90% 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 neuropsychological testing (7-domains). Kruskal-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, respectively ($P=0.54$; 95 ± 6 vs. 100 ± 17 W, $P=0.69$). 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 groups further suggest the feasibility and safety of the HIIT exercise intervention in these patients. The study was supported by NIMHD S21MD001830, R21MH095524, U54-MD007587-04, R25MD007607.

1985 Board #246 May 31 3:30 PM - 5:00 PM
Cardiopulmonary Profile Of Individuals With Intellectual Disabilities During Maximal Exercise

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(No relevant relationships reported)

Individuals with intellectual disabilities (ID) often live a sedentary life and present with low fitness levels. Exercise intolerance has been shown in individuals with Down syndrome, but in individuals with non-syndromic ID, the parameters derived from cardiopulmonary exercise tests (CPET) relating to exercise intolerance have not yet been thoroughly investigated. **PURPOSE:** Our purpose was to assess potential differences in the maximal oxygen uptake and full cardiopulmonary profile during CPET in individuals with non-syndromic ID and healthy controls. **METHODS:** Participants performed a treadmill CPET using an incremental protocol until exhaustion. Differences between groups in peak heart rate (HR_{peak}), peak oxygen uptake (VO_{2peak}), peak minute ventilation (VE_{peak}), peak CO₂ expired (VCO_{2peak}), oxygen uptake efficiency slope (OUES), relationship between VE and VCO₂ (VE/VCO₂ slope), relationship between VO₂ and HR (O₂ pulse), heart rate reserve (HRR), and peak respiratory exchange ratio (RER_{peak}) were tested with students t-test and

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-ID Physiology.

	ID	Controls	p-value
HRpeak (bpm) ^a	182.0 ± 19.50	194.6 ± 7.54	0.003 ^b
VO ₂ peak (L/min)	1.8 ± 0.86	2.7 ± 0.50	0.014
VO ₂ peak (ml/kg/min)	25.7 ± 7.73	39.6 ± 7.63	0.001
VEpeak (L/min)	74.2 ± 35.29	109.3 ± 23.97	0.028
VCO ₂ peak (L/min)	1.9 ± 0.97	3.2 ± 0.56	0.01
OUES	1723.8 ± 875.91	2700.8 ± 516.67	0.012
VE/VCO ₂ slope (L/min)	35.8 ± 3.99	31.7 ± 4.45	0.06
O ₂ pulse (L/bpm)	10 ± 4.42	13.9 ± 2.38	0.003
O ₂ pulse (ml/kg/bpm)	143.6 ± 39.02	202.6 ± 33.40	0.003
HRR (bpm)	111.1 ± 9.4	135.3 ± 14.6	< 0.001
RERpeak (L/min)/(L/min)	1.13 ± 0.05	1.16 ± 0.08	0.34

All data are presented as mean \pm SD, unless otherwise noted. ^a median \pm IQR ^b Mann-Whitney U test

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

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(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·m⁻²) participated in this study. Participants attended a session where time during the timed-up-and-go test and distance covered during the 6-min walk test were measured. Participants then wore for 7 days on their right wrist an accelerometer (wGT3X+, Actigraph) which provided sleep, physical activity, and sedentariness variables. We calculated descriptive statistics and we used Spearman's rho to examine associations of sleep with physical functioning and physical activity variables, and BMI.

RESULTS: Mean \pm SD of sleep, physical functioning, physical activity, and sedentariness variables were: total time in bed 557 ± 61 min·day⁻¹; total sleep time 407 ± 54 min·day⁻¹; latency 26.8 ± 21.0 min; efficiency $73.9 \pm 12.0\%$; wake after sleep onset 123 ± 65 min; number of awakenings 21.0 ± 6.2 ; average length of awakenings 6.1 ± 3.0 min; timed up-and-go 10.3 ± 3.1 s; 6-min walk distance 255.6 ± 89.6 m; moderate-to-vigorous physical activity accumulated in 10 min bouts 91.3 ± 173.0 min·week⁻¹; total sedentary time 3165 ± 527 min·week⁻¹; total sedentary time in 15-min bouts 731 ± 560 min·week⁻¹. Six-minute walk distance was significantly associated with average length of awakenings ($\rho = -0.69$; $p = 0.005$) and total sleep time ($\rho = 0.58$; $p = 0.024$), and moderately, but non-significantly, with efficiency, latency, and number of awakenings ($\rho = 0.50, 0.45$, and 0.40 , respectively). There were no other significant correlations between sleep variables and physical activity, sedentariness, and BMI.

CONCLUSIONS: Adults with DS experience difficulties in sleeping and have low physical activity and physical functioning levels, and high sedentariness levels. Indices of sleep are associated with performance during the 6-min walk test, but not with physical activity or sedentariness.

1987 Board #248 May 31 3:30 PM - 5:00 PM
Metabolic And Cardiovascular Effects Of Body Weight Support Treadmill Walking In Healthy Adults

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(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 ± 6.7 yr; 74.6 ± 14.3 kg; 170.8 ± 6.9 cm; 26.1 ± 5.3 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 5 minutes between each trial, and did not begin a subsequent trial 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 (SPSS ver. 24, New York, NY).

RESULTS: At rest, HR was 78.2 ± 11.5 bp and BP was $121.2 \pm 7.9 / 76.9 \pm 8.0$ 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 statistical 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

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(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 test for differences within and between DM1 and control for each test. **Results:** H-reflex suppression was not different between DM1 and control (0.40 and 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

1989 Board #250 May 31 3:30 PM - 5:00 PM

Bioimpedance Spectroscopy Measurements Comparing Different Body Positions and Electrode Types in Men and WomenJordan R. Moon¹, Michael T. Lane², Lee A. Doernste², Ryan M. Bean², April M. Spears², Zackary S. Cicone³, Clifton J. Holmes³, Bailey A. Welborn³, Todd Freeborn³, Michael R. Esco, FACSM³.¹Impedimed, Inc., Carlsbad, CA. ²Eastern Kentucky University, Richmond, KY. ³University of Alabama, Tuscaloosa, AL.

(No relevant relationships reported)

PURPOSE: To evaluate how BIS measurements are affected by metal electrodes and different body positions (sitting and standing) compared to the traditional supine, gel-backed electrode method. **METHODS:** Forty-nine subjects (m=24, w=25) participated in the study (24 +/- 6 years, 172 +/- 11 cm, 74.2 +/- 15.4 kg). Whole body, right side measurements were taken sitting with metal electrodes (SiM), standing with metal electrodes (StM), and supine with gel-backed electrodes (SuG). Supine measurements were taken with a traditional lead-based device while standing and sitting measurements were taken using a fixed metal electrode device. Both devices independently calculated R0 and Rinf. **RESULTS:** Significant correlations were identified between all measurements ($r > 0.88$, $p < 0.001$). The highest correlations were observed between SiM and StM as well as StM and SuG for Rinf in the women ($r > 0.949$, $p < 0.001$) and between SiM and StM R0 as well as SiM and StM for Rinf in the men ($r > 0.973$, $p < 0.001$). Significant differences ($p < 0.05$) were observed in both R0 and Rinf for men and women comparing all measurements apart from R0 between SiM (764.95 ohms) and StM (773.18 ohms, $p = 0.116$) and R0 between SiM (764.95 ohms) and SuG (755.2 ohms, $p = 0.172$) in women. Compared to SuG, (women: R0 = 755.20, Rinf = 517.43 ohms; men: R0 = 599.30, Rinf = 384.70 ohms) SiM (women: R0 = 764.95, Rinf = 553.61 ohms; men: R0 = 613.31, Rinf = 417.54 ohms) was less affected than StM (women: R0 = 773.18, Rinf = 572.06 ohms; men: R0 = 623.58, Rinf = 434.40 ohms). **CONCLUSIONS:** Successful BIS measurements and calculations using complex Cole models were obtained from all measurements (sitting with metal electrodes, standing with metal electrodes, and lying supine with gel-backed electrodes). High (significant) correlations were observed between each measurement. Compared to the traditional supine measurements using gel-backed electrodes, both standing and sitting measurements taken with metal electrodes resulted in slightly (< 55 ohms) higher R0 and Rinf values. An R0 and Rinf correction factor should be applied when utilizing standing or sitting BIS measurements using metal electrodes for the calculations of fluid volumes or tissue masses when using the same calculations and resistivity coefficients as traditional supine measurements using gel-backed electrodes.

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Room: CC-Hall B

1990 Board #251 May 31 2:00 PM - 3:30 PM

Predicting Basal Metabolic Rate After Spinal Cord Injury

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(No relevant relationships reported)

PURPOSE: To assess the accuracy of existing basal metabolic rate (BMR) prediction equations in men with chronic (> 1 year) spinal cord injury (SCI). The primary aim is to develop new SCI population-specific BMR prediction models, based on anthropometric, body composition and/or demographic variables that are strongly associated with BMR.

METHODS: Thirty men with chronic SCI (Paraplegic; n = 21, Tetraplegic; n = 9), aged 35 ± 11 years (mean ± SD) participated in this cross-sectional study. Criterion BMR values were measured by indirect calorimetry. Body composition (dual energy X-ray absorptiometry; DXA) and anthropometric measurements (circumferences and diameters) were also taken. Criterion BMR values were compared to values estimated from six commonly used prediction equations. Multiple linear regression analysis was performed to develop new SCI-specific BMR prediction models.

RESULTS: Existing equations that use information on stature, weight and/or age, significantly ($P < 0.001$) over-predicted measured BMR by a mean of 14-17% (187-234 kcal/day). Equations that utilized fat-free mass (FFM) accurately predicted BMR. The development of new SCI-specific prediction models demonstrated that the addition of anthropometric variables (weight, height and calf circumference) to FFM (Model 3; $r^2 = 0.77$), explained 8% more of the variance in BMR than FFM alone (Model 1; $r^2 =$

0.69). Using 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 $\leq 6\%$.

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.

1991 Board #252 May 31 2:00 PM - 3:30 PM

Effects of Resistance Training on Vascular and Hemodynamic Responses to Standardized Workloads in Coronary Patients

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(No relevant relationships reported)

PURPOSE: 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 = 66.1 ± 5.1 yrs) 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 (JHR x 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 ± 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.

1992 Board #253 May 31 2:00 PM - 3:30 PM

The Effects Of Multi-directional Exercise Training On Body Composition, Physical Fitness, And Mobility In Stroke PatientsEunkyung Park¹, Younsun Son², James Johnson³, Kyungock Yi⁴, Jung-II Oh¹. ¹University of Texas Rio Grande Valley, McAllen, TX. ²University of Houston, Houston, TX. ³Baylor College of Medicine, Houston, TX. ⁴Ewha Womans University, Seoul, Korea, Republic of.

(No relevant relationships reported)

PURPOSE: The aim of this study was to compare the effects of multi-directional exercise training with conventional uni-directional stroke rehabilitation training on body composition, lower body strength and endurance, flexibility, balance, and mobility in stroke patients.

METHODS: Twenty-three male patients with chronic stroke were randomly assigned either a multi-directional exercise training group (MET) or a uni-directional exercise training group (UET). All participants in both groups underwent 12 weeks of exercise training (3 times/week, 60 mins/day). The MET group utilized a half-ball balance device and the UET group utilized a treadmill. The following tests were administered pre- and post-intervention: chairstand test, up and down test, single-leg balance test, sit and reach test, 6m walking test, and 6min walking test. Data were analyzed using T-test and ANCOVA with a significance level of 5%.

RESULTS: Twenty participants completed the exercise regimen (MET, n=10, 53.9 ± 8.3 yrs; UET, n=10, 58.3 ± 12.1 yrs). There was a significant increase between pre- and post-intervention values in the sit and reach test (-6.50 ± 9.52 vs -4.45 ± 11.06, $t = -2.13$, $p < .05$) and up and down test (10.30 ± 2.91 vs -12.1 ± 2.60, $t = -9.00$, $p < .05$) in MET, and although up and down values did improve in the UET the results did not meet criteria for statistical significance. Significant increases of single-leg balance test (F(1, 17) =

4.73, $p < .05$) and up and down test ($F(1, 17) = 14.03$, $p < .05$) values were found in the post-intervention MET group compared to the UET group using ANCOVA analysis. No significant effects were found on body composition or mobility.

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.

1993 Board #254 May 31 2:00 PM - 3:30 PM
Blood Pressure in Subjects under Treatment for Knee Osteoarthritis: Role of Physical Activity Status

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(No relevant relationships reported)

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 tendency 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

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(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 yrs; 34.0 ± 7.4 kg/m²; (FBG: 105.6 ± 6.1 mg/dl, 2-hr glc: 120.7 ± 28.1 mg/dl) and IFG+IGT ($n=14$, 61 ± 8.1 yrs; 33.1 ± 3.3 kg/m²; FBG: 104.2 ± 10.5 mg/dl, 2 hour glc: 165.4 ± 2 mg/dl) were compared in this cross-sectional study following a 75g OGTT screening based on ADA criteria. Aerobic fitness (VO_{peak}) 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) via applanation tomography. A 180-min OGTT was also performed to assess glucose tolerance. **Results:** Although there was no significant difference between IFG and IFG+IGT for body fat ($P=0.94$), VO_{peak} ($P=0.46$), FMD ($P=0.42$), AI ($P=0.71$), or PWV ($P=0.95$), elevated VO_{peak} 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 blood glucose at 180 min was associated with lower VO_{peak} ($r=-0.51$, $P=0.06$) and FMD ($r=-0.54$, $P=0.05$) 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.

1995 Board #256 May 31 2:00 PM - 3:30 PM
Six Weeks of Aerobic Exercise Improves Markers of Insulin Sensitivity and Metabolic Endotoxemia: Correlations with the Gut Microbiota

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(No relevant relationships reported)

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* ($r = 0.610$, $p = 0.009$), 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 post fecal 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.

1996 Board #257 May 31 2:00 PM - 3:30 PM
Cardio-Ankle Vascular Index (CAVI) And Leisure-Time Physical Activity In Men With Type 1 Diabetes

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(No relevant relationships reported)

Diabetes is known to amplify the vascular changes that result in arterial stiffening. Individuals with type 1 diabetes (T1D) may also have impaired cardiorespiratory fitness which may influence their leisure-time physical activity (LTPA). Cardio-Ankle Vascular Index (CAVI) is a noninvasive method used to assess arterial stiffness. Currently there are few studies investigating the relationship between arterial stiffness and LTPA in individuals with T1D. **PURPOSE:** To determine CAVI and its associations with LTPA and cardiorespiratory fitness (VO_{2max}) in young men with T1D. **METHODS:** As a part of a larger study investigating early signs of cardiovascular disease in T1D 12 men with T1D (33 ± 7 y, 181 ± 7 cm, 81 ± 11 kg, T1D duration 13 ± 7 y) and 17 healthy age- and anthropometry-matched men (CON) (33 ± 6 y, 181 ± 5

cm, 83±10 kg) participated in the study. CAVI was assessed using VaSera VS-1500 (Fukuda Denshi Co. Ltd., Tokyo, Japan). Self-reported LTPA (min/wk) was obtained through a questionnaire. The subjects also performed incremental cycling exercise test until volitional fatigue to determine maximal oxygen uptake ($\text{VO}_{2\text{max}}$). Group comparisons were made using independent samples t-test and relationships were determined using Pearson correlation coefficient. All parameters are presented as mean ± SD. **RESULTS:** CAVI was higher in T1D (7.1 ± 0.5 for right, 7.1 ± 0.4 for left) compared to CON (6.5 ± 0.6 for right, 6.4 ± 0.6 for left) ($p<0.01$). LTPA did not differ between the groups, whereas $\text{VO}_{2\text{max}}$ was lower in T1D than in CON (35.9 ± 4.8 ml/kg/min vs. 42.7 ± 7.5 ml/kg/min, $p<0.05$). LTPA was inversely associated with right CAVI ($r=-0.72$, $p<0.01$) and left CAVI ($r=-0.68$, $p<0.05$) in T1D but not in CON. $\text{VO}_{2\text{max}}$ was not associated with CAVI in T1D or in CON. **CONCLUSIONS:** Young men with T1D have increased arterial stiffness determined by CAVI which may be an early sign of cardiovascular disease. Our finding of the inverse association between CAVI and LTPA in men with T1D suggests that LTPA may be especially important in modifying arterial stiffness in T1D.

1997 Board #258 May 31 2:00 PM - 3:30 PM
The Influence Of Physical Inactivity On Risk Of Type 2 Diabetes In University Staff

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(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: (i) to 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 ± 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:** Lack of physical activity measured by 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				
	Women		Men	
FINDRISC	Frequency	%	Frequency	%
Low (<7 points)	34	24.1	18	16.2
Slightly elevated (7-11 points)	61	43.3	36	32.4
Moderate (12-14 points)	22	15.6	29	26.1
High (15-20 points)	19	13.5	21	18.9
Very high (>20 points)	5	3.5	7	6.3

1998 Board #259 May 31 2:00 PM - 3:30 PM
Association Between Cardiovascular Markers And Physical Activity In Patients With Obstructive Sleep Apnea

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(No relevant relationships reported)

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 cardiometabolic markers.

METHODS: A cross-sectional study, the Sao Paulo Epidemiologic Sleep Study, assessed 1042 individuals aged between 20 and 80 years of age through polysomnography, self-report PA level (MET's/week) and cardiometabolic profile such as C-reactive protein (CRP), homocysteine, folic 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-apneic group ($P=0.013$), the MET level was 20.9% lower in the mild apnea group, 39.9% lower in the moderate group ($P<0.001$), and 57.7% lower in the severe apnea group ($P<0.001$). There was a negative association between PA level, 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 ($B=-0.027$, $P=0.02$). There was no association between PA level, and CRP and insulin when apneic 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 (#98/14303-3), CAPES

1999 Board #260 May 31 2:00 PM - 3:30 PM
Obesity, Lower Extremity Soft Tissue Pain & Physical Functioning

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(No relevant relationships reported)

Loss of physical functioning due to non-surgical lower extremity soft tissue pain (LESTP) is not well studied, but LESTP have been linked to difficulty 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 exertional symptoms, 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 Trendelenberg 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 Fischer'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 ($r^2=0.27$, $p<0.05$). **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.

2000 Board #261 May 31 2:00 PM - 3:30 PM
Special Rehabilitation Treatment of Patients with Low Back Pain

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(No relevant relationships reported)

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) (cm^2), 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 to measure postural control on a pressure mat system MatScan, before and after the rehabilitation treatment. Another dependent variable, the visual analog scale (VAS) of low back subjective pain scores (1 - pain free; 10 - unimaginable, unspeakable), was measured before and after the treatment. Data were analyzed using a Paired t-test and Wilcoxon signed-ranks test. $P < .05$.

RESULTS: The mean COF before treatment ($M = 4.89$, $SD = 0.91$) was significantly greater than the mean after treatment ($M = 2.81$, $SD = 1.77$), $t(14) = 2.14$, $p < .05$. The sway was reduced in both directions after treatment. M-L instability had larger effects on sway compared to A-P instability. The mean A-P before and after ($M = 2.95$, $SD = 1.08$) and ($M = 2.81$, $SD = 1.21$) showed only small, non-significant difference, $t(14) = 0.42$, $p > .05$; however, the mean M-L score before and after treatment ($M = 3.69$, $SD = 1.37$) and ($M = 2.71$, $SD = 1.24$) revealed significant difference, $t(14) = 2.63$, $p < .05$. VAS pain scores for pre- and post-treatment indicated significant difference ($Mdn = 5.00$) and ($Mdn = 4.00$), $z = -3.32$, $p < .01$.

CONCLUSIONS: The study revealed a significant decrease in pain and the area of COF, A-P and L-R sway components of COF. Out of all these parameters study shows that over 70% of patients with LBP improved at least in three dependent variables. The results of this study present the efficacy of IM in treatment of patients with LBP.

2001 Board #262 May 31 2:00 PM - 3:30 PM
**Exercise Effects On Health, Fitness, And
 Cardiometabolic Risk Factors Among Firefighters: A
 Meta-analysis**

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 (No relevant relationships reported)

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. **PURPOSE:** 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 increase physical activity and/or improve fitness/health, and included a validated measure of ≥ 1 biological CVD risk factor(s). Hedges' d 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 ($\Delta = 0.29$, $[0.02-0.56]$, $p \leq 0.05$, $k=12$), body composition ($\Delta = 0.34$, $[95\% \text{ CI}: 0.14-0.54]$, $p \leq 0.001$, $k=21$), body fat percentage ($\Delta = 0.53$, $[0.20-0.86]$, $p \leq 0.001$, $k=5$), strength ($\Delta = 0.33$, $[0.11-0.54]$, $p \leq 0.05$, $k=15$), and occupational fitness ($\Delta = 0.59$, $[0.20-0.99]$, $p \leq 0.05$, $k=8$). Significant, large effects were found for fitness ($\Delta = 0.85$, $[0.58-1.12]$, $p \leq 0.001$, $k=45$), aerobic capacity ($\Delta = 1.21$, $[0.47-1.95]$, $p \leq 0.001$, $k=8$), and endurance ($\Delta = 1.53$, $[0.79-2.28]$, $p \leq 0.001$, $k=11$). 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).

**D-75 Basic Science World Congress/Poster -
 Skeletal Muscle I**

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
 Room: CC-Hall B

2002 Board #263 May 31 2:00 PM - 3:30 PM
**Morphometric Parameters in Somatic and
 Branchiomeric Muscles of Mdx Mice**

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 (No relevant relationships reported)

Duchenne muscular dystrophy is a neuromuscular disorder characterized by progressive muscle degeneration. A common histological alteration in dystrophic muscle is variation in fiber size. However, muscles with somatic and branchiomeric embryological origins have different responses to muscular dystrophy. **Purpose:** To investigate morphometric parameters in somatic and branchiomeric muscle of mdx

mice, an experimental model of Duchenne muscular dystrophy. **Methods:** Male sixteen-week-old C57BL/10 (Control group; $n=5$) and C57BL/10-Dmd^{mdx} (Mdx group; $n=5$) mice (Ethical protocol number 8165240614). After euthanasia, the *gastrocnemius* (somatic muscle) and *masseter* (branchiomeric muscle) were dissected, sectioned, and stained with Hematoxylin-Eosin (H&E). Five fields from one section have been chosen and photographed with 40x objective, through computerized imaging equipment attached to a binocular microscope. The frame with area known was used to measure all cells (μm^2) in this area. Analysis of distribution frequency of the muscle fiber areas was presented in a histogram. **Results:** In *gastrocnemius* muscle, fibers areas revealed greater of heterogeneity in Mdx group when compared with Control. Mdx group showed muscle fiber area values between 70 and $3,000\mu\text{m}^2$ and Control group had a lower numerical range between 190 and $2,000\mu\text{m}^2$. Furthermore, we observed that the groups presented difference between frequency peaks of muscle fiber area. Control group presented two peaks of frequency: $500/600\mu\text{m}^2$ and $1,000/1,100\mu\text{m}^2$. In contrast, Mdx groups showed only one peak of distribution frequency between $400/600\mu\text{m}^2$. In *masseter* muscle, Control and Mdx groups had similar values between muscle fiber areas ($70-100\mu\text{m}^2$ and $2,000-2,200\mu\text{m}^2$), with the same frequency peaks in $600\mu\text{m}^2$. **Conclusion:** Morphometric parameters are different in somatic and branchiomeric muscles of mdx mice. Muscle with somatic embryological origin was most affected by variability of muscle fiber sizes than muscle with branchiomeric embryological origin.

2003 Board #264 May 31 2:00 PM - 3:30 PM
**Exercise Training Alleviates MuRF1-mediated Muscle
 Atrophy By Activating The Sirt1-AMPK Pathway In
 Diabetic (db/db) Mice**

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(No relevant relationships reported)

Nuclear factor- κ B (NF- κ B) pathway activation in conjunction with stimulated ubiquitin-proteasome pathway, especially E3 ubiquitin ligases MuRF1, leads to muscle loss in diabetes. Aerobic exercise training stimulates oxidative energy production via activation of sirtuin 1 (SIRT1) and AMP-activated protein kinase (AMPK) which could inhibit NF- κ B signaling and suppress inflammation. **PURPOSE:** The study examined the underlying mechanisms of aerobic exercise training on attenuating diabetes-related muscle loss. **METHODS:** Eight weeks moderate-intensity exercise (5m/min, 60min/day, 5days/week for a total of 8weeks) on the skeletal muscle size and transcription factors such as NF- κ B involved in regulation of MuRF1 were investigated in diabetic db/db (C57BL/KsJ-lepr^{db}/lepr^{db}) mice ($n=10$ /per group). The statistical significance of the differences between two groups was determined by independent sample t-test ($P < 0.05$). **RESULTS:** No differences in fasting glucose and serum insulin levels and the areas under the curve (AUC) of intraperitoneal glucose tolerance test were observed in db/db mice with and without exercise training. The wet weights of *gastrocnemius* (64.25 vs. 74.64 mg) and *tibialis anterior* muscles (21.56 vs. 27.14 mg) were significantly increased in db/db mice with exercise training. The average cross-sectional area of *tibialis anterior* muscle was significantly increased by 1.2-fold in db/db mice with training compared with untrained mice (676.5 vs. $830.6 \mu\text{m}^2$). Prevention of muscle loss by exercise training was associated with downregulation of MuRF1 (-44%, $P=0.014$) and K48-linked poly-ubiquitination (-24%, $P < 0.01$) in db/db mice with exercise training. Decreases in phosphorylation of I κ B α (-68%, $P = 0.015$) and NF- κ B were observed in db/db mice with training compared with untrained mice (-64%, $P = 0.017$). Upregulation of SIRT1 (+33%, $P < 0.01$) and AMPK α activity (+165%, $P = 0.015$) were observed in db/db mice with exercise training. **CONCLUSION:** Aerobic exercise training inhibits NF κ B signaling pathway via activation of the SIRT1/AMPK α pathway, thereby alleviating MuRF1-mediated muscle atrophy.

2004 Board #265 May 31 2:00 PM - 3:30 PM
**Ceramide Accumulation and Insulin Resistance During
 Hindlimb Suspension In Wheel-Running Mice Is TLR4
 Dependent**

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 (No relevant relationships reported)

Short term skeletal muscle inactivity (i.e. hospitalization, bed rest) impairs muscle size, function, and insulin sensitivity. We have suggested that muscle inflammation (TLR4 signaling) and accumulation of the bioactive sphingolipid, ceramide, are potent determinants of muscle health following inactivity periods. **Purpose:** To study specific inflammatory mediated effects on skeletal muscle of physically active mice, following 7-days of inactivity. **Methods:** In efforts to build on our recent findings and to study rapid inactivity induced changes, we provided 8-week old C57BL/6 mice access to running wheels for 5-weeks. Mice were then hindlimb suspended for 7-days (HS, $n=10$) or continued running wheel activity (Con, $n=10$) during this 7-day period. An additional group of HS mice were given daily injections of TAK242, a TLR4 specific inhibitor (HS+TAK242, $n=10$), in an attempt to protect muscle health during

7-days of inactivity. Primary outcomes were soleus-specific ceramide content, muscle Akt signaling, insulin sensitivity, and muscle size. **Results:** Muscle total ceramide abundance was greater (45%, $p<0.01$) in HS vs. Con, while TLR4 inhibition prevented ceramide accumulation during HS (HS+TAK242 vs. Con, $p=0.87$). Muscle ceramide increases during inactivity were largely driven by ceramide carbon chain lengths C16:0 & C18:0. Soleus mass declined (27%, $p<0.01$) in both HS and HS+TAK242. HOMA-IR, an estimate of peripheral insulin sensitivity, was significantly impaired (53%, $p<0.01$) in HS vs. Con, while TLR4 inhibition provided partial protection (HS+TAK242 vs. Con, $p=0.19$; HS+TAK242 vs. HS, $p=0.24$). Muscle Akt^{S473} and AS160^{S588} phosphorylation was not different across the groups. **Conclusions:** These data extend the body of evidence implicating the connection between TLR signaling, muscle ceramide accumulation, and impaired metabolic health. Follow-up analyses in other tissues (i.e. liver) are warranted, in order to understand the peripheral insulin sensitivity discrepancies compared to muscle.

Funding was provided by the NIH: R01AG050781.

2005 Board #266 May 31 2:00 PM - 3:30 PM
Muscle Activation Patterns of Lower Body Musculature Among Three Traditional Lower Body Exercises in Trained Women

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(No relevant relationships reported)

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 muscle activity of the gluteus maximus (GM) differed among exercises ($p = .01$, $\eta_p^2 = .39$). Specifically, post hoc analysis indicated greater muscle activity during the front squat ($M = 94\%$, $SD = 15\%$) compared to the deadlift ($M = 72\%$, $SD = 16\%$; $p < .05$) 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.

2006 Board #267 May 31 2:00 PM - 3:30 PM
Effect of the In Vitro Mechanical Loading of Myotubes on their Myogenic Lineage Progression

Athanasios Moustogiannis, Anastassios Philippou, Orjona Taso, Evangelos Zevalis, Michael Koutsilieris. National and Kapodistrian University of Athens, Attiki, Greece.

(No relevant relationships reported)

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 myoblasts (myotubes) on signaling and gene expression responses associated with the progression of their myogenic lineage.

METHODS: C2C12 myoblasts were cultured on elastic membranes up to the day 10 of their differentiation and then underwent a passive, cyclic stretching (2.2% elongation, at a frequency of 0.25Hz, for 12h). Cells were harvested and lysed 24 hours after the completion of the stretching protocol. Phosphorylation of signaling proteins ERK1/2 and Akt and the expression of the key myogenic factor MyoD were determined by immunoblotting of cell lysates derived from stretched and non-stretched myotubes. Real Time-PCR was utilized to measure changes in expression levels of the myogenic regulatory factors (MRFs; MyoD, Myogenin, MRF4), as well as growth (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), apoptotic (Foxo, Fuca) atrophy (Murfl, Atrogin, Myostatin) and inflammatory factors (IL-1b, IL-6, INF- γ) in response to mechanical loading of the differentiated C2C12 cells.

RESULTS: Mechanical loading of the myotubes resulted in significantly increased activation of Akt and of MyoD protein levels (422%; $p<0.05$), while no significant differences were found in ERK1/2 phosphorylation. Gene expression levels of IGF-

1 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 (FOXO: 0.7-fold, FUCA: 0.3-fold) and atrophy factors (Atrogin: 0.09-fold, Myostatin: 0.7-fold, Murfl: 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.

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(No relevant relationships reported)

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 [GC]) or empty-vector plasmids were electroporated 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 SHAM 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 OM muscles or vs both SHAM or overloaded YE and OE muscles. 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 an 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

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(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 acetylsalicylic 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 unaltered. Protein phosphorylation of p70S6K increased (24-fold, $P > 0.0005$) in response to the resistance exercise bout, with no difference across groups. Protein phosphorylation of STAT3 remained unchanged.

CONCLUSIONS: These results show that high and low doses of NSAIDs do not differentially affect exercise-induced changes in gene expression and protein signaling for key markers of muscle growth in young adults. We therefore conclude that these acute markers do not seem to explain the negative effects of high doses of NSAIDs on muscle hypertrophy.

2009 Board #270 May 31 2:00 PM - 3:30 PM

ULK2 Regulates Autophagic Cargo Recognition Impacting Contractile Function In Skeletal Muscle

Jordan D. Fuqua, Caleb Mere, Jay Bloome, Dam Bae, Vitor de Melo, Estevão Scudese, Kristen Turner, Ana Kronemberger, Christopher M. Adams, Vitor A. Lira. *University of Iowa, Iowa City, IA.*

(No relevant relationships reported)

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) ULK2tm 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 (ULK2tm, Myogenin-Cre^{+/+}; ULK2mKO) via stimulation of the fibular nerve, and compared to control littermates (ULK2tm, 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.

2010 Board #271 May 31 2:00 PM - 3:30 PM

Mathematical Modeling of Skeletal Muscle Focal Adhesion Kinase Signaling in Response to Contraction

Sida Zhao, David C. Clarke. *Simon Fraser University, Burnaby, BC, Canada.*

(No relevant relationships reported)

Force is a stimulus of resistance exercise (RE) that prompts adaptations to muscle size. Force acts at the molecular level on mechanotransducers such as focal adhesion kinase (FAK), which is a tyrosine kinase that undergoes a conformational change in response to force and subsequently activates a signaling cascade that controls the rate of protein synthesis. The dynamics by which FAK signaling transduces mechanical forces into chemical signals to induce hypertrophy are unclear.

PURPOSE:

The purpose of this study was to develop and analyze a mathematical model of the skeletal-muscle FAK signaling in response to contractions.

METHODS:

The model was expressed as a system of ordinary differential equations incorporating signaling proteins involved in the control of protein translation (the FAK/ERK1/2/TSC2 axis). Intracellular biochemical reactions were represented by mass-action or Michaelis-Menten kinetics. We constructed the model by amalgamating a published model of FAK signaling [Zhou et al. (2015) *PLoS Comput Biol*] and ERK1/2 signaling [Hatakeyama et al. (2003) *Biochem J*]. We calibrated the kinetic parameters of the Zhou et al. and Hatakeyama et al. models to reflect skeletal muscle cells.

RESULTS:

Our model outputs qualitatively agreed with published time-course data for FAK, ERK1/2, and TSC2 following the simulation of muscle force contraction profiles. Specifically, we simulated thirty contraction cycles featuring 15-pN contractions and

3 sec per contraction followed by 7 sec of rest [Ato et al. (2016) *Physiol Rep*], which led to increased ERK1/2 signaling lasting ~3.5 hrs. Parameter sensitivity analysis determined that the model was most sensitive to parameters that described the force-induced rate of conformational change for FAK. We also simulated various force inputs for the contraction protocol described above and observed that ERK1/2 signaling was responsive to forces between 8-15 pN, achieving a plateau for higher forces.

CONCLUSION:

Our model provides a working quantitative hypothesis of the dynamics of protein translational control in skeletal muscle induced by mechanical factors. Going forward we will use the model to study the effects that different RE variables (repetitions, sets, loads, rest, etc.) have on FAK signaling dynamics by simulating different contraction profiles.

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/PI3K/AKT/mTOR axis). Intracellular biochemical reactions were represented by mass-action kinetics. We constructed the model by modifying amalgamated published models of mTOR signalling [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 qualitatively agreed with published time-course data for plasma leucine, plasma insulin, and phosphorylation of Akt^{S473}, mTORC1^{S2448}, and p70S6K^{T389} 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-ketoisocaproate.

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

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 Iliopsoas Peritendinous Injection In Athletes With Iliopsoas Tendonitis

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: Iliopsoas 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 tendonitis. 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).

Two-way repeated measures analysis of variance (ANOVA) with effect size (η^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% (N154) 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) ($p=0.001$, $\eta^2=0.193$). Significant differences between normal vs. abnormal hips 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 tendonitis 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, Dai Sugimoto, Bridget Dahlberg, Lyle Micheli, FACSM, 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 23 male, age: 14.2±2.3 years, height: 158.8±9.68 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%), knee (19.5%), back (16.2%), hip (10.5%) and wrist/hand (4.3%). In male figure skaters, they were foot/ankle (27.9%), back (14.8%), knee (13.1%), hip (13.1%), pelvis (6.6%), and lower leg (6.6%). **CONCLUSIONS:** Pediatric figure skaters most commonly sustain foot/ankle (29%), knee (16.3%) and back (15.5%) 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 Kerkhof², Trent Honda², Renato Calatroni³, Gianmichel Corrado¹. 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. An unpaired 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 from the Year 2 cohort; all athletes 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, Nisha Batta¹, Montana Dunn¹, Glenda Marshall¹, Marissa Ogata¹, Phil Sundin². ¹*UCLA, Santa Monica, CA.* ²*UCLA, 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 (4.8%) 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% ($p<.001$). 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 Kussman³, Emily Krauss², Sonal Singh⁴, Megan Deakins-Roche², Brian Kim⁵, Adam Tenforde⁶, Kristin Sainani², Aurelia Nattiv, FACSM¹. ¹*University of California, Los Angeles, Los Angeles, CA.* ²*Stanford University, Stanford, CA.* ³*Stanford University, Los Angeles, CA.* ⁴*UCLA, Los Angeles, CA.* ⁵*University of California, Irvine, Irvine, CA.* ⁶*Harvard University, Boston, MA.* (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 women and men. 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-impact or multi-directional sport. For women, prior participation in high-impact sports was associated with nearly a half-standard deviation increase in total body BMD ($Z=.49$, $p=.047$); in contrast, the effect in men was small ($Z=.12$, $p=.65$). 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 (2.1-8.95, $p<0.001$) 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.

2017 Board #278 May 31 3:30 PM - 5:00 PM Effects Of A 12-week Cycling Training Program On Clinical Parameters In Patients With Parkinson Disease

Zinta Zarins¹, Gary Smith², Robert Sallis, FACSM¹. ¹Kaiser Fontana, Fontana, CA. ²Pomona College, Claremont, CA. (Sponsor: Dr. Robert Sallis, MD, FACSM)
(No relevant relationships reported)

PURPOSE: We examined the effects of endurance training [12 week, 3 days/week, 45 min/session, 60-75% of age-adjusted maximum heart rate, targeted rpm of 80-90] on change MDS-UPDRS (Unified Parkinson's Disease Rating Scale) score in patients with mild to moderate Parkinson's Disease ($n=12$, 71 ± 2.23 years, 1.5 ± 0.23 Hoehn and Yahr staging, 5.71 ± 0.62 years duration of Parkinson's Disease). We also looked at changes in body composition, resting blood pressure and heart rate, five-times sit to stand test, and timed up and go test. **METHODS:** The 12 subjects recruited for the study had an average BMI of 24.39 ± 1.13 and were weight-stable. The exercise intervention was supervised and consisted of pedaling on a stationary bike 3 days/week for 45 minutes and intensity of exercise training was gradually increased such that by the second week the subjects were exercising at 60-75% of their age-adjusted maximum heart rate and pedaling at a target rpm of 80-90. Body composition was analyzed using the InBody270. **RESULTS:** Subjects attended an average of 76.9% of the training sessions and trained at an average of 64.7% of their age-adjusted maximum heart rate and cycled at an average of 78.3 rpm. With regards to testing time, there was no significant difference in the time since the last levodopa dose. While all of the UPDRS components decreased after training, there was only a statistically significant decrease in UPDRS I (pre-training= 11.5 ± 1.31 , post-training= 9.50 ± 1.58 , $p<0.01$), UPDRS III (pre-training= 20.83 ± 4.17 , post-training= 7.91 ± 2.22 , $p<0.01$), and the total UPDRS (pre-training= 51.0 ± 7.56 , post-training= 32.4 ± 6.75 , $p<0.01$). Four of the 12 subjects in the study were unable to maintain the average target rpm goal of 80-90, but were still noted to have significant clinical improvements with training. There was no significant change in body composition, five times sit to stand, or get up and go testing. Diastolic blood pressure significantly decreased after training (pre-training= 77.08 ± 1.88 , post-training= 65.91 ± 1.85 , $p<0.01$). **CONCLUSION:** These results suggest that in patient's with mild to moderate Parkinson's Disease a cycling endurance training program 1) significantly improves the total UPDRS by 36% and UPDRS III by 62% 2) improvement in UPDRS III score was irrespective of the average rpm.

2018 Board #279 May 31 3:30 PM - 5:00 PM Play Lifestyle And Activity Assessment In Children With Cerebral Palsy

Amy Rabatin, Rebecca Zwicker, Dai Sugimoto, Eric Nohelty, Jodie Shea, Benjamin Shore, Andrea Stracciolini, FACSM. Boston Children's Hospital, Boston, MA. (Sponsor: Andrea Stracciolini, FACSM)
(No relevant relationships reported)

BACKGROUND: The World Health Organization (WHO) recommends at least 60 minutes of moderate to vigorous physical activity (MVPA) for all children 5-17 years. Exercise Deficit Disorder (EDD), defined as reduced levels of MVPA, afflicts both typically developing (TD) children and children with disability. Currently there is a lack of knowledge surrounding factors that affect physical activity in children with disability.

PURPOSE: (1) To investigate knowledge and understanding, daily behavior, and motivation/attitudes surrounding physical activity in children with cerebral palsy (CP); (2) To compare TD and CP responses to Play Lifestyle & Activity in Youth (PLAY) questionnaire.

METHODS: **Study design:** cross sectional questionnaire study. **Study subjects:** children ages 6-11 with GMFCS level I and II CP or related diagnoses, and TD children in the same age group. **Main outcome measures:** answers to selected questions from PLAY questionnaire focusing on (1) family rules regarding screen-time/media-use (knowledge and understanding), (2) status of daily physical activity (daily behavior), (3) frequency of parents driving child to sporting events (motivation and attitudes). **Statistical analyses:** simple descriptive statistics and two-sided Fisher's exact test.

RESULTS: Nine children with CP (5 males, 4 females; mean age 7.9 ± 1.4 years) and 11 TD children (4 males, 7 females; mean age 7.7 ± 1.6 years) were enrolled. All TD children (100%) had screen-time/media-use rules in the household, as compared to 89% of CP children. Almost two thirds of TD children reported 60-min of MVPA daily, as compared to less than half of the children with CP (44%, $P=.653$). A greater proportion of parents of children with CP drove their children to sporting activities for each outing versus parents of TD children (67% and 56%, respectively, $P=.545$).

CONCLUSIONS: The majority of CP and TD children in this study had screen time/media use rules in the household. Preliminary analyses found no significant differences between CP and TD children in knowledge and understanding, daily behavior, and motivation/attitudes surrounding physical activity. Continued research will strive to increase our understanding of physical activity barriers in all children.

2019 Board #280 May 31 3:30 PM - 5:00 PM The Prevalence Of NCAA Division III Athletes With Positive Depression Screening: A Retrospective Cohort Study

Mary Iaculli, DO¹, Ula Lewandowski, MS III², Elizabeth Rothe, MD³, Peter Sedgwick, MD, FACSM³. ¹Evergreen Sports Medicine Fellowship, Augusta, ME. ²Central Maine Medical Center, Lewiston, ME. ³Evergreen Sports Medicine Fellowship, Lewiston, ME. (Sponsor: Peter Sedgwick, MD, FACSM)
(No relevant relationships reported)

PURPOSE: Mental health is a growing area of concern for college athletes. A 2015 report from the NIMH estimated that 6.7% of all American adults experienced an episode of MDD within the past 12 months. Episodes were highest in college-age individuals and females. While there is currently no standardized protocol for screening student-athletes for depressive symptoms during pre-participation physical exams, it has been adopted by some. Our retrospective cohort study evaluates the prevalence of depressive symptoms in student-athletes at a division III college.

METHODS: The entire student-athlete population ($N=729$) of a single division III college was screened for depressive symptoms over the course of one year using the clinically validated questionnaires, PHQ-2 followed by PHQ-9 if positive. Screening was performed during routine pre-participation physicals for sport over a one-year period. Depression screening results were evaluated by gender, sport, class year, and time of year data was collected, and then compared to published national rates.

RESULTS: The prevalence of clinically significant depressive symptoms using the PHQ screening tools in our study was 4.1%, significantly lower than the prevalence of 23.7% cited by Wolanin et al in 2016 using CES-D screening ($z=12.45$, $p<.001$). Inconsistent with previously published data, there was no overall significant gender difference, $\chi^2=1.58$, $p=.21$. However there was a statistically significant difference in women reporting moderate to severe depressive symptoms compared to men, $\chi^2=16.36$, $p=.001$. There was no statistical difference with season of screening, $\chi^2=4.52$, $p=.61$.

CONCLUSIONS: In this sample, PHQ screening revealed depressive symptoms in less than 5% of division III student-athletes from a single school. Female college athletes reported significantly more moderate-severe depressive symptoms than males. There was no statistical difference in the time of year screening was performed. Hypothesized explanations for the differences in results obtained through our study

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.

2020 Board #281 May 31 3:30 PM - 5:00 PM
Comparison of Running Mechanics in Healthy Female Runners Versus Those with Sacroiliac Pain

Kristin E. Schwarz¹, Dai Sugimoto¹, Charles A. d'Hemecourt², Duncan A. d'Hemecourt², Pierre A. d'Hemecourt, FACSM¹.

¹Boston Children's Hospital, Boston, MA. ²The Micheli Center for Sports Injury Prevention, Waltham, MA. (Sponsor: Pierre d'Hemecourt, FACSM)

(No relevant relationships reported)

BACKGROUND: Injuries to the back, pelvis, hip, and thigh have been reported to account for 25-35% of all injuries sustained by runners. Repetitive torsional forces, shear stress, and inflammation can cause deleterious effects and pain in the sacroiliac (SI) joint. SI joint pain is more common among women, in part due to gender-related anatomic differences. Research on the gait mechanics of female runners with SI joint pain has been limited to date. **PURPOSE:** To identify running gait mechanical differences between healthy female runners and those with SI joint pain. **METHODS:** Retrospective case-control running gait video analysis was performed. Runners who had completed video gait analysis and who had been diagnosed as SI joint pain were identified by chart review. Diagnosis was made either by positive response to SI joint injection (i.e. resolution of pain after ultrasound-guided SI joint injection with a mixture of analgesic and steroid) and/or 2 or more positive physical exam provocative tests for SI joint pain. Based on the runner's age, height, mass, and BMI, matched healthy female runners were designated as control. Running mechanics at point of initial contact during the stance phase of the gait cycle were measured from side view (sagittal plane) of runners on a treadmill. Measurements included: foot strike angle, ankle angle, overstride angle, knee angle, hip angle, and trunk posture angles. Foot strike pattern (i.e. rearfoot, midfoot, or forefoot) was documented. Videos were analyzed by an experienced sports medicine physician. **RESULTS:** There were 19 female runners with SI joint pain and 63 healthy female runners in the control group. Runners with SI joint pain demonstrated significantly greater foot strike angles ($p=0.001$) than those without. Those with SI joint pain also had smaller ankle angles ($p=0.001$) than healthy runners. There were no significant differences between overstride angles, knee angles, hip angles, or trunk posture angles. There were no significant differences in foot strike patterns between the two groups. **CONCLUSIONS:** Female runners with SI joint pain demonstrated greater ankle dorsiflexion at the point of initial contact during stance phase compared to healthy runners. This suggests a potential role for gait retraining in the treatment and prevention of SI joint pain.

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

Elizabeth E. Barton - (Sponsor: Kyle J. Cassas, FACSM), Vicki R. Nelson, Irfan M. Asif. *Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greenville, SC.*

(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 denied nausea, HA, and syncope. Family history was negative for congenital heart disease and sudden cardiac death, but her mother had atrial fibrillation and MGF died before age 60 from an MI.

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, flutter, afib, PACs
2. pulmonary valve stenosis, tricuspid valve regurgitation
3. cardiomyopathy—hypertrophic cardiomyopathy, ARVD
4. ASD
5. anemia
6. hyperthyroidism

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 nsr 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

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.

2022 Board #2
Cotton Mouth In A Cross Country Runner

Jason A. Kirkbride - (Sponsor: John MacKnight, FACSM), Siobhan Statuta. *University of Virginia, Charlottesville, VA.*

(No relevant relationships reported)

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.

PHYSICAL EXAMINATION: Temp: 36.9 °C (Oral) HR: 54 beats per minute Orthostatic blood pressure: Supine: 112/72 Standing: 108/65 Weight: 61.3 kg BMI: 17.36 kg/m² GEN: No acute distress, Thin. Cachectic appearing. HEENT: Eyes prominent where conjunctiva is visible around entire iris, no thyromegaly. Tongue and uvula covered with white scrapable film, no cervical lymphadenopathy. CV: Normal S1, S2, normal rhythm. No murmurs. Bradycardic (baseline for patient). NEURO: Alert, oriented x3, speech fluent, sensation intact. PSYCH: Quiet, slower to respond compared to baseline. "Spacey," but logical thinking. No tangentiality.

DIFFERENTIAL DIAGNOSIS: Relative energy deficiency in sport Overtraining syndrome Thyroid disease Anemia Viral illness/ Mononucleosis Diabetes Mellitus Type 1 Malignancy Diabetes Insipidus

TEST AND RESULTS: Urinalysis: Color yellow, Appearance Clear, Specific Gravity 1.035, pH 6.5, Protein Neg., Glucose 3+, Ketone Moderate, Bilirubin Neg., Blood Neg., Nitrite Neg., Leukocyte esterase neg. CBC: WBC 7.3, Hgb. 16.6, Hct. 46, Plt. 268 CMP: Na 130, K+ 5.6, Cl. 88, Bicarb. 27, BUN. 39, Cr. 0.8, Glc. 870, Alk phos. 183, ALT 67, AST 35, Anion Gap 15 TSH 0.27, Free T4 0.9, Free T3 1.5 CRP 0.2 ESR 7 Ferritin 224 HIV Non-reactive Hgb. A1c 13.6

FINAL WORKING DIAGNOSIS: New onset Diabetes Mellitus Type 1 in diabetic ketoacidosis

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 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.

PHYSICAL EXAMINATION: Temp: 36.9 Celsius, BP: 140/80, HR: 90-110, RR:21-27, SpO2: 100% on RA, GEN: Responsive, staring. Pale. NAD. Photosensitive. No rigidity. Clear speech. **PSYCH:** Answers "Yup." to most questions. Occ. confused. Alert. Oriented x3. **HEENT:** PERRL, EOMI. No LAD. Neck supple. No JVD. **CARDIOPULM:** CTA B/L. S1, S2, RRR, no MRG, ABD: Soft, NT, ND, no HSM, BS+, EXT: No edema, capillary refill <2, SKIN: No rash, **NEURO:** CN II-XII testing limited, but grossly intact. Would not stick out tongue. Opens eyes on request. Normal grasp. Reflexes 2+ DTR's b/l.

DIFFERENTIAL DIAGNOSIS: Metabolic Derangement, Hyponatremia, Hypercalcemia, 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: questionable 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. Referred 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 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.

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

Differential Diagnosis:

Migraine (hemiplegic/retinal) 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. Labwork 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 transseptal 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 scheduled 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 vaulting. 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 interosseous and posterior interosseous 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 anconeus epitrochlearis muscle. MRI elbow Right: Normal MRI. **FINAL WORKING DIAGNOSIS:** Pronator syndrome bilaterally. Left arm with accessory anconeus epitrochlearis 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 fasciotomy. 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 fasciotomy. She is due to have surgery on her right arm for median nerve release and fasciotomy three weeks 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 worsening 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. **PHYSICAL EXAM:** Full and symmetric strength, sensation, and reflexes. Mild lumbar dextrosciosis. No palpable step-offs. Tenderness over right lumbar paraspinals and above right iliac crest. No tenderness over PSIS. Full, non-painful range of motion with lumbar flexion and extension. No pain with facet loading. Full, non-painful hip range of motion. Negative FABER, FADIR, and straight leg raise test bilaterally.

DIFFERENTIAL DIAGNOSIS: 1. Discogenic pain 2. Facet-mediated pain 3. Disc herniation 4. Muscular strain 5. Sacroiliac joint dysfunction 6. Intrabdominal/intrapelvic etiology 7. Neoplasm

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 dextrosciosis 2. MRI lumbar spine: -Lumbarization of S1 vertebral body -Normal disc heights and signal -Normal central canal and neural foramen size throughout lumbar spine -T1/T2 hyperintensity within S2 vertebral body, likely lipoma -Increased T2 signal medial to right kidney suggestive of hydronephrosis

3. Renal ultrasound: -Moderate right hydronephrosis 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 Dietl's crisis

TREATMENT AND OUTCOMES: 1. Referral to urology 2. Resolution of pain and improvement in renal function after pyeloplasty

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 Hryvniak. *University of Virginia, Charlottesville, VA.*
(No relevant relationships reported)

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 arch 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 bursitis
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 tramcinolone/0.5% bupivacaine - 5 months of relief.

US guided hydrodissection saphenous nerve - Full resolution for 1.5 years.

Patient 2:

US guided hydrodissection saphenous nerve - 6 months of relief.

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.

(No relevant relationships reported)

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 cerebrum 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 ($Ave = 23.8 \pm 9.1g$). 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 in word 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.*

(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.

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 relevant relationships reported)

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 non-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 (ACL-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 \pm SD; Wk0: $53 \pm 18\%$, Wk4: $67 \pm 15\%$, Wk8: $76 \pm 16\%$; $p < 0.001$). Treatment benefits were maintained over the retention period (Wk16: $81 \pm 15\%$; $p = 0.052$). 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 reinjury. 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

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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. On 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 6.67%. **CONCLUSION:** Our preliminary results suggest that a HMW VS hip injection for degenerative OA, when compared to true placebo, may lead to long-term improvements in pain relief, increase in function and in activity participation. NIH Clinical Trials Registry: NCT02086474

2030c Board #12

Lisa S. Krivickas Clinician/Scholar Travel Award - The Prevalence of Hypertension in a Population of Former Professional Football Players

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(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 these 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 men had high blood pressure at screening.