

## EFFECTS OF DIFFERENT BI-ACROMIAL HAND WIDTHS ON PLYOMETRIC PUSH-UP PERFORMANCE

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**PURPOSE:** The purpose of this study was to investigate the effects of different hand widths during the performance of plyometric push-ups. **METHODS:** Ten male participants (Age:  $24.14 \pm 2.79$  years, Height:  $178.14 \pm 5.21$  cm, Weight:  $91.55 \pm 6.04$  kg) with a minimum of 6 months resistance training and no upper body injuries within the previous 6 months performed 2 plyometric pushups at 3 different hand widths, respectively. Hand widths for each participant were determined as being 120%, 150% and 170% of the individual's bi-acromial width. Height (H), peak force (pF), peak power (pP), and rate of power development (RPD) data were collected utilizing a force plate (AccuPower; AMTI, Watertown, NY, USA). **RESULTS:** One-way repeated measures ANOVA showed no significant differences in performance measures across all hand widths. Secondary analysis using a mixed effects linear regression model was performed to account for the variability in participants' height, weight, and body mass. Regression analysis showed a significant difference in pF ( $p < .05$ ) between 120% and 170% hand widths. **CONCLUSION:** Study results suggest that although upper body power output appears to be similar across varying hand widths; upper body force development (pF) may be significantly affected by hand width during the plyometric push-up. To the authors' knowledge this may be the first study to investigate the effects of varying hand widths on plyometric push-up performance.

*Keywords:* peak power, force plate, peak force, upper body power

## EFFECT OF A RESPIRATORY TRAINING MASK ON HEALTHY, YOUNG ADULTS AT REST AND DURING EXERCISE

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Training at altitude has proven to be an effective training method when attempting to increase an athlete's aerobic capacity. Respiratory training masks (RTM's), or "altitude training masks", are routinely used to aid in the training of aerobic exercise performance. The current claim is that the RTM creates an atmosphere similar to training at altitude by restricting ambient airflow to the athlete. **PURPOSE:** The purpose of this study was to examine the effect that wearing an RTM had on physically fit young adults both at rest and during submaximal aerobic exercise. **METHODS:** Seven men and two women completed the study, the average age of all participants was  $21 \pm 1$  yrs, (men; mass:  $82 \pm 3$  kg, and height:  $177 \pm 2$  cm, women; mass:  $63 \pm 4$  kg, and height:  $165 \pm 0$  cm) and all participants met the ACSM standards for a "good" or better VO<sub>2</sub>max (men;  $51.52 \pm 4.69$  ml/kg/min, and women;  $42.93 \pm 1.36$  ml/kg/min). Participants had their respiratory data measured via the metabolic cart at rest and then during a 10 minute exercise session performed at 50% of their VO<sub>2</sub>peak. Participants performed the test twice, once with the RTM and once with a standard non-restrictive control mask (CM). The RTM was set to the lowest altitude setting for this experiment (~6,000 ft.). **RESULTS:** While wearing the RTM, participants experienced decreases in mean respiratory rate (CM:  $23.66 \pm 3.46$  breaths/min, RTM:  $20.31 \pm 4.37$  breaths/min), and mean FeO<sub>2</sub> (CM:  $15.74 \pm 0.49\%$ , RTM:  $15.24 \pm 0.69\%$ ). At the same time, the RTM created an increase in mean FeCO<sub>2</sub> (CM:  $4.53 \pm 0.44\%$ , RTM:  $4.92 \pm 0.50\%$ ). Decreases in VE/VO<sub>2</sub> (CM:  $23.45 \pm 2.39$  L/min, RTM:  $21.47 \pm 2.98$  L/min) and VE/VCO<sub>2</sub> (CM:  $27.97 \pm 2.85$  L/min, RTM:  $25.71 \pm 3.12$  L/min) were also observed. **CONCLUSIONS:** The reduction in respiratory rate with the RTM equipped suggests the possibility of increased work from the inspiratory muscles. The changes in FeO<sub>2</sub> and FeCO<sub>2</sub> show probable rebreathing of CO<sub>2</sub> from the RTM's dead space. However, the decrease in factors related to breathing efficiency (VE/VO<sub>2</sub> and VE/VCO<sub>2</sub> ratios) indicate that breathing efficiency is actually increased with the RTM.

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## ESTIMATING ENERGY EXPENDITURE FROM DEVICE-DETERMINED CADENCES

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While steps/day provides a measure of physical activity (PA) volume, cadence (steps/min) describes PA intensity, a critical contributor to PA health outcomes. Determining cadence-based energy expenditure (metabolic equivalents (METs); where 1 MET = 3.5 mL O<sub>2</sub>/kg/min) equations may provide support for PA intensity recommendations. **PURPOSE:** To estimate associations between METs and device-determined cadences in 21-60 year-old adults. **METHODS:** 160 adults (50% women; age=40.2±11.7 years; BMI=25.4± 3.7 kg/m<sup>2</sup>) completed simulated activities of daily living (ADLs, including: seated rest, seated/watching a movie, seated/typing at a computer, standing/folding laundry, vacuuming, self-paced stepping, and self-paced walking) in a laboratory setting. Participants also walked on a treadmill (TM) for 5-min bouts at speeds increasing from 0.5 to 5.0 mph in 0.5 mph increments until 75% age-predicted heart rate maximum was reached, the participant naturally transitioned to running, or reported a Borg rating of perceived exertion > 13. Cadence was measured across all conditions with a hip-worn triaxial accelerometer (ActiGraph GT9x). METs were measured using a portable indirect calorimeter. Cadence was derived from device-specific software and analyzed in MATLAB R2017b. Standard MET cut points (Table 1) were used for sedentary (SED), light (LPA), moderate (MPA), and vigorous (VPA) intensity classifications. The association between cadence and METs was analyzed as a continuous outcome using a Random Forest (RF) algorithm and the root-mean-square-error (RMSE) was used to evaluate model accuracy. **RESULTS:** Device-determined cadences for each activity intensity are presented in Table 1. The RF model estimated METs from cadence with an RMSE of 0.9METs.

**CONCLUSION:** METs were accurately estimated from hip-worn accelerometers across low, moderate, and vigorous intensity activities. Cadence data collected from wearable devices can be used to estimate energy expenditure in adults with an error of 0.9METs.

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## EFFECT OF MARATHON RUNNING ON CARDIAC BIOMARKERS AND CORE BODY TEMPERATURE

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**PURPOSE:** The purpose of this study was to observe specific measures which may be associated with cardiac stress in marathon runners including; sustained heart rate, core body temperature, weight loss and cardiac serum markers. **METHODS:** Twenty-three healthy individuals (eleven males and twelve females, ages 22-63 years old) were recruited to run the 2017 Hartford Marathon. Serum cardiac markers, including BNP and Troponin, and body weight were measured 20 hours prior to the race, immediately post-race and 20 hours post-race. Prior to race start, participants were outfitted with a Zephyr monitoring unit, secured around the chest, which collected an estimated core body temperature and average heart rate throughout the race. ANOVAs were performed to look for changes between variables pre and post-race. Pearson correlations were performed to look for associations between elevated cardiac biomarkers and body temperature, weight loss and race pace. **RESULTS:** 22 subjects finished the marathon with an average time of 4:28:45 (3:04:53, 5:51:07). BNP and troponin significantly increased pre-race to post-race by an average of 92.00 pg/mL (0, 257) and 0.04 ng/mL (0, 0.126), respectively ( $p < 0.05$ ). The average peak core body temperature and weight loss pre to post-race were 102.6 (101.5, 104.4) and 4.48lbs (0.4, 11.2) respectively ( $p < 0.05$ ). On average subjects ran at 88.59% (73.44, 100.63) of their age adjusted max HR across the duration of the race. There was a negative correlation between average race-pace and troponin ( $R = -0.432$ ,  $p = 0.04$ ), indicating higher troponin levels with a faster pace. Maximum body temperature was associated with increased troponin ( $R = 0.468$ ,  $p = 0.024$ ) levels, indicating more damage with increased internal body temperature. **CONCLUSION:** Significant elevations in body temperature, HR and weight loss were observed with marathon running. A faster pace and higher body temperature were associated with elevated troponin. Since troponin is a biomarker of myocardial damage, these results help to inform risks associated with cardiac damage during and after a marathon.

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## DIFFERING INDIVIDUAL PAP RESPONSES IN THE JUMP SQUAT AND BENCH THROW EXERCISES

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Post Activation Potentiation (PAP) has been explored in various literature, but the relationship between upper and lower body PAP has yet to be fully elucidated. **PURPOSE:** The purpose of this study was to determine if PAP response of the jump squat (JS) after a back squat (BS) and the bench throw (BT) after a bench press (BP) were related. A secondary objective was to assess the relationship between regional strength PAP response.

**METHODS:** Fifteen resistance-trained participants ( $n=15$ ) took part in one-repetition maximum (1RM) testing for the BS ( $1.79 \pm 0.26$  body mass) and BP ( $1.37 \pm 0.19$  body mass) and PAP testing on separate days. During PAP testing, changes in JS and BT kinematics (concentric displacement and velocity) and kinetics (peak force and power) were compared after BS or BP using force platform data respectively. **RESULTS:** In the JS, jump height ( $\Delta-13.16\%$ ,  $p=0.002$ ) and concentric jump power ( $\Delta-4.96\%$ ,  $p = 0.036$ ) significantly decreased while in the BT peak ground reaction force increased ( $\Delta12.15\%$ ,  $p=0.016$ ). BS-1RM was a significant positive predictor of changes in JS displacement after the CA accounting for 27.6% of the observed variation ( $JS\text{-displacement} = 0.001341 \cdot BS\text{-1RM} - 0.2763$ ,  $p = 0.044$ ). Changes in BT and JS displacement were not significantly related ( $p=0.970$ ). **CONCLUSION:** Our results suggest that occurrences of PAP in the upper and lower body are independent of one another, and that optimal protocols to elicit PAP may differ by body region.

## EFFECTS OF 3D MULTIPLE OBJECT TRACKING ON HEAD IMPACTS DURING A COLLEGIATE ICE HOCKEY SEASON

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Player-to-player contact is the most frequent head impact mechanism in collegiate ice hockey. Training with three-dimensional multiple object tracking (3D-MOT) could potentially reduce the quantity and severity of head impacts by enhancing player anticipation of these impacts.

**PURPOSE:** The purpose of this study was to utilize 3D-MOT training as a tool to reduce the quantity and severity of head impacts in NCAA Division III men's and women's ice hockey players. **METHODS:** Collegiate men's and women's ice hockey players ( $N = 33$ ; men = 17, women = 16) were randomly assigned to a 3D-MOT group (3D-MOT = 17) or control group (C = 16). 3D-MOT training occurred twice per week for 12 weeks throughout one regular season. Quantity, location, linear acceleration, and rotational velocity of head impacts were measured in practices and games. Independent samples t-tests compared peak linear acceleration and peak rotational velocity between groups. Pearson chi square analysis compared the quantity of impacts between groups. Independent groups ANOVAs compared peak linear acceleration and peak rotational velocity of impacts between player positions and peak linear acceleration and peak rotational velocity at five different helmet locations between groups. **RESULTS:** 3D-MOT forwards sustained head impacts with greater mean peak linear acceleration (3D-MOT =  $41.33 + 28.54\text{g}$ ; C =  $38.03 + 24.30\text{g}$ ) and mean peak rotational velocity (3D-MOT =  $13.59 + 8.18 \text{ rad.sec}^{-1}$ ; C =  $12.47 + 7.69 \text{ rad.sec}^{-1}$ ) in games, and greater mean peak rotational velocity in practices versus control forwards (3D-MOT =  $11.96 + 6.77 \text{ rad.sec}^{-1}$ ; C =  $10.22 + 6.95 \text{ rad.sec}^{-1}$ ).

Conversely, 3D-MOT defensemen sustained fewer in-game head impacts (3D-MOT = 181 head impacts; C = 282 head impacts) and head impacts with a mean peak rotational velocity less than control defensemen (3D-MOT =  $11.54 + 6.76 \text{ rad.sec}^{-1}$ ; C =  $13.65 + 8.43 \text{ rad.sec}^{-1}$ ). There was no significant difference for all other parameters analyzed between 3D-MOT and control groups.

**CONCLUSION:** 3D-MOT training reduced the quantity and severity of head impacts for defensemen in games, but not for forwards. Player position may play an important role in future interventions to reduce quantity and severity of head impacts in collegiate ice hockey.

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**INFLUENCE OF LOWER EXTREMITY STRENGTH ON CHAIR RISE FUNCTIONAL DEMAND IN OLDER FEMALE CANCER SURVIVORS**

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Functional demand (FD) is the ratio of the muscular force required by a physical task to the maximal force capacity of the muscle, which is elevated in older individuals. Measuring FD in older adult cancer survivors (CS) can determine whether chair rise (CR), and other tasks, are more exhaustive for CS than healthy older adults (NC). **PURPOSE:** The purpose of this experiment was to quantify the differences in hip (HE) and knee extension (KE) strength, and FD during CR, between NC and CS. **METHODS:** Eleven NC (65.9+6.6 yr, 75.4+26.9 kg, 1.60+0.04 m, 29.5+10.8 kg·m<sup>-2</sup>) and nine CS (57.1+6.6 yr, 75.5+23.1 kg, 1.68+0.07 m, 27.0+9.2 kg·m<sup>-2</sup>) performed 3 maximal isokinetic contractions on a dynamometer at 30 deg·s<sup>-1</sup> to measure peak HE and KE strength. Retroreflective markers were placed on the lower extremity using the Helen Hayes model and a 3D video motion capture system and an in-ground force plate were used to record kinematic and kinetic data during CR. The HE and KE moments during CR were calculated by inverse dynamics using Visual3D software; FD was calculated as the ratio of joint moment during CR to available strength and expressed as a percentage. Analysis of Covariance was used to compare NC and CS with age and BMI as covariates. Data are reported as estimated population means (95% CI) adjusted for age and BMI. **RESULTS:** Peak KE strength was 1.20 Nm·kg<sup>-1</sup> in CS (0.84-1.56 Nm·kg<sup>-1</sup>) and 1.67 Nm·kg<sup>-1</sup> in NC (1.36-1.99 nm·kg<sup>-1</sup>, p=0.082). Peak HE strength was 2.12 Nm·kg<sup>-1</sup> in CS (1.59-2.64 Nm·kg<sup>-1</sup>) and 3.01 Nm·kg<sup>-1</sup> in NC (2.55-3.46 Nm·kg<sup>-1</sup>, p=0.029). Peak knee FD was 131% in CS (92-171%) and 51% in NC (17-86%, p=0.012). Peak hip FD was 78% in CS (28-128%) and 41% in NC (-2, 85%, p=0.31). **CONCLUSIONS:** Older female CS had poor HE and KE strength, and greater FD during CR, which may help explain the greater fall risk and mobility limitation observed in this at-risk clinical population. Resistance training exercise should be incorporated in cancer rehabilitation programs to increase strength and functional reserve capacity.

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## THE EFFECT OF A RESPIRATORY TRAINING MASK ON RESPIRATORY SINUS ARRHYTHMIA.

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Respiratory training masks (RTM) are typically worn by athletes to obtain physiological adaptations similar to those produced from high altitude. Previous studies have suggested that RTM potentially alter breathing mechanics and CO<sub>2</sub> concentrations within the mask. No current studies have examined the effects of a RTM on heart rate variability, which could be influenced by CO<sub>2</sub> or altered breathing. **PURPOSE:** The purpose of this study was to determine if a RTM influences heart rate variability through respiratory sinus arrhythmia (RSA). **METHODS:** Sixteen healthy young adults completed the study, however only nine participants (seven men, two women; age=20±2 yrs.; mass=77.8±11.7 kg; height=174.1±7.9 cm) had adequate breathing recordings and are presented herein. Using a randomized cross-over study design, participants completed two study visits wearing either a control mask (CON; 7450 Hans Rudolph V2 Mask) or a RTM (Training Mask 2.0® set to 6,000 feet) separated by 4-10 days. Resting heart rate variability and RSA were measured during three minutes of quiet rest at baseline (Base) and while wearing each mask. **RESULTS:** RTM and CON masks significantly increased mean RSA magnitude from baseline (CON: Base = 169.7±28.9 to Mask = 200.6±27.5ms; RTM: Base = 131.8±17.7 to Mask = 179.2±25.3ms), but was not different between conditions. The maximum R-R intervals significantly increased from baseline (CON: Base = 1089.5±66.9 to Mask = 1108.6±68.8ms; RTM: Base = 1066.2±63.9 to Mask = 1083.1±73.8ms), but not between conditions. Interestingly, there was no change breathing rate under either condition (CON: Base = 13.5±1.9 to Mask = 13.2±2.2 bpm; RTM: Base = 12.5±1.4 to Mask = 13.2±1.4 bpm). Both masks produced reductions in normalized low frequency heart rate variability (CON: Base = 41.6±6.5 to Mask 36.1±7.5 Hz; RTM: Base = 36.1±5.2, Mask = 25.7±3.6 Hz), but no difference in normalized high frequency heart rate variability (CON: Base = 56.7±6.3 to Mask = 58.0±6.7 Hz; RTM: Base = 61.8±4.9 to Mask = 71.0±3.5 Hz). **CONCLUSION:** The findings of the present study report that a RTM (set to 6,000ft) does not influence resting heart rate variability or RSA at rest.

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**PELVIC AND CORE STRENGTH TRAINING IMPROVES PELVIC POSTURE, HAMSTRINGS-TO-QUADRICEPS RATIO, AND VERTICAL JUMP PERFORMANCE**


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Poor pelvic posture demonstrated through anterior pelvic tilt have been known to produce musculoskeletal imbalances involving muscular weakness of the abdominal and pelvic regions. While stretching and massage techniques have been reported to be effective in alleviating anterior pelvic tilt, it remains unclear if similar improvements can be elicited by pelvic and core strength training. **PURPOSE:** To examine the effect of an 8-week pelvic and core strengthening program on anterior pelvic tilt (APT), hamstrings-to-quadriceps (H:Q) strength ratio, and vertical jump performance in healthy individuals. **METHODS:** Nine healthy males (age=27.11±12.15 years; mass=82.78±8.84 kg; height=178.76±8.07 cm) performed resistance training (2x/week; 30-40 min) involving a combination of abdominal and hip extensors strengthening exercises for 8 weeks. APT (°), vertical jump height (m), vertical jump power (W), and H:Q ratio at 60 °/s, 180 °/s, and 300 °/s were assessed prior to and following the 8-week pelvic and core strengthening program. Effect sizes (ES) were calculated for all analyses and ES magnitudes of < 0.50, 0.50-1.0, and > 1.0, were interpreted as small, medium, and large effects, respectively. **RESULTS:** APT was significantly decreased, and vertical jump height and the H:Q ratio at the angular velocity of 300 °/s were significantly increased, following 8 weeks of pelvic and core strength training (all  $p < 0.05$ , Table 1). **CONCLUSION:** These results demonstrate that 8 weeks of resistance training emphasizing pelvic and core strengthening was effective in reducing anterior pelvic tilt, improve vertical jump performance and H:Q ratio. To the best of my knowledge, this is the first report of a significant improvement in pelvic posture following 8 weeks of pelvic and core strength training. Our findings have potential implications for clinicians prescribing resistance exercises to improve pelvic posture in patient populations with musculoskeletal imbalances, and for injury prevention and maintenance of postural equilibrium in healthy individuals.

**Table 1.** Pre- versus post-training anterior pelvic tilt (APT), vertical jump performance, and hamstrings-to-quadriceps ratio values following 8 weeks of pelvic and core strength training. Data presented as mean $\pm$ SD.

	Pre-training	Post-training	%Δ	P	ES
APT (°)	14.9±3.2	8.6±3.5*	42	0.0005	1.95
Vertical jump power (kW)	4.45±8.76	4.56±1.02	2	0.18	0.12
Vertical jump height (m)	0.457±0.099	0.493±0.090*	8	0.004	0.36
H:Q ratio @ 60 °/s	0.49±0.07	0.56±0.12	14	0.06	0.92
H:Q ratio @ 180 °/s	0.50±0.15	0.57±0.12	15	0.06	0.49
H:Q ratio @ 300 °/s	0.51±0.13	0.60±0.13*	18	0.04	0.70

\*Significantly different compared to pre-training ( $P<0.05$ ).

## ACUTE HEAVY RESISTANCE EXERCISE PROTOCOL INDUCES SIGNIFICANT PHYSIOLOGICAL STRESS ELEVATING EXTRACELLULAR HEAT SHOCK PROTEIN.

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Cytoprotective protein HSP70 is important in recovery from stress and exercise, but has not been well-characterized in response to muscle damaging resistance exercise protocols.

**PURPOSE:** To characterize the physiological response to a high stress acute heavy resistance exercise protocol (AHREP) in blood biomarkers including extracellular HSP70 (eHSP70). **METHODS:** Healthy, resistance-trained men ( $n = 10$ ,  $24 \pm 4.5$  years,  $176.8 \pm 5.5$  cm,  $84.65 \pm 12.78$  kg,  $17.6 \pm 6.3\%$  body fat,  $145 \pm 18$  kg 1RM) completed an AHREP (6x10RM). Blood samples were collected pre-exercise (PRE), immediately post (IP), and at 15, 30, 60, 120 minutes (min) and 24, 48 ,72 hours (h) post-exercise. Samples were analyzed for stress biomarkers including lactate, creatine kinase (CK), complete blood count, cytokines, and eHSP70. The results were analyzed with a rANOVA and post hoc t tests. **RESULTS:** Plasma lactate was elevated 12 fold (vs. PRE  $0.880 \pm 0.296$  mmol·L<sup>-1</sup>) immediately after the AHREP ( $12.15 \pm 3.19$ ) and remained elevated (vs. PRE,  $p \leq 0.0002$ ) at 120 min. Muscle damage was demonstrated by significantly ( $p < 0.01$ ) elevated CK (vs. PRE  $126 \pm 29$  IU·L<sup>-1</sup>) at 24h post-exercise ( $439 \pm 151$ ). CBC indicated changes in leukocyte populations that were coincident with post-exercise increases ( $p < 0.05$ ) in chemoattract cytokine IL-8 (PRE  $4.77 \pm 2.73\%$ , IP  $6.38 \pm 3.53$ ). eHSP70 levels were increased ( $p < 0.05$ , vs. PRE  $0.391 \pm 0.244$  ng·mL<sup>-1</sup>) at IP ( $0.567 \pm 0.366$ ) and 15 min post-exercise ( $0.515 \pm 0.345$ ). **CONCLUSIONS:** The AHREP caused significant physiological stress that coincided with increases in circulating eHSP70 that returned to baseline levels within minutes post-exercise. eHSP70 likely responds with different kinetics during resistance exercise than as has been well-characterized during aerobic exercise.

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## EFFECTS OF AN ACUTE PHYSICAL ACTIVITY INTERVENTION ON CLASSROOM BEHAVIOR IN OFF-TASK PRESCHOOLERS

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Growing evidence suggests that physical activity (PA) may be one way to improve classroom behavior in elementary school-age children. More specifically, studies have demonstrated that the most off-task children may exhibit greater benefit from acute bouts of PA. However, limited data exists in preschoolers. **PURPOSE:** The purpose of this study was 1) to examine baseline relationships between PA and classroom behavior, and 2) to identify if the most off-task preschoolers at baseline responded differently to PA compared to the least off-task preschoolers. **METHODS:** Participants ( $n=31$ , age= $3.8\pm0.8$  years, 61% male) attended preschool at a university-based early learning center. During week one of this two-week pilot study, children engaged in their typical curriculum activities. Week two included daily 10-minute bouts of PA that were integrated into Massachusetts early learning standards. Preschool day PA was assessed utilizing accelerometers, which were worn on the lower back for all hours of preschool attendance. Trained researchers conducted weekly 10-minute classroom observations to quantify children's classroom behavior [active engaged time, (AET); passive engaged time, (PET); off-task motor, (OFT-M); off-task verbal, (OFT-V); off-task passive, (OFT-P)] using the Behavioral Observation of Students in Schools (BOSS) tool. Spearman correlations were utilized to examine baseline relationships between PA and classroom behavior variables. To examine if children with high levels of off-task behavior (HIGH) responded differently to PA compared to children with low levels of off-task behavior (LOW), participants were categorized into tertiles based on total baseline off-task behavior and groups were compared using *t*-tests. **RESULTS:** A significant negative correlation was observed between light intensity activity (min/day) and AET at baseline ( $r=-0.44$ ,  $p=0.02$ ). No other significant relationships were observed. However, when change in classroom behavior following PA among the most off-task children was examined, improvements were observed in OFT-M (HIGH= $-36.5\pm5.4\%$ , LOW= $10.5\pm5.7\%$ ;  $p=0.0001$ ), OFT-V (HIGH= $-16.7\pm2.8\%$ , LOW= $5.7\pm3.3\%$ ;  $p=0.0004$ ), and OFT-P behaviors (HIGH= $-19.6\pm7.6\%$ , LOW= $12.0\pm7.1\%$ ;  $p=0.01$ ). **CONCLUSION:** Preliminary evidence for PA to improve classroom behavior among children who exhibited greater levels of off-task behavior was observed in this sample, which is consistent with previous findings. Future studies should build on this acute observation and examine chronic PA as a strategy to limit classroom off-task behaviors.

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## CORE TEMPERATURE RESPONSES TO MILITARY LOAD CARRIAGE OVER COMPLEX TERRAIN

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Soldiers are at risk of heat injuries when working in encapsulating clothing and/or hot and humid environments. A relatively unexplored area is the added thermal burden of walking over undulating terrain carrying a heavy load. **PURPOSE:** Compare core body temperatures of Soldiers marching over varied terrain while carrying two different loads. **METHODS:** Eight active duty military personnel, (7 males, 1 female; age,  $20 \pm 2$  yr.; height,  $173 \pm 8$  cm; body mass,  $85 \pm 13$  kg) carried a fighting load (30% body mass) and an approach load (45% body mass) for two self-paced laps around a 2.5 km trail on separate test days. Core body temperatures were monitored continuously and recorded minute-by-minute using ingestible temperature pills (Jonah™ Core Temperature Pill, Resironics, Bend, OR). **RESULTS:** Peak core body temperature was significantly higher during approach load carriage versus fighting load carriage for Lap 1 ( $0.28 \pm 0.14^\circ\text{C}$ ) and Lap 2 ( $0.36 \pm 0.24^\circ\text{C}$ ) ( $p < 0.05$ ). **CONCLUSION:** Warfighters have higher heat strain when carrying heavy approach loads over complex terrain.

**DISCLAIMER:** The views expressed in this paper are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the US Government.

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## THE EFFECTS OF FITNESS ON THE RELATIONSHIP BETWEEN MENOPAUSAL HORMONES AND LIPIDS IN MIDLIFE WOMEN

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Midlife women experience adverse changes in plasma lipids and cardiovascular disease (CVD) risk, in part due to the fluctuations in hormones associated with the menopausal transition. It is unclear whether habitual exercise and cardiorespiratory fitness have an effect on the relationship between cholesterol profile, follicle stimulating hormone (FSH), and estradiol (E2). **PURPOSE:** To evaluate the relationship between cholesterol profile, FSH, and E2 in midlife women with disparate levels of fitness.

**METHODS:** Healthy peri- and postmenopausal women, ages 44–65 (56±1) with high (HIGH, ≥80<sup>th</sup> percentile of VO<sub>2</sub> peak, n=25) and low cardiorespiratory fitness (LOW, ~40<sup>th</sup> percentile of VO<sub>2</sub> peak, n=15) participated. Cardiorespiratory fitness was assessed via treadmill VO<sub>2max</sub> test. Sedentary time and time in moderate to vigorous physical activity (MVPA) were assessed via the International Physical Activity Questionnaire. Plasma lipids (high-density lipoprotein, HDL; low-density lipoprotein, LDL; and triglycerides, TG) were measured in all participants. FSH, and E2 were measured via ELISA. Data were analyzed for normality and other assumptions for statistical tests, and transformed when appropriate. Correlation analyses were performed to evaluate relationships between lipids and hormones on the entire group, and by fitness level. Stepwise linear regressions were used to determine the main predictors of HDL, LDL, and TG in groups combined. **RESULTS:** There were significant relationships between FSH and age ( $r=0.402$ ,  $p=0.012$ ), FSH and estradiol ( $r=-0.507$ ,  $p=0.001$ ), and FSH and HDL ( $r=0.460$ ,  $p=0.004$ ) with fitness groups combined. When separated by fitness, HIGH had significant relationships between FSH and estradiol ( $r=-0.549$ ,  $p=0.005$ ), FSH and HDL ( $r=0.548$ ,  $p=0.005$ ), and estradiol and HDL ( $r=-0.494$ ,  $p=0.012$ ). Conversely, there was only a significant relationship between FSH and estradiol ( $r=-0.578$ ,  $p=0.039$ ) in LOW women. Regression analyses revealed that FSH predicted 19% of the variance in HDL ( $R^2=0.212$ ,  $F(1,36)=9.681$ ,  $p=0.004$ ). Sedentary time predicted 10% of the variation in TG ( $R^2=0.124$ ,  $F(1,36)=5.108$ ,  $p=0.03$ ). Age predicted 10.5% of the variance in LDL ( $R^2=0.129$ ,  $F(1,36)=5.347$ ,  $p=0.027$ ). **CONCLUSION:** These data suggest that the relationships between menopausal hormones and lipids in peri- and postmenopausal women are associated in part with cardiorespiratory fitness and sedentary time.

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**THE AMBULATORY BLOOD PRESSURE AND HEART RATE VARIABILITY  
RESPONSES AMONG FIREFIGHTERS FOLLOWING SUDDEN VIGOROUS PHYSICAL  
EXERTION**

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We have shown that a bout of vigorous physical exertion evokes BP reductions of 5-12 mmHg that persist for the remainder of the day, termed *postexercise hypotension* (PEH). Firefighters experience a disproportionately high amount of cardiovascular disease (CVD) and its associated major risk factors, including hypertension. Surprisingly, PEH has not been studied among career firefighters.

**METHODS:** Firefighters (n=5) performed non-exercise control (CONTROL) and GEST followed by attachment to an ABP and HRV monitor for 19hr. Systolic (ASBP) and diastolic (ADBP) ABP, and low (LF) and high (HF) frequency were recorded at hourly intervals over awake (11hr), sleep (8hr), and 19hr. **RESULTS:** Firefighters (n=5 men) were middle-aged ( $40.6 \pm 6.2$ yr) and overweight ( $28.1 \pm 3.9$ kg.m<sup>-2</sup>) men with high BP ( $126.4 \pm 9.5$ / $85.6 \pm 5.9$ mmHg) and normal resting HR ( $71.1 \pm 11.2$ bpm). Compared to CONTROL, ASBP increased over awake ( $26.0 \pm 4.9$ mmHg, p=0.006), sleep ( $13.1 \pm 4.5$ mmHg, p=0.042), and 19hr ( $20.6 \pm 4.1$ mmHg, p=0.008). Compared to CONTROL, ADBP tended to increase over awake ( $8.8 \pm 3.9$  mmHg, p=0.091), sleep ( $8.2 \pm 4.3$ mmHg, p=0.134), and 19hr ( $8.6 \pm 3.5$ mmHg, p=0.072). Compared to CONTROL, LF/HF increased over awake ( $1.9 \pm 0.5$ , p=0.015), and tended to increase over 19hr ( $0.8 \pm 0.5$  p=0.155). LF/HF explained up to 84.5% of the variance in the SBP response over 19hr ( $r^2 = 0.92$ , p=0.013) and 59.3% of the variance in the DBP response over awake ( $r^2 = 0.77$ , p=0.064). **CONCLUSION:** Sudden vigorous exertion evoked *postexercise hypertension* as opposed to PEH among firefighters with elevated BP. Reasons for these unexpected findings are not clear but may reside in a compensatory baroreflex response to sympathetic predominance (i.e., higher LF/HF) due to either increased sympathetic or decreased parasympathetic modulation.

## CONTRIBUTIONS TO FREE-LIVING ACCELEROMETER CALIBRATION: A NOVEL DIRECT OBSERVATION SYSTEM

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Models for estimating physical activity (PA) and sedentary behavior (SB) using wearable accelerometers are generally calibrated in laboratory settings. Estimates from these models are compromised when applied to free-living (FL) data. Calibration of models in FL settings will improve model estimates, but criterion measures from direct observation (DO) have not been developed. **PURPOSE:** Develop a DO system as a criterion measure for FL model calibration. **METHODS:** Ten participants (age:  $19.4 \pm 0.8$  years) were video-recorded during four, 1-hour FL sessions in different settings: 1) school, 2) home, 3) community and 4) exercise/activity. For each setting, 10-minute clips from three, randomly selected sessions were extracted and coded by a criterion coder and research assistants using the Observer XT software (Noldus, Wageningen, the Netherlands). The coder defines each whole-body movement (body position, movement pattern), which is further described with three modifiers: 1) locomotion, 2) activity type and, 3) MET value. Percent agreement was calculated for intra- and inter-rater reliability. For intra-rater reliability, the criterion coder coded all 12 clips twice, separated by at least one week between coding sessions. For inter-rater reliability, coded clips by research assistants were compared to the criterion coder. Intraclass correlations (ICCs) were calculated to assess agreement of intensity category for intra-rater and inter-rater comparisons described above. **RESULTS:** For intra-rater reliability, mean percent agreement ranged from  $91.9 \pm 3.9\%$  to  $100.0 \pm 0.0\%$  across all variables in all settings. For inter-rater reliability, mean percent agreement ranged from  $88.2 \pm 3.5\%$  to  $100.0 \pm 0.0\%$  across all variables in all settings. ICCs for intensity category ranged from 0.74-1.00 and 0.81-1.00 for intra- and inter-rater comparisons, respectively. **CONCLUSION:** The DO system is reliable and feasible to serve as a criterion measure for model building from FL accelerometer data in young adults. The DO system can serve as a standardized instrument to calibrate accelerometers, subsequently, improving interpretation of surveillance and intervention research. Future work will adapt the DO system for different age groups and clinical populations.

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NEACSM FALL MEETING ABSTRACT SUBMISSIONS 2018

## FOAM ROLLING AND INDICES OF AUTONOMIC RECOVERY FOLLOWING EXERCISE-INDUCED MUSCLE DAMAGE

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**PURPOSE:** With the increased popularity of foam rolling (FR) as a recovery tool, it is important to establish the exact manner in which the practice is useful. This study will examine the impact of FR on recovery from exercise-induced muscle damage.

**METHODS:** This study received approval from the Salem State University Institutional Review Board. In a between-group design, 40 participants performed 40x15m sprints, inducing muscle damage. Immediately following sprinting and in the four days following, perceived muscle soreness measured by general labelled magnitude scale, vertical jump (VJ), agility, heart rate variability (HRV), and pulse wave velocity (PWV) were recorded. Nineteen subjects (mean $\pm$ sd; age 23.1 $\pm$ 5.0 yrs; BMI 25.6 $\pm$ 3.3 kg.m $^{-2}$ ) foam rolled prior to testing each day (FR), while 21 (mean $\pm$ sd; age 24.2 $\pm$ 3.4 yrs; BMI 26.3 $\pm$ 4.0 kg.m $^{-2}$ ) served as a non-foam rolling control (CON). Measurements recorded during the five days of recovery from the repeated sprint protocol were compared to those obtained during three baseline days of familiarization the prior week. The area under the curve (AUC) was calculated by summing all five scores and these data were compared by condition using a two-tailed Mann-Whitney U test (alpha level = 0.05).

**RESULTS:** Agility, HRV, and PWV were not significantly different between groups ( $p>0.05$ ). Perceived muscle soreness and VJ impairment were significantly lower in FR ( $p<0.05$ ). Mean Monday to Friday values for perceived muscle soreness in CON were 16.52, 30.24, 24.48, 17.19, and 11.10, respectively. Mean Monday to Friday values in FR were 12.63, 24.63, 21.79, 15.05, and 10.16, respectively. Mean Monday to Friday values for VJ (inches) in CON were 17.81, 17.36, 17.39, 17.83, and 17.82, respectively. Mean Monday to Friday values in FR were 18.14, 18.10, 18.07, 18.25, and 18.80, respectively.

**CONCLUSION:** FR may be useful for reducing soreness and preserving vertical jump ability following damaging exercise. Under the conditions of the present experiment, the recovery benefits associated with FR do not appear to be mediated by the autonomic nervous system.

Performance Health LLC (Warrenville, Illinois) supported this project with donations of foam rollers.

## PROLONGED DURATION OF KNEE EXTENSOR ACTIVITY DURING CYCLING IN PARKINSON'S DISEASE

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Muscle activity patterns in cycling are well studied in healthy young adults (YA) and trained cyclists. Although stationary cycling is a commonly prescribed exercise modality in older adults (OA) and people with Parkinson's disease (PD), little is known about the timing of muscle activity in these groups. **PURPOSE:** To compare patterns of muscle activity among YA, OA and people with PD at increasing cadences. Secondly, to relate muscle activity measures during cycling to mobility in people with PD. **METHODS:** Fifteen YA ( $23.3 \pm 3.1$  years old, 4 females), 15 healthy OA ( $69.0 \pm 7.8$  years old, 6 females) and 15 people with PD ( $70.7 \pm 7.1$  years old, 4 females, Hoehn-Yahr stage 1-3) participated in this study. Surface electromyograms (EMG) were recorded from six representative muscles of the dominant leg during recumbent bicycling at 40, 60, 80, 100 and 120 revolutions per minute (rpm) conditions at the lowest resistance setting. EMG was normalized to the peak EMG during the 60 rpm condition in each muscle and a 4th order low pass Butterworth filter with a cutoff of 7 Hz was used to create linear envelopes. Five revolutions were averaged, and EMG burst duration was calculated in each speed condition. People with PD performed the three meter timed up and go (TUG) and four square step test (FSST). A two way analysis of variance with repeated measures was used to test for EMG differences between groups and cadence conditions. Pearson correlations were used to quantify relationships between cycling measures and mobility. **RESULTS:** A significant group by cadence interaction was found for burst duration in the vastus lateralis ( $F=2.11$ ,  $p=0.037$ ), in which people with PD had longer burst durations than YA in the 120 rpm condition. Cadence effects were observed in burst duration of all muscles ( $p<0.001$ ), where duration of activation increased with increasing cadence. Additionally, duration of muscle activity in the vastus lateralis was strongly correlated to times on the TUG and FSST in people with PD ( $r>0.78$ ,  $p<0.001$ ). **CONCLUSION:** These results reveal prolonged activation of the knee extensors during high cadence cycling in people with PD, and such activity patterns may relate to impaired mobility.

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**ACUTE AEROBIC EXERCISE REDUCES ARTERIAL STIFFNESS IN HEALTHY, PREMENOPAUSAL WOMEN**

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Central arterial stiffness is an independent predictor of cardiovascular morbidity and mortality. Augmentation index (AIx) of the pulse wave and carotid-femoral pulse wave velocity (cfPWV) are two measures of arterial stiffness. One bout of aerobic exercise has been shown to yield beneficial adaptations in arterial stiffness in young, healthy men, wherein cfPWV significantly decreased after exercise. It is unclear whether young, healthy women exhibit changes in arterial stiffness following an acute bout of exercise. **PURPOSE:** To evaluate AIx and cfPWV in young, healthy, premenopausal women before and after an acute bout of exercise. **METHODS:** Participants were healthy women (n=9) ages 18-37 (24±2 yr). AIx and cf-PWV were measured via arm and thigh pressure sensor cuffs and applanation tonometry of the carotid artery at rest before, and 30 minutes after an acute bout of treadmill exercise (30 minutes at a heart rate corresponding to 60-64% VO<sub>2peak</sub>). Testing was performed on days 2 through 5 of the participant's menstrual cycle in order to control for the effects of hormonal fluctuations. AIx, cf-PWV and other related outcomes were analyzed using paired t-tests. **RESULTS:** Neither systolic (SBP), nor diastolic pressure (DBP) were different after the acute exercise (SBP, 108±2 vs. 111±2, p=0.427; DBP 65±2 vs. 66±1, p=0.349). However, resting heart rate was higher following exercise (57±4 vs. 63±3 bpm). AIx significantly decreased following the acute bout of exercise (19.11±2.27% vs. 9.89±3.59%, p = 0.007). AIx-75, or the augmentation index normalized to a heart rate of 75 bpm, trended lower following exercise (10.33±2.91% vs. 4.00±1.06%; p = 0.063). cf-PWV was not different following the acute bout of exercise (5.15±0.21 m/s vs. 5.08±0.16 m/s; p = 0.530). **CONCLUSION:** These results suggest that for young, healthy, premenopausal women, a reduction in augmentation index is one benefit of acute exercise. These data may provide insight into mechanisms underlying reduction in cardiovascular disease risk with exercise in women.

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## IMPACT OF HEAT THERAPY ON HEART RATE VARIABILITY IN WOMEN WITH AUTONOMIC DYSFUNCTION

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Heart rate variability (HRV) is a widely-used measure of cardiac autonomic function, with increased total and high-frequency variability representing a healthier cardiovascular profile. Both obesity and polycystic ovary syndrome (PCOS) are associated with autonomic dysfunction, which may limit exercise tolerance or capacity. Repeated passive heat exposure (termed 'heat therapy') shows promise as a supplemental lifestyle intervention to improve cardiovascular health, but the impact of heat therapy on HRV is unknown. **PURPOSE:** To examine the impact of an 8-10 week heat therapy intervention on resting HRV in obese women with PCOS. **METHODS:** Eighteen obese (BMI:  $41.3 \pm 1.1 \text{ kg/m}^2$ ) women with PCOS were age and BMI-matched and divided into heat therapy (HT) or time control (CON). HT subjects took part in 30 x 1-hr hot tub sessions (3-4 per week for 8-10 weeks) in 40.5°C water, while CON subjects did not undergo heat therapy. HRV was assessed in the supine position in a dark, thermoneutral room during paced breathing. A 3-lead electrocardiogram recorded heart rhythm for 5 minutes, and R-R intervals were analyzed offline using HRVanalysis 1.1 software. Key variables included R to R interval (RRI), total variability (Ptot), and the ratio of low-frequency (0.04-0.15Hz, attributed to sympathetic influence) to high-frequency (0.15-0.4Hz, attributed to parasympathetic influence) variability (LF/HF). **RESULTS:** Resting heart rate significantly declined in HT subjects (Pre:  $73 \pm 4$ ; Post:  $64 \pm 3 \text{ beats/min}$ ,  $p=0.003$ ), resulting in an increased RRI (Pre:  $0.822 \pm 0.067 \text{ ms}$ , Post:  $0.938 \pm 0.058 \text{ ms}$ ,  $p=0.010$ ). Total variability (Ptot) significantly increased in HT subjects (Pre:  $2365 \pm 704$ ; Post:  $3757 \pm 1317$ ,  $p=0.043$ ), while LF/HF (Pre:  $1.21 \pm 0.41$ , Post:  $1.03 \pm 0.33$ ;  $p=0.407$ ) did not change. **CONCLUSION:** Heat therapy substantially reduced resting heart rate and moderately increased HRV, representing a healthier cardiovascular profile and improved autonomic function. However, heat therapy did not appear to impact the relative balance of sympathetic and parasympathetic influence as assessed by HRV.

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## SALIVARY STRESS BIOMARKERS DURING THE LAKE PLACID IRONMAN □ ULTRAENDURANCE EVENT

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Biomarkers such as salivary IgA (sIgA) have been established as valid, reliable, and noninvasive stress markers. sIgA concentrations have been reported to decrease following periods of high physiological stress, such as that experienced during ultra-endurance events. Heat shock protein 70 (HSP70), a molecular chaperone, has been assessed primarily as a plasma/serum stress biomarker. The role of HSP70 in saliva, how it responds to extremely stressful exercise events and its correlation to changes in sIgA remain unclear. **PURPOSE:** To test the hypothesis that salivary HSP70 can be used as a salivary stress biomarker correlated to sIgA during an ultraendurance event. **METHODS:** Thirty-three subjects competing in the Lake Placid Ironman triathlon participated (all data, mean $\pm$ SD: 38 $\pm$ 8 yrs, 178.4 $\pm$ 8.9 cm, 76.3 $\pm$ 10.4 kg, 10.8 $\pm$ 3.8% body fat, finish time 708 $\pm$ 90 min). Environmental symptoms questionnaires (ESQ) were administered before (PRE) and 1 hour after the race (1hPOST). Hydration status was assessed via urine specific gravity (USG). Saliva samples were collected PRE, POST, and 1 day post-race (AMPOST) and analyzed for IgA (Salimetrics) and HSP70 (Enzo Life Sciences) by ELISA according to manufacturer instructions. Significant differences among time points were analyzed by repeated measures ANOVA and LSD post hoc tests. **RESULTS:** Subjects experienced significant stress with completion of the race (708 $\pm$ 90 min finish time, ESQ 1hPOST (20 $\pm$ 8) vs. PRE (5 $\pm$ 3, p<0.05), POST RPE 18 $\pm$ 2). sIgA was decreased POST (41.71 $\pm$ 20.46  $\mu$ g $\times$ ml $^{-1}$ ) vs. PRE (48.88 $\pm$ 17.20  $\mu$ g $\times$ ml $^{-1}$ , p=0.05) and vs. AMPOST (37.76 $\pm$ 27.02  $\mu$ g $\times$ ml $^{-1}$ , p=0.006). Salivary HSP70 was increased POST (3.91 $\pm$ 3.29 ng $\times$ ml $^{-1}$ ) vs. PRE (1.68 $\pm$ 1.93 ng $\times$ ml $^{-1}$  p=0.0002). **CONCLUSIONS:** Salivary HSP70 was detectable using a commercially available ultrasensitive HSP70 ELISA. Extracellular HSP70 in the oral cavity may be a non-invasive marker of stress during an ultraendurance event and is correlated with more common salivary stress marker sIgA.

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## SKELETAL MUSCLE FATIGUE: MECHANISMS AND MITIGATION AT THE CELLULAR AND MOLECULAR LEVELS IN OLDER ADULTS

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Older adults experience greater dynamic skeletal muscle fatigue, or contraction-induced decline in whole muscle force or power, than young adults, which ultimately decreases physical function. Fatigue primarily results from elevated hydrogen ( $H_+$ ) and phosphate ( $P_i$ ) altering myosin-actin interactions; however, discrepancies exist about which steps of the myosin-actin cross-bridge cycle are altered, their effect on single fiber function, and whether these decrements can be reversed. **PURPOSE:** The study objectives were to: 1) Examine the effects of simulated fatigue (elevated  $H_+$  and  $P_i$ ) on molecular and cellular function, and 2) Test the ability of deoxyadenosine triphosphate (dATP), an alternative energy source to adenosine triphosphate (ATP), to mitigate fatigue-related contractile alterations. **METHODS:** Force production, myofilament mechanics and cross-bridge kinetics were measured during maximal activation in single fibers from the vastus lateralis of five healthy, sedentary older adults (65-75 years) under normal and fatigued conditions. *In vivo* fatigue was simulated using  $P_i$  (30 mM) and  $H_+$  (pH 6.2) levels previously measured in fatigued human skeletal muscles. **RESULTS:** Single fiber force was reduced with fatigue in slow-contracting myosin heavy chain (MHC) I (22%,  $P<0.01$ ) and fast-contracting MHC II (30%,  $P<0.01$ ) fibers ( $P<0.01$ , MHC I vs. II), due to a reduction in the number or stiffness of strongly bound myosin heads. Cross-bridge kinetics slowed (longer myosin attachment times and reduced rates of myosin force production) with fatigue in both fiber types. Notably, MHC I fibers became stiffer with fatigue, suggesting a compensatory mechanism to fatigue that results in a lesser decrease in force with fatigue compared to MHC II fibers. Adding dATP to fatiguing conditions caused force to decrease relative to control (MHC I: 14%,  $P<0.01$ ; MHC II: 24%,  $P<0.01$ ) but increase relative to fatigue with ATP (MHC I: 11%,  $P<0.05$ ; MHC II: 10%,  $P=0.10$ ) due to a smaller reduction in the number or stiffness of myosin heads than in fatigue with ATP and faster cross-bridge kinetics overall. **CONCLUSION:** These results suggest novel molecular mechanisms and a possible countermeasure for reduced force with fatigue in human single fibers, which could ultimately facilitate identifying exercise-based or pharmaceutical treatments to help eliminate fatigue related functional decline in older adults.

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## ASSOCIATIONS OF ADIPOSE BIOMARKERS WITH VOLUMETRIC BONE MEASUREMENTS

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**PURPOSE:** Literature indicates that circulating adipokines (adiponectin and leptin) influence bone metabolism through the sympathetic nervous system; but the influence of adipokines on volumetric bone density in humans has been understudied.

**METHODS:** Framingham Heart Study Third Generation (exam 1, years 2002-2005) participants (45.3±6.2 years old, 43.7% female) were included if they had circulating adipokine measures (full sample collection from the antecubital vein - adiponectin pg/ml, leptin ng/ml, and soluble leptin receptor ng/ml) and underwent QCT scans using an eight-slice multidetector CT. Free leptin index (FLI) was calculated leptin/soluble leptin receptor. They were excluded if pregnant or had a history of glucocorticoid use (n=1,098). QCT images were analyzed for L3 cross-sectional area (cm<sup>2</sup>) (CSA) and volumetric density (trabecular and integral g/cm<sup>3</sup>). Multivariate linear regression analysis was used to assess the association of adipokines with bone CSA and volumetric density adjusting for age, sex, smoking, height (cm) and body mass index (BMI); a second model replaced BMI with visceral adipose tissue (cm<sup>3</sup>) (VAT). Each biomarker (per 1000 units) and bone measurement were analyzed independently due to collinearity, then repeated separately by sex.

**RESULTS:** In our main model, statistically significant associations were noted between adiponectin, leptin, and FLI with CSA ( $\beta=0.03$ ,  $p<0.001$ ;  $\beta=-0.02$ ,  $p<0.001$ ;  $\beta=-0.17$ ,  $p<0.001$  respectively), there was statistically significant associations with leptin and trabecular density (TbBMD) ( $\beta= -0.0002$ ,  $p=0.04$ ) and adiponectin with integral density ( $\beta=-0.0005$ ,  $p=0.009$ ). With VAT in the model, statistically significant associations with adiponectin (TbBMD  $\beta=-0.0005$ ,  $p=0.03$ ) and FLI (TbBMD  $\beta=0.002$ ,  $p=0.004$ ; integral density  $\beta=0.002$ ,  $p=0.003$ ) were also observed. In sex-specific models, significant associations remained in men for adiponectin, leptin, and FLI, with bone CSA when adjusted for BMI ( $\beta=0.05$ ,  $p<0.001$ ;  $\beta=-0.04$ ,  $p=0.001$ ;  $\beta=-0.4$ ,  $p=0.005$  respectively); whereas women showed a greater number of statistically significant associations when adjusted for VAT across all bone measurements.

**CONCLUSION:** Our findings suggest similar relationship trends between these adipokines and volumetric bone density as recent animal studies. As obesity is a growing public health concern and these adipokines are regulated by adipose tissue, future research should focus on their potential mechanisms of action on bone in humans.

## EFFECT OF STATIC AND BALLISTIC STRETCHING ON MUSCLE-TENDON UNIT STIFFNESS, WORK ABSORPTION, STRENGTH, AND POWER

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Various stretching modalities are commonly performed prior to exercise with little understanding of their effect on passive-elastic and active muscle force production. PURPOSE: To evaluate effects of static and ballistic stretching on muscle-tendon unit (MTU) stiffness, work absorption (WA), strength, and power. METHODS: Twenty-two recreationally active men's ( $n=13$ ) and women's ( $n=9$ ) ( $21.9 \pm 2.8$  yr,  $73.7 \pm 12.4$  kg,  $1.72 \pm 0.10$  m) stiffness, WA, strength, and power were measured for the ankle plantarflexors on an isokinetic dynamometer on three separate days, following an acute bout of static, ballistic, or no stretching. The dynamometer passively dorsiflexed the ankle  $0\text{-}30$  deg at  $5$  deg· $s^{-1}$  and joint position and torque were recorded. Stiffness was calculated as the slope of the joint angle torque curve (Figure 1) and WA was calculated as the area under the curve. Subsequently, subjects performed 3-5 maximal voluntary isometric plantarflexion contractions at a neutral ankle position, followed by 3-5 contractions at  $180$  deg· $s^{-1}$  to determine strength and power, respectively. Multivariate analysis of variance with paired t-tests were used to detect within-subject differences between stretching conditions. RESULTS: In control, ballistic, and static conditions, respectively, mean MTU stiffness was  $76.1 \pm 26.6$ ,  $73.5 \pm 70.4$ , and  $70.4 \pm 24.6$  Nm·rad $^{-1}$ , WA was  $4.9 \pm 2.2$ ,  $4.6 \pm 2.2$ , and  $4.3 \pm 1.9$  Nm·rad, strength was  $141.4 \pm 37.7$ ,  $137.6 \pm 44.9$ , and  $139.3 \pm 40.0$  Nm, and power was  $78.5 \pm 24.1$ ,  $76.2 \pm 24.0$ , and  $72.5 \pm 18.0$  W. There was a significant linear trend for the decrease in WA ( $p=0.049$ ) and power ( $p=0.047$ ) from control, to ballistic, to static conditions. Compared to control and ballistic stretching conditions, respectively, static stretching insignificantly decreased MTU stiffness by 7.6% ( $p=0.194$ ) and 4.2% ( $p=0.334$ ), WA by 12.4% ( $p=0.103$ ) and 7.6% ( $p=0.323$ ), and power by 7.7% ( $p=0.093$ ) and 4.9% ( $p=0.241$ ). CONCLUSION: Clinicians, researchers, and coaches should appreciate that an acute bout of static stretching marginally impairs both passive-elastic and active muscle force production.

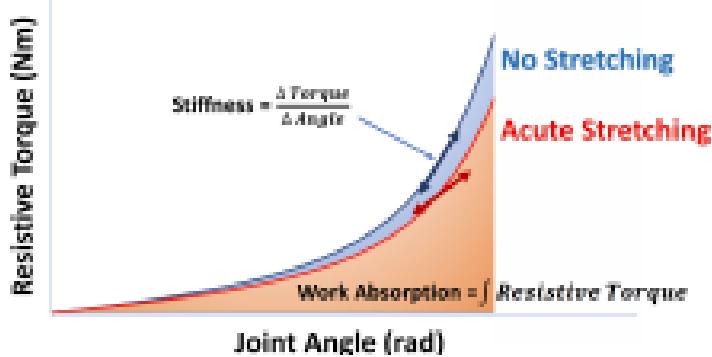


Figure 1. Typical stress strain relationship between joint angle and muscle-tendon unit passive resistive torque.

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## EFFECT OF MUSIC-BASED RHYTHMIC AUDITORY CUEING ON GAIT VARIABILITY

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Extreme levels of variability (as indicated by large or small standard deviation magnitudes) of various gait parameters are associated with increased risk of falling. Rhythmic auditory cueing (RAC) via a metronome or music has been suggested as a strategy to improve gait variability in certain populations.

**PURPOSE:** To investigate the effect of music-based RAC on gait variability during overground walking in young, healthy adults.

**METHODS:** Twenty adults (mean $\pm$ SD age 23.7 $\pm$ 2.7 years, height 172.8 $\pm$ 8.8 cm, BMI 23.1 $\pm$ 4.0 kg) completed six 5-minute walking trials along a 40m oval track. Three trials were completed at self-selected (SS) speeds (slow, normal, and fast), and three trials were completed while listening to one song modulated to 80, 100, and 125 beats per minute via a commercial phone app. Participants were instructed to match their foot strikes to the tempo of the song. Gait parameters (Table 1) were assessed using a GAITRite electronic walkway inserted on the track. For each trial, individual variability (within-participant standard deviation) of gait parameters were exported from the GAITRite software. Group means and standard deviations of variability for each parameter were then calculated. Gait variability was also averaged for SS and RAC conditions. Differences between conditions were compared via paired t-tests ( $p<0.05$ ).

**RESULTS:** RAC conditions significantly increased the variability of step length (%diff=16.2%,  $p=0.007$ ), stride length (%diff=19.8%,  $p=0.011$ ), swing time (%diff=22.2%,  $p<0.001$ ), and single support time (%diff=22.2%,  $p<0.001$ ). There were no differences in step, stride or stance time (Table 1).

**CONCLUSION:** The constraints required for walking to the tempo of the song disturbed the participants' more naturally stable self-selected gait patterns. However, RAC preserved temporal characteristics (e.g., step timing). These results suggest that healthy young adults may employ multiple dynamic gait strategies to synchronize their foot strike with RAC, as displayed by modified variability of a number of gait parameters.

## THE EFFECT OF ECOLOGICAL MOMENTARY ASSESSMENT ON EXERCISE BOUTS, DURATION, AND INTENSITY

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Ecological momentary assessment (EMA), or the assessment of individuals in their free-living environment, is an important and increasingly utilized method of data collection. Physical activity (PA) is often measured via accelerometry, smartphone surveys, or a combination of both. However it is unclear whether frequent prompting to think about exercise via surveys or continuously wearing an accelerometer influences structured exercise bouts. **PURPOSE:** To examine, within the context of a 12-week exercise intervention, whether the use of EMA (weeks 11 & 12) affects the intensity, duration or number of exercise bouts when compared to non-EMA weeks (weeks 9 & 10).

**METHODS:** 14 overweight/obese women (BMI:  $33.18 \pm 4.56$ ; age:  $38.07 \pm 11.52$  years) completed a 12-week exercise program and were given an exercise goal of 200 min/wk of moderate intensity exercise. Participants performed one 50-min supervised exercise session per week and wore the Sensewear armband during all home-based exercise to assess the intensity and duration of these bouts. During 'EMA weeks' (weeks 11 & 12), participants were also instructed to respond to smartphone surveys 5x/day and to wear the armband during all waking hours. The surveys asked questions related to exercise, diet, and feeling states and the armband did not provide any feedback. Exercise bouts were identified via participant diaries and minute-by-minute MET values captured by the armband were used to determine the duration and intensity of the exercise bout. **RESULTS:** Compliance to wearing the armband ( $12.7 \pm 3.4$  hours/day on  $13.7 \pm 1.0$  days) and answering the surveys (84%  $\pm$  10.83%) was high. Overall, participants engaged in 85% of the prescribed, home-based exercise minutes. Home-based exercise minutes during non-EMA weeks ( $128.8 \pm 49.0$  min/wk) was similar to EMA weeks ( $127.1 \pm 47.2$  min/wk,  $p=0.88$ ). The number of bouts/week did not differ on non-EMA ( $2.96 \pm 1.1$ ) versus EMA weeks ( $3.25 \pm 1.5$ ;  $p=0.44$ ) and the intensity of home-based exercise was also similar (non-EMA:  $4.52 \pm 0.65$ , EMA:  $4.44 \pm 0.62$  METs;  $p=0.43$ ).

**CONCLUSION:** There was no significant difference in the duration or intensity of home-based exercise bouts on non-EMA versus EMA weeks. The results support the use of EMA as a data collection tool. The constant reminder of exercise via EMA surveys does not appear to influence engagement in an exercise program.

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**EFFECT OF ROUX-EN-Y GASTRIC BYPASS SURGERY ON FGF21 IN SKELETAL MUSCLE FROM SEVERELY OBESE HUMANS**

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Severe obesity has a major adverse influence on overall health and is a risk factor for the development of metabolic diseases such as type 2 diabetes. Roux-en-Y Gastric Bypass (RYGB) surgery is an effective weight loss therapy that improves glycemic control and reverses type 2 diabetes. A metabolic hormone called Fibroblast growth factor 21 (FGF21) predominately produced by metabolically active organs is highly involved in regulating glycemic control. However, how FGF21 is altered in skeletal muscle with RYGB surgery is largely unclear.

**PURPOSE:** The purpose of this study was to determine the effect of RYGB on FGF 21 expression in skeletal muscle from severely obese humans. **METHODS:** Skeletal muscle was obtained from RYGB patients via muscle biopsy prior to, 1-month and 7-months following surgery ( $n=6$ ,  $BMI=47.3 \pm 2.8 \text{ kg/m}^2$ ,  $41.0 \pm 2.9 \text{ kg/m}^2$ ,  $33.7 \pm 2.2 \text{ kg/m}^2$ , Fasting Glucose =  $89.8 \pm 1.9 \text{ mg/dl}$ ,  $87.7 \pm 2.8 \text{ mg/dl}$ ,  $78.3 \pm 3.1 \text{ mg/dl}$ , respectively). Human skeletal muscle cells were isolated and cultured into myoblasts on type I- collagen coated plates. After reaching an 80-90% confluence, myoblasts were then differentiated into myotubes. On day 7 of differentiation, myotubes were harvested for immunoblot analysis. **RESULTS:** Whole body insulin sensitivity is improved 7-months post RYGB surgery when compared to pre-surgery ( $HOMA-IR = 1.7 \pm 0.5$  vs.  $3.4 \pm 0.4$ ,  $P < 0.05$ ). FGF21 protein expression was not altered statistically after RYGB. However, FGF21 was correlated with BMI and fasting glucose level ( $r = -0.424$ ,  $-0.542$ , respectively,  $P < 0.05$ ). **CONCLUSION:** RYGB does not significantly alter skeletal muscle FGF21 protein expression. However, weight loss in severely obese people may slightly increase skeletal muscle FGF21 levels which affects the overall amount of fasting glucose within the body.

## EFFECT OF NEUROTRACKER TRAINING ON COLLEGIATE MEN AND WOMEN'S HOCKEY AND LACROSSE IN-GAME PERFORMANCE

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3D multiple object tracking (3D MOT) aids in improving working memory and spatial awareness by stressing foveal and peripheral vision while demanding multi-faceted attentional focus. 3D MOT also improves cognitive processing which may improve the ability to rapidly extract data from the environment thereby enhancing decision making capabilities. These attributes have the potential to enhance sports performance. **PURPOSE:** The purpose of this study was to determine if 3D MOT training increases in-game performance during a competitive season. **METHODS:** 79 athletes from four NCAA DIII collegiate athletic teams (ice hockey n=34; lacrosse n=45) participated. Athletes were assigned to either a 3D MOT (n=38) training intervention or control (C) group (n=41). Athletes completed 24 sessions of 3D MOT training, 2-4 times per week over 12 weeks during the respective competitive seasons. At the conclusion of the seasons, independent samples t-tests were used to compare performance measures (game statistics) between 3D MOT and C groups for ice hockey (men's and women's combined), men's lacrosse, and women's lacrosse. **RESULTS:** There were no significant differences in performance measures between 3D MOT and C groups for ice hockey ( $p>0.05$ ). For men's lacrosse, faceoff winning percentage was significantly different ( $p=0.000$ ) with the C group having a greater faceoff winning percentage versus the 3D MOT group (30% vs. 0%). For all other performance measures there were no significant differences ( $p>0.05$ ) between groups. For women's lacrosse, there were significant differences for assists ( $p=0.045$ ), points ( $p=0.034$ ), shots ( $p=0.035$ ), and free-position shots ( $p =0.014$ ) with the 3D MOT group having lower values versus C. **CONCLUSIONS:** Athletic performance is multifactorial in uncontrolled environments such as competitive ice hockey and lacrosse, which may suggest that performance benefits of 3D MOT training may be overshadowed by the complexities of game play. The significant differences found between groups may be due to player skill differences versus a 3D MOT effect. Further research is warranted.

## EFFECTS OF A MEAL HIGH IN FAT, SODIUM AND CHOLESTEROL ON ARTERIAL STIFFNESS

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The prevalence of quick-service (QS) meals is a contributing factor to not only the obesity epidemic but also more subtle health concerns such as arterial stiffening. Arterial stiffening is defined as the general inability of arteries to vasodilate and vasoconstrict to accommodate changes in blood flow and pressure. Arteries respond to a variety of internal and external cues but whether the arteries respond to ingestion of a meal high in fat, sodium and cholesterol is not known. **PURPOSE:** To observe whether arterial stiffening occurs following ingestion of a typical QS meal. **METHODS:** Arterial stiffness was assessed via applanation tonometry (AT) on ten sedentary college-aged subjects. Blood pressure and AT were recorded prior to a QS meal and then immediately, 20, 40, and 60 mins post-ingestion. Dependent variables included: heart rate (HR), sub-endocardial viability ratio (SEVR), central systolic blood pressure (CSBP), central diastolic blood pressure (CDBP), central pulse pressure (CPP), and aortic augmentation index (AIx). A repeated-measures ANOVA was used to determine differences between the pre- and post-meal measurements with significance set at  $P < 0.05$ . **RESULTS:** Pre-CDBP ( $79.2 + 8.33$  mm Hg) was significantly higher than the 20 ( $72.2 + 4.19$  mm Hg), 40 ( $70.8 + 6.25$  mm Hg), or 60 minute ( $72.1 + 2.33$  mm Hg) measurements. SEVR approached statistical significance ( $P = 0.07$ ) but was under-powered. No significant differences were observed between the pre and post-meal measurements of HR, CSBP, CPP and AIx.

**CONCLUSION:** This study showed that a QS meal decreased CDBP over the duration of 1-hour suggesting a drop in coronary artery perfusion pressure. SEVR, an indicator of myocardial perfusion, and several other dependent variables approached statistical significance and since the study was under-powered, collecting data from more subjects is warranted.

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## ASSOCIATIONS OF SELF EFFICACY, SOCIAL SUPPORT, AND STAGE OF CHANGE WITH EXERCISE PRESCRIPTION ADHERENCE

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Adherence to an exercise prescription (ExRx) can be influenced by many individual, social and interpersonal factors. However, there are few studies reporting adherence to healthcare provider initiated ExRx in underserved minority urban populations. **PURPOSE:** The purpose of this study was to examine whether social support, self-efficacy, or stage of change are associated with women's adherence to an ExRx at an urban Boston women's only fitness facility.

**METHODS:** Patients ( $\geq 18$  yrs) who had received an exercise prescription from a healthcare provider located within a safety-net healthcare system and joined Healthworks Community Fitness (Dorchester, MA) since April 2018 were eligible. Using a community based mixed methods design, participants were phone interviewed using Physical Activity Stage of Change, Exercise Self-Efficacy Scale, and Social Support and Exercise Scale. Adherence was defined as gym utilization or the number of check-ins (attendance) over the period of the ExRx and then averaged per week. Correlations were used to assess the relationship between self-efficacy and social support, and adherence. Stage of change was dichotomized to pre-action (precontemplation, contemplation, preparation) and action (action, maintenance) and adherence was compared between pre-action and action using t-tests. **RESULTS:** Patients ( $n=13$ ) had a mean $\pm$ SD age of  $40.5\pm3.9$  years, BMI of  $35.0\pm2.1\text{kg/m}^2$ , and 84.6% of the participants were African American. 38.5% of participants were in the pre-action stage and 61.5% were in the action stage. Attendance averaged less than once a week ( $0.69\pm0.23$  visits/week) for the duration of the ExRx; where 8.3% had 0 visits, 66.6% attended less than 1x/week, 8.3% attended 1x/week, and 16.6% attended 2x/week. There was a significant correlation between self-efficacy and adherence ( $r=0.62$ ;  $p=0.03$ ). There were no significant associations between family or friend social support and adherence (family:  $r=0.12$ ;  $p=0.70$ ; friend:  $r=-0.07$ ;  $p=0.81$ ) and no significant differences for adherence between patients in pre-action ( $0.35\pm0.11$  visits) versus action ( $0.85\pm0.33$ ;  $p=0.32$ ). **CONCLUSIONS:** Self-efficacy appears to be an important construct showing an association with adherence to exercise prescriptions in minority underserved communities. Stage of change suggest that more advanced stages may be associated with higher adherence. More research, with larger sample sizes, is needed to confirm these results.

## HEAD IMPACTS IN WOMEN'S COLLEGIATE RUGBY: INCIDENCE AND FORCE APPLICATION

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With the growth in women's rugby participation, there is a need to enhance our understanding of subconcussive and concussive risk potentials in such a physical sport. Investigating head impact exposure in women's rugby is necessary for understanding these risks and for the development of interventions to ultimately minimize concussion potential. **PURPOSE:** The purpose of this study was to quantify incidence, magnitude, and distribution of head impacts throughout a collegiate women's rugby season. **METHODS:** Twenty-three collegiate female rugby athletes wore Smart Impact Monitors (SIM) within headbands during practices and games. Head impact data including number of head impacts, peak linear acceleration, peak rotational acceleration, peak rotational velocity, and location of head impacts were collected. Analyses were performed to compare these data in practices and games, first and second half of game play, and by athlete position group, including hit up forwards, outside backs, and adjustables. Paired sample t-tests, repeated measure ANOVAs, and 3-way ANOVAs with a set level of significance at  $p < .05$  were utilized in the analysis. **RESULTS:** Players sustained 120 head impacts  $> 15\text{g}$  (range 18.1g – 78.9g) with 1199 total athlete exposures in practices and games combined. In games, 67 head impacts were recorded with a mean of 0.40  $\pm$  0.22 impacts per-player per-game. There were 53 head impacts recorded in forty-seven practices with a mean of 0.05  $\pm$  0.04 impacts per-player per-practice. There were no significant differences in number or magnitude of head impacts between practices and games, first half and second half of games, or by position group ( $p > 0.05$ ). The front and the back of the head locations had significantly more head impacts than the crown and the right side of the head ( $p < 0.05$ ). **CONCLUSION:** Collegiate women's rugby athletes endured the same number and magnitude of head impacts in both practices and games, regardless of position or time of game. These findings give insight into the subconcussive impacts that female collegiate rugby athletes sustain during competition. Further research is necessary to develop interventions that minimize head impacts and ultimately reduce risk of head injury in women's rugby.

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## KINETIC THERMOREGULATORY RESPONSES TO MAXIMAL AEROBIC EXERCISE DEPEND MORE ON BODY COMPOSITION THAN SEX

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Heat loss is of vital importance during strenuous aerobic activity, and it is a limiting factor of exercise capacity. Therefore, it is important to understand the heat loss kinetics during a maximal aerobic test. **PURPOSE:** To study the kinetics of skin temperature (SkT) regulation during a maximal aerobic exercise test, and to determine whether changes in SkT are different depending on weight status and sex. Moreover, we examined the correlations between the changes in SkT parameters with maximal oxygen consumption ( $\text{VO}_{2\text{max}}$ ) in young healthy adults. **METHODS:** 144 healthy individuals (32% male; Age:  $22.1 \pm 2.2$  yrs; BMI:  $24.9 \pm 4.7$  kg/m<sup>2</sup>) underwent a graded, maximal, treadmill walking test (modified Balke protocol). SkT was continually measured with 14 iButtons allocated in different anatomic positions during the  $\text{VO}_{2\text{max}}$  test. We calculated mean, proximal, and distal SkT as well as estimated peripheral vasoconstriction. The changes ( $\Delta$ ) in SkT were calculated as the difference of the final minute of the test minus the baseline.  $\text{VO}_{2\text{max}}$  was determined using indirect calorimetry. **RESULTS:** SkT at all measured sites rose during exercise (all  $P \leq 0.001$ ), except for supraclavicular Tsk ( $P=0.205$ ). During exercise, both mean and proximal SkT rose substantially more steeply as BMI increased ( $P < 0.01$ ). Also during exercise, lean individuals achieved the greatest peripheral vasoconstriction (all  $P \leq 0.025$ ). Distal SkT was not influenced by weight status ( $P=0.147$ ). Sex did not influence any SkT parameters during exercise (all  $P \geq 0.078$ ), except for proximal SkT ( $P=0.001$ ). Furthermore, we found a positive correlation between the  $\Delta$  mean and  $\Delta$  proximal SkT with  $\text{VO}_{2\text{max}}$  ( $r: 0.351$ ;  $P < 0.001$  and  $r: 0.329$ ;  $P < 0.001$ ) and a negative correlation between  $\Delta$  peripheral vasoconstriction with  $\text{VO}_{2\text{max}}$  ( $r: -0.253$ ;  $P < 0.001$ ). All results persisted after adjusting for the duration of the exercise test. **CONCLUSION:** We found that the thermoregulatory responses to a maximal exercise test are different across body mass index categories, but not between sexes. Our results also demonstrate that those with the highest  $\text{VO}_{2\text{max}}$  have the greatest heat loss. Interestingly, lean individuals had the greatest peripheral vasoconstriction during exercise. Therefore, there may be an important relationship between heat dissipation capacity and cardiorespiratory fitness.

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NEACSM FALL MEETING ABSTRACT SUBMISSIONS 2018

## OBJECTIVE AND SELF-REPORTED PHYSICAL FUNCTIONING IN MIDDLE-AGED WOMEN: A CORRELATIONAL ANALYSIS

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Self-report data suggests that some middle-aged women have moderate to severe functional limitations, but there is little data available examining objective physical function performance in this age group. **PURPOSE:** The purpose of this study was to examine the association between self-reported and objectively measured physical function in middle-aged women. The strength of the relationships between age, body mass, body composition, and physical activity with physical function was also analyzed, as these have been shown to influence physical function performance. **METHODS:** Seventy-six women ( $52.3 \pm 6.0$  years; range 40-64 years) completed the SF-36 Physical Functioning Subscale (PF-10) and a battery of objective physical function measures [30-Second Chair Stand (CHR), Transfer Task, Six-Minute Walk (WALK), Lift and Carry (LIFT), Timed Up-And-Go (TUG)]. Body composition (%Fat) was measured via dual energy x-ray absorptiometry and steps/day via accelerometer. **RESULTS:** Participants had high PF-10 scores ( $94.4 \pm 7.7$ ; range 65 – 100), with 99% of the sample scoring above the established normative value. PF-10 scores were significantly related to CHR ( $r = .32$ ), Transfer Task ( $r = -.46$ ), 6MW ( $r = .39$ ) and Lift and Carry scores ( $r = -.26$ ). Age was related to Transfer Task ( $r = .30$ ) and LIFT ( $r = .24$ ) (both  $p < 0.05$ ). Body mass was significantly associated with PF-10 ( $r = -.36$ ), CHR ( $r = .36$ ), Transfer Task ( $r = .41$ ), and WALK ( $r = -.45$ ), while %Fat was significantly related to PF-10 ( $r = -.41$ ), CHR ( $r = -.37$ ), Transfer Task ( $r = .53$ ), WALK ( $r = .49$ ) and LIFT ( $r = .25$ ). Steps/day were related to CHR ( $r = .42$ ), Transfer Task ( $r = -.32$ ), WALK ( $r = -.26$ ) and LIFT ( $r = -.23$ ) (all  $p < 0.05$ ). **CONCLUSION:** In middle-aged women, objective measures of physical function were moderately associated with self-reported physical function, supporting the use of both subjective and objective measures in this age group. Additionally, body mass and %Fat were similarly related to self-report and objective measures. This suggests that the use of subjective measures of physical function and body mass may be adequate for assessing these outcomes in situations where more sophisticated measures are not available.

## AN EVALUATION OF ACTIGRAPH HIP AND WRIST METHODS TO ESTIMATE SEDENTARY BEHAVIOR UNDER FREE-LIVING CONDITIONS

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Hip-and wrist-worn accelerometers are used to estimate sedentary behavior (SB), however the validity of existing data processing methods in free-living conditions is understudied.

**PURPOSE:** Determine the validity of existing methods to estimate SB under free-living conditions using ActiGraph accelerometers (AG). **METHODS:** Forty-eight participants (age 20.4±1.3 years, 45.8% male) were video recorded during four 1-hour sessions in different settings (home, community, school, environment) while wearing an AG on the hip and wrist. Direct observation videos were coded for postural orientation and activity (e.g. walking). Time directly observed in sitting and lying postures were classified as SB (criterion measure). Twelve methods using cut-points from vertical counts/minute (CPM), counts/15-s (CP15s), and vector magnitude counts (vm) (e.g., CPM1853vm), raw acceleration and arm-angle (Sedentary Sphere), Euclidean norm corrected for gravity (ENMO, mg) thresholds, single- or tri-axial Sojourn hybrid-machine learning models (Soj1x and Soj3x), random forest (RF) and decision tree (TR) models were applied to AG data to estimate SB. Repeated measures linear mixed models were used to estimate method bias and the 95%CI around the bias. **RESULTS:** On average, participants spent 34.1 minutes/session in SB. No significant bias was observed using CPM100, Soj1x, and Soj3x for the hip or Sedentary Sphere for the wrist. For the hip, SB was underestimated using CPM200vm by -3.3 minutes and overestimated using CPM150 and ENMO47.4 (2.5 and 12.3 minutes, respectively). For the wrist, SB was underestimated using RF, CP15s376vm, TR, and CPM1853vm, ranging from -10.2 to -6.4 minutes, and overestimated using ENMO44.8 by 3.7 minutes (Figure 1). **CONCLUSION:** Accurate estimates of SB from a hip-worn AG can be achieved using either simpler count-based approaches (CPM100) or machine learning models (Soj1x, Soj3x). However only the Sedentary Sphere may be suitable to estimate SB from the wrist. Future work to develop large free-living calibration datasets may lead to improvements in SB estimates.

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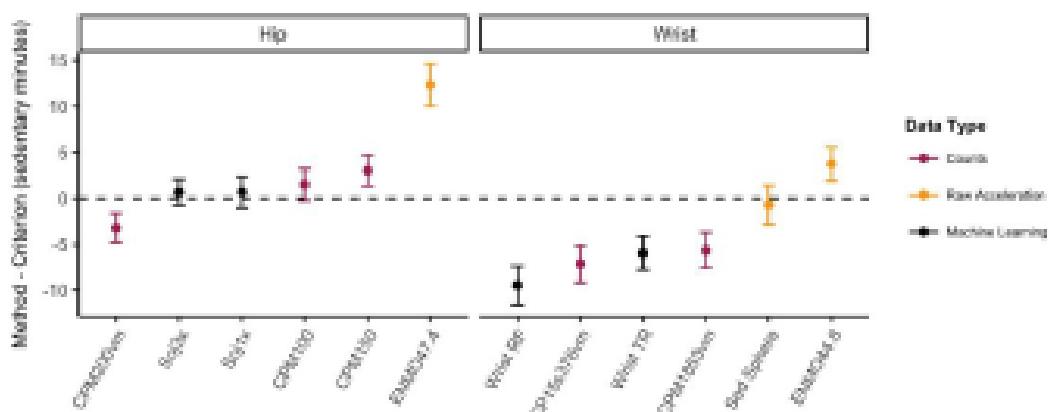


Figure 1: Mean bias and 95%CI for hip- and wrist-method estimated time spent in sedentary behavior

**EFFECTS OF A TEACHER-LED MOVEMENT-TRAINING PROGRAM ON PHYSICAL FITNESS, MOTOR SKILLS, AND PHYSICAL ACTIVITY IN THIRD AND FOURTH GRADE STUDENTS**

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**PURPOSE:** FUNDamental Integrative Training (FIT) is a circuit-style strength training approach designed to be implemented in conjunction with a physical education program. The short-term goal of FIT is to improve physical fitness in youth and the longer-term goal of this program is to physically prepare children for an active lifestyle beyond childhood. Currently, no studies have assessed the effects of FIT on fundamental movement skills, psychosocial mediators, or physical activity. The purpose of the current study was to evaluate the effects of a 12-week, FIT program on physical fitness, fundamental movement skills, physical activity, and psychosocial mediators among children in third and fourth grade classrooms. **METHODS:** A total of seven classrooms in one school were randomly assigned to the intervention (INT, n=4) or control (CON, n=3) group. The INT classrooms received a 12-week, teacherled FIT intervention. The CON group continued participation in regular physical education. At baseline, mid-point, and immediately post intervention, physical fitness (curl-up, push-up, sit & reach), motor skills (hop, jump, throw, catch), objectively measured weekly physical activity and sedentary time, and psychosocial factors (self-efficacy, enjoyment, social support) were measured for all participants. Kruskal-Wallis rank-sum tests were used to compare pre-post changes between the INT and CON groups for all variables. **RESULTS:** Sedentary time decreased for the INT group (-19 minutes) and increased slightly for the CON group ( $p=0.04$ ). No significant differences were observed between groups for any of the physical fitness, motor skill, or physical activity variables. **CONCLUSIONS:** The current study adds valuable insight into the efficacy of delivering a short, high intensity FIT intervention dose into an existing PE curriculum. Future studies should continue to explore the relationships between physical activity, fitness, and motor skills in children to identify causal pathways and intervene appropriately. Due to the limited amount of studies using the FIT intervention, more research is needed to determine if the FIT intervention could be a reproducible and efficacious model to improve fitness, FMS, psychosocial variables, and PA.

Supported by: University of Massachusetts Graduate School Dissertation Grant

## CAUGHT IN TRANSITION: CASE REPORT OF TWO FEMALE SWIMMERS WITH A TRANSITIONAL REPRODUCTIVE PROFILE

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Research on female athletes has demonstrated that energy status influences reproductive hormones and sport performance. Primate studies have demonstrated amenorrhea and restoration of menses by creating a negative energy balance or refeeding respectively. To date, these relationships have not been demonstrated in female athletes. **PURPOSE:** The purpose of this case study was to inspect bioenergetic factors, metabolic hormones and swim performance in two female swimmers who demonstrated a transitional menstrual cycle status. **METHODS:** Two junior elite female swimmers (15 and 16 years) were assessed over a 20-week period including a 12-week swim season, 2-week recovery phase and 6 weeks of a second swim season. Reproductive and metabolic related hormones (estradiol [E2], progesterone [P4], triiodothyronine [T3]), insulin-like growth factor-1 [IGF-1]), resting energy expenditure [REE], energy intake [EI], energy expenditure [EE or TDEE] and swim performance were assessed every two weeks. Swim performance was determined from a standardized maximal 400m swim trial. EI was assessed using three-day diet records coupled with 24 hr dietary recall. REE was measured using standard indirect calorimeter techniques. Bioenergetic parameters were evaluated as 24-hr measures and in one-hour segments. Energy balance [EB] was calculated as EI minus TDEE. Relationships between hormones and bioenergetics or swim performance outcomes were evaluated graphically for both participants. **RESULTS:** EB, T3, and IGF-1 throughout transitional cycles were temporally related in both athletes. Reductions in EB, T3, and IGF-1 corresponded to declines in swim performance. Meal patterning over the day related to metabolic and reproductive hormones and swim performance. **CONCLUSIONS:** The swimmers demonstrated a unique reproductive hormone pattern that transitioned from cyclic to acyclic each season that was temporally related to increases in EE and reductions in EI patterning. T3 and IGF-1 patterns related to the changes in EB over the 20 weeks. Meal patterning appears to influence both reproductive hormones and swim performance. This case study represents a novel reporting in the area of female athlete's response to bioenergetic changes. Future studies are needed to better establish the relationship between bioenergetics factors, reproductive and metabolic hormones and sport performance in competitive female athletes.

*Supported by: USA Swimming Research Grant*

**TITLE: LISTENING TO MUSIC WHILE EXERCISING INCREASES RISK FOR THE NOISE-INDUCED HEARING LOSS**

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Music has an ergogenic effect on exercise performance, improves motivation, decreases exertion, and delays the onset of fatigue. However, loud sound levels from music can cause permanent damage to the inner ear resulting in noise-induced hearing loss (NIHL). **PURPOSE:** The purpose of this study was to assess the risk of NIHL among students utilizing campus recreational facilities and examine whether music used as a motivator was associated with increased risk for NIHL. **METHODS:** One hundred and nineteen students were recruited from the main fitness center on college campus. Physical activity level was recalled using a modified short version of the International Physical Activity Questionnaire. Music intensity levels were assessed by a sound pressure level mannequin with a built-in microphone. Thirty second samples were taken in 5 second intervals using participant's personal listening devices. Average, minimum, and maximum sound levels were recorded in decibels (dBA). The estimated risk for NIHL was established based on the average sound level and duration of exposure using NIOSH criteria. Participants indicated whether music was a motivator during a workout. Descriptive statistics were performed for all variables. Chi-square analyses evaluated relations between risk for NIHL, gender, and music as a motivator. T-tests assessed the difference in average loudness level and gender. **RESULTS:** Participants were college students (51.3% males, 48.7% females). Majority of participants (89.1%) used music as motivation while exercising (93.4% male and 84.5% female,  $p>0.05$ ). Twenty four percent of participants were at risk for NIHL, approaching statistical significance for gender (29.5% males vs 19% females,  $p=0.056$ ). The average sound levels for the participants were  $88.8+10.3$  dBA and statistically significant for gender ( $90.9+10.6$  dBA for males,  $86.5+9.4$  dBA for females,  $p=0.017$ ).

**CONCLUSION:** Every fourth college student listening to music while exercising was at risk for NIHL. NIHL is an avoidable cause of permanent hearing impairment. Recommendations for safe use of personal listening devices during workouts include keeping volume at a safe level, below 85 dBA, and limiting time spent using the device during workouts.

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**CADENCE (STEPS/MIN) AND METABOLIC INTENSITY DURING UNCONSTRAINED AND CADENCE-ENTRAINED OVERGROUND WALKING**

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A walking cadence of 100 steps/min has consistently been reported as a reasonable heuristic (i.e., evidence-based, practical, rounded) threshold indicative of absolutely-defined moderate intensity (3 metabolic equivalents [METs]) walking. Most of these studies were conducted during speed-constrained overground or treadmill walking. However, walking during free-living rarely entails a constraint on speed. The cadence-intensity relationship may also differ when foot-strikes are entrained to the tempo of music (i.e., cadence-entrained walking), as could be used to implement cadence-based walking prescriptions. **PURPOSE:** To determine cadence thresholds associated with levels of absolutely-defined intensity (METs) during overground unconstrained and cadence-entrained (via music) walking. **METHODS:** Ten men and ten women (mean $\pm$ SD, age=23.7 $\pm$ 2.7 years, BMI=23.1 $\pm$ 4.0 kg/m<sup>2</sup>) completed three unconstrained (self-selected slow, normal, and fast pace) and three cadence-entrained (one song modulated to 80, 100, and 125 beats/min) overground walking bouts. Each bout was five minutes in duration and separated by five minutes of rest. Metabolic intensity (oxygen consumption converted to METs) was measured with indirect calorimetry and cadence was determined by dividing directly-observed step counts by bout duration. A quadratic regression model was used to derive cadence thresholds associated with MET levels. **RESULTS:** Most participants ( $\geq$ 90%) reached intensities  $\geq$ 4 METs during unconstrained and cadence-entrained bouts, whereas  $\leq$ 45% attained  $\geq$ 5 METs. The cadence thresholds for 3 and 4 METs were lower in the cadence-entrained condition by 11 and 5 steps/min, respectively (Table 1). Further, the 3 MET cadence threshold for cadence-entrained walking (84 steps/min) was notably lower than 100 steps/min.

**CONCLUSIONS:** Compared to unconstrained walking or other walking conditions examined in previous studies, these data indicate that a lower cadence is needed to attain a given level of absolutely-defined intensity during cadence-entrained walking. Such differences in the cadence-intensity relationship may need to be considered when using music to prescribe cadences associated with desired walking intensities.

## EFFECTS OF ACUTE STATIC AND BALLISTIC STRETCHING ON COUNTERMOVEMENT VERTICAL JUMP PERFORMANCE

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Acute static stretching has been shown to be detrimental to maximal muscle performance, such as in a countermovement vertical jump (CMJ), while the effect of ballistic stretching on maximal performance remains unclear. **PURPOSE:** To determine if static and ballistic stretching prior to a maximal CMJ affects maximum velocity of the center of mass (MV), peak power (PP), rate of force development (RFD), peak force (PF), maximum work (MW), and vertical jump height (VJ).

**METHODS:** Twenty-two recreationally active college-aged males (n=13) and females (n=9) ( $21.9 \pm 2.8$  yr,  $73.7 \pm 12.4$  kg,  $1.72 \pm 0.08$  m) performed a five-minute submaximal warm up on a cycle ergometer, immediately followed by no stretching (C), static stretching (S), or ballistic stretching (B) of the quadriceps, hamstrings, gluteus, and gastrocnemius muscle groups. The three conditions were performed by each participant on separate days in random order. A twenty-five-minute waiting period followed stretching to mimic the time between a warm-up and sports performance. The subjects then completed three maximal countermovement jumps on an AMTI force plate while using a Vertec to measure vertical jump height. AMTI BioAnalysis software was used to obtain MV, PP, PF, and MW. RFD was calculated using a spreadsheet program as the change in force over change in time every 40 ms. Multivariate analysis of variance was used to compare the dependent variables across the three stretching conditions. **RESULTS:** No statistically significant differences were found between C, B, S conditions for MV ( $2.75 \pm 0.30$ ,  $2.72 \pm 0.31$ ,  $2.74 \pm 0.30$  m·s<sup>-1</sup>, p=0.680), PP ( $3818 \pm 1137$ ,  $3779 \pm 1185$ ,  $3803 \pm 1196$  W, p=0.764), RFD ( $8407 \pm 3833$ ,  $8164 \pm 3470$ ,  $8003 \pm 3201$  N·s<sup>-1</sup>, p=0.719), PF ( $944.6 \pm 276.8$ ,  $933.0 \pm 286.3$ ,  $957.8 \pm 280.2$  N, p=0.514), MW ( $398.1 \pm 112.4$ ,  $380.0 \pm 136.0$ ,  $420.0 \pm 131.4$  Nm, p=0.253), or VJ ( $0.495 \pm 0.107$ ,  $0.483 \pm 0.114$ ,  $0.472 \pm 0.102$  m, p=0.143). **CONCLUSION:** The results indicate that CMJ performance was neither impaired nor improved by static or ballistic stretching. This suggests the twenty-five-minute waiting period may have diminished the effects of stretching on performance.

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## COMPARISON OF DIFFERENT METHODS USED TO ASSESS BODY COMPOSITION IN COLLEGE AGES ATHLETES

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With the prevalence of obesity increasing to almost 40% as of 2016 and the vast amount of health complications known to be associated with being overweight or obese, knowing one's body composition is increasingly important. The American College of Sports Medicine has recommended values for % body fat that places individuals into different categories (from very lean to very poor), based on sex and age. However, these categories of % body fat are based on the use of Skinfold Thickness measurements. There are now numerous ways in which to assess body composition and we don't know the variability that may exist between these methods.

**PURPOSE:** The purpose of this study was to compare the most common methods of measuring body composition that are currently being used today in order to determine- 1) how much of a difference exists between the different techniques, and 2) the relationship of the different methods of measuring body composition. **METHODS:** Thirty-nine healthy males (age=20 $\pm$ 2 yrs; body weight=97.38 $\pm$ 21.26 kg; height=1.79 $\pm$ 0.06m) had their body composition assessed five different ways. Prior to each testing day subjects completed a 10-12 hour fast, did not exercise, and had a Urine Specific Gravity of <1.02. Body composition assessments included skinfold (SF) thickness (Lange Skinfold Caliper), Dual Energy X-Ray Absorptiometry (DXA; GE Advanced Prodigy DXA Encore V17 Software), Ultrasound Thickness (US; BodyMetrix), Bioelectric Impedance (BIA; Tanita Body Composition Analyzer, BF-350), and Underwater Weighing (UWW; Exertech Floatweight System). **RESULTS:** Body fat % for US was 17.62 $\pm$ 6.82%, SF 17.69 $\pm$ 7.59%, UWW 21.94 $\pm$ 8.97%, BIA, 23.64 $\pm$ 7.74%, and DXA 24.98 $\pm$ 8.63%. In comparison to DXA, % fat was significantly greater than US, SF, and UWW ( $p<0.000$ ). In respect to the relationship to DXA, correlations ranged from .873 (DXA vs. BIA  $p=0.000$ ) to .957 (DXA vs SF  $p=0.000$ ). **CONCLUSIONS:** These results suggest that a difference in body fat up to 7.36% can be observed between the different methods assessed. However, the relationship between the different methods is fairly strong. Due to the large variability observed in the different body composition methods assessed, it would suggest the need for a standard of recommended values based on the body composition assessment utilized.

**PERCEIVED PHYSICAL ACTIVITY IN CHILDREN: DOES SEX PLAY A ROLE IN PEDIATRIC POPULATION?**

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Boston Children's Hospital Orthopaedics and Sports Medicine, Boston, MA, The Micheli Center for Sports Injury Prevention, Waltham, MA, Harvard Medical School, Boston, MA.

**PURPOSE:** Global health recommendations suggest school aged children accumulate 60 minutes of moderate-to-vigorous physical activity (MVPA) per day. Many parents perceive their children to be physically active, although national statistics report less than 4 in 10 children meet physical activity (PA) recommendations.<sup>1</sup> The primary aim of this study was to determine the association between a pediatric physical activity questionnaire and physical literacy, defined by strength, speed, balance, coordination, and functional movement among children 6-11 years old.

The secondary aim of this study was to investigate effect of sex on MVPA.

**METHODS:** Design: Cross sectional study. Participants: Children 6-11 years enrolled a YMCA summer camp and after school program. Intervention: Play Lifestyle & Activity in Youth (PLAY) questionnaire given to participants and parent/guardian. Validated tests of motor competence included Y-balance, grip strength, vertical jump and V-sit-and-reach, and obstacle course. Physical competency test results were compared to national data when available. Chi-square ( $\chi^2$ ) analyses and independent sample t-test were performed with statistical significance level of  $p \leq 0.05$ .

**RESULTS:** 67 children were enrolled (32 boys and 35 girls,  $8.7 \pm 1.8$  years of ages). 90.7% of parents responded that their children met a minimum of 60 min of MVPA/day compared to 72.7% of children replied that they had a 60 min of MVPA/day. Approximately 53.8% of parent/guardian of boys reported meeting the recommended daily MVPA compared to 46.2% of parent/guardian in girls ( $p=0.883$ ). Similarly, 56.3% of boys answered having the suggested daily MVPA dosage compared with 43.8% of girls ( $p=0.388$ ). In V-sit-and-reach sit test, 80.3% of the cohort was lower than mean scores of the national presidential fitness test.

**CONCLUSION:** Although less than 50% of children nationally participate in the recommended 60 minutes per day of MVPA, our results showed that almost all of the parents and roughly 70% of children perceive that they participate in the recommended 60 mins/day. V-sit-and-reach scores were below national scores for this cohort despite perceived PA levels. Boys showed slightly greater physical activity compared to girls in this young cohort. These findings support increased early identification of children who are deficient in motor competency despite perceived PA levels.

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**Title: THE RELATIONSHIP BETWEEN THE FUNCTIONAL MOVEMENT SCREEN AND BUNKIE TEST**

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**PURPOSE:** The purpose of the proposed study was to determine if the Functional Movement Screen (FMS) was related to the Bunkie Test. **METHODS:** 18 males and 19 females between the ages of 18 and 26 participated in this study. Subjects were healthy with no previous musculoskeletal injuries, as determined by a pre-participatory questionnaire and informed consent form. Subjects complete the FMS followed by the Bunkie test. **RESULTS:** The correlations between the total FMS scores and the Bunkie positions ranged from -.033 to .312. This yielded no significant ( $p > .05$ ) correlations. However, correlations did occur between individual FMS test scores and the five Bunkie positions. Significant ( $p < .05$ ) positive correlations were found between the Hurdle Step and Posterior Stabilizing Line; and the Trunk Stability Push Up was correlated with the Anterior Power and Medial Stabilizing Lines. Significant ( $p < .05$ ) negative correlations were found between Shoulder Mobility and both Lateral and Medial Stabilizing Lines. **CONCLUSION:** The Bunkie test is a tool designed with the intent to identify myofascial dysfunction while the FMS is utilized to assess movement quality in subjects. Although the current study did find some relationship between the individual FMS tests and the Bunkie test assessments, more research is needed with larger sample sizes.

**ESTIMATING FREE-LIVING PHYSICAL ACTIVITY USING A WRIST-WORN ACTIGRAPH ACCELEROMETER: CAN IT BE DONE?**

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Despite the proliferation of wrist-worn accelerometers to assess moderate-to-vigorous physical activity (MVPA), estimating MVPA performed in free-living settings using wrist acceleration remains a challenge. **PURPOSE:** Determine the accuracy of wrist-worn ActiGraph GT3X+ accelerometer (AG) data processing models and examine relationships among model features and type of MVPA.

**METHODS:** Forty-eight participants wore an AG on their non-dominant wrist during four, 1-hour sessions in free-living settings. Sessions were video-recorded and coded using a direct observation (DO) system that provided criterion measures for minutes and type of MVPA. Four previously developed AG processing models were applied to estimate MVPA minutes: raw acceleration and arm angle cut-point (sed-sphere), Euclidean norm corrected for gravity (ENMO) cut-point, random forest (RF) and decision tree (DT) models. Mixed models were used to assess the difference between model estimates and DO measured MVPA minutes. Principle components analysis (PCA) was used to examine features of the AG data that were associated with type of MVPA. **RESULTS:** DO identified 12.8 minutes of MVPA/session. Sed-sphere was the only model to accurately estimate MVPA minutes (bias [95% confidence interval] = 1.0 [-0.4, 2.5] minutes). MVPA was overestimated using RF and DT (5.9 [3.3, 8.5] and 4.0 [2.4, 5.6] minutes, respectively) and ENMO significantly underestimated MVPA minutes (-10.7 [-12.9, -8.4] minutes). PCA showed that two principle components account for 89.4% of the variance in MVPA type (64.4% and 25.0%, respectively; figure 1). The first principle component placed equal weight on three features (mean, standard deviation of acceleration vector magnitude and standard deviation of arm angle) while the second loaded on mean arm angle. **CONCLUSION:** Sed-sphere was the only model to accurately estimate minutes of MVPA. PCA indicates that arm angle estimates aspects of MVPA beyond acceleration vector magnitude, and future research should use that feature.

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Using a 3D-Accelerometer to Enhance Fitness Assessment.

**Authors**

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**PURPOSE:**

Traditional fitness evaluations utilize a standard battery of assessments to quantify fitness to a single value. However, devices such as triaxle accelerometers (TM) provide the potential for tracking human movements in 3D. The purpose of this inquiry was to establish how a TM can be used to provide a more robust measure of fitness.

**METHODS:**

Subjects (N=2) wore a Heart Rate (HR) monitor & TM while performing 4 different movement tasks (squat (SQ), pushup (PU), cross crunch (CC) & rowing (RW)) at 40-60% of predicated max. Values for workload (WL), Exercise HR (EHR) and acceleration (Ac) was collected. 20 sec intervals of consistent Ac values were selected then used to determine: mean (M), standard deviation, and correlation (R). Due to the observational nature of the collected data, a descriptive analysis was completed and the highest values reported.

**RESULTS:**

Subjects: S1: 32 yo, 187lbs (BW); S2: 53 yo, 150lbs (BW). PU: S1: EHR:95 bpm, WL:BW, Z-Ac ( $M=0.96G$ , +/- 0.07); R-YZ (0.16); S2: EHR:115 bpm, WL:BW Y-Ac ( $M=0.38G$ , +/- 0.09); R-XY (0.44); RW: S1: EHR:127bpm, WL:32 m/s, Z-Ac ( $M=0.25G$ , +/- 0.45); R-YZ (0.72); S2: EHR:119 bpm, WL: 27m/s, Z-Ac ( $M=0.09G$ , +/- 0.30); R-XY (-0.52); SQ: S1: EHR:132bpm, WL:80lbs, Z-Ac ( $M=0.63G$ , +/- 0.29), R-XY (-0.22); S2: EHR:114bpm, WL:60lbs Z-Ac ( $M=0.30G$ , +/- 0.14); R-YZ (-0.42). CC: S1: EHR:110 bpm, WL:BW, X-Ac ( $M=-0.02G$ , +/- 0.05); R-YZ=-0.20); S2: EHR:110 bpm, WL:BW, X-Ac ( $M=0.05G$ , +/- 0.11); R-YZ=-0.36)

**CONCLUSION:**

Task comparisons revealed that subjects exemplified different 3D Ac values. For most conditions S1 displayed a Z-Ac that was consistently coupled Y-Ac. In contrast, S2, displayed varied Ac with each task, but demonstrated X-Ac pairings in PU & RW. These values suggest S1 utilizes flexion and extension motions to complete a given task; while S2 has instability in upper body tasks. In sum, Ac values provide more robust insights to motion and could potentially be used to enrich traditional fitness assessments.

## THREE-DIMENSIONAL MULTIPLE OBJECT TRACKING'S ROLE IN INJURY INCIDENCE REDUCTION IN COLLEGIATE ATHLETICS

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Three-dimensional multiple object tracking (3D-MOT) has been proposed as a training tool for processing dynamic events such as sports activities, and has been hypothesized to reduce athletic injuries through increased awareness of player movement. **PURPOSE:** The purpose of this study was to determine if 3D-MOT is an effective intervention to minimize the risk of injury in collegiate ice hockey and lacrosse. **METHODS:** 78 NCAA Division III ice hockey and lacrosse players volunteered for a season-long investigation. Players were assigned to a 3D-MOT training intervention (3D-MOT; n=38) or a control group (C; n = 40). 3D-MOT training gains were measured by mean speed threshold (m/s) obtained from Core training sessions and were analyzed using paired t-tests. Athletic trainers (ATs) attended school-sanctioned team conditioning sessions, practices, and competitions from which injury data was collected.

Repeated measures analysis of variance (RM-ANOVA) were performed to compare total number of injuries over time and between groups (3D-MOT and C). Two additional RM-ANOVA were performed to explore if 3D-MOT training decreased the number of injuries over time based on injury mechanism (i.e., contact vs. non-contact). **RESULTS:** The mean speed threshold significantly increased from the first Core session to the last Core session ( $p=0.000$ ). The total number of injuries significantly decreased over the course of the season ( $p=0.002$ ). When comparing the 3D-MOT to C, there was no significant difference in the total number of injuries ( $p=0.293$ ). For those injured at baseline, the total number of injuries also significantly decreased over time ( $p=.002$ ) though the 3D-MOT intervention had no effect on the number of injuries in athletes injured at baseline ( $p=.204$ ). The 3D-MOT intervention did not have an effect on mechanism of injury, however both contact ( $p=.016$ ) and non-contact injuries ( $p=.013$ ) significantly decreased over time (length of season). **CONCLUSION:** Motion perception training with 3D-MOT did not decrease injury incidence in NCAA Division III men's and women's ice hockey and lacrosse athletes compared to controls. NCAA Division III men's and women's ice hockey and lacrosse athletes experience fewer injuries, both contact and noncontact, as their seasons' progress.

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**A LINEAR PERIODIZED RESISTANCE TRAINING PROGRAM REDUCES DEPRESSIVE SYMPTOMS IN FEMALES: A PILOT**

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**PURPOSE:** The purpose of this study was to determine whether a periodized resistance training program would have an effect on patient-reported depression and/or anxiety scores in college-aged females.

**METHODS:** Eight subjects participated in a six-week periodized resistance training program. During the initial visit, subjects completed a Beck Depression Inventory (BDI) and a Beck Anxiety Inventory (BAI) to determine baseline values. The subjects completed a 3-5 repetition maximum (3-5 RM) for the sumo deadlift (SDL), bench press (BP), barbell back squat (BBS), and standing shoulder press (SSP). This data was used to estimate the 1 repetition max, which in turn was used to develop the periodization program. Following baseline testing, subjects participated in two full-body workouts per week for six weeks. The subjects were retested after they completed the six week program, performing 3-5 RM for the SDL, BP, BBS, and SSP. The subjects were asked to once again complete the BDI and BAI. A repeated measures 2 x 2 Analysis of Variance (ANOVA) was used to determine the effect of each resistance training activity had on the outcome measures. **RESULTS:** There was a significant ( $P \leq .05$ ) decrease in BDI scores after the six-weeks of resistance training. There was no statistical significant difference in the BAI scores ( $P = .106$ ). There was no correlation between any individual exercise and the outcome scores. **CONCLUSIONS:** The results of the current study indicate that a periodized resistance training program is effective at reducing self-reported measures of depression using the BDI.

## UNDERLYING KINETICS OF THE FIRST STEP DURING GAIT INITIATION IN THE DYSVASCULAR TRANSTIBIAL AMPUTEE

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Dysvascular transtibial amputees are the most sizeable and growing population in America. Though gait initiation is well understood in healthy adults, few studies have been carried out in transtibial amputees. Moreover, no studies have focused solely on gait initiation in the dysvascular transtibial amputee population. Gait initiation precedes every walking bout, is part of almost all activities of daily living and poses important constraints to balance as individuals must shift from bi-pedal to mono-pedal stance, from static to forward motion. **PURPOSE:** The purpose of the present study was to compare the underlying kinetic differences of the first step in gait initiation of dysvascular transtibial amputees with those of healthy age-matched controls. **METHODS:** Ten dysvascular transtibial amputees and ten controls participated in this study consisting of five gait initiation trials with the right limb, from quiet standing to steady-state walking velocity, followed by five gait initiation trials with the left limb. Kinetic and kinematic data was recorded for seven parameters. **RESULTS:** A reduced steady-state walking velocity was observed in the dysvascular transtibial amputee ( $1.07 \pm 0.2$  m/s vs.  $1.30 \pm 0.2$  m/s in control subjects;  $p=0.03$ ), as expected due to the increased braking force ( $-0.3 \pm 0.2$  N/kg vs.  $-0.5 \pm 0.3$  N/kg;  $p=0.03$ ) and reduced propulsive impulse ( $2.0 \pm 0.9$  N•s/kg vs.  $3.9 \pm 0.6$  N•s/kg;  $p=0.03$ ) observed in the prosthetic limb when compared to controls. The propulsive impulse possible by the prosthetic limb makes evidence of gluteal contribution to gait initiation propulsion in the first step, in the absence of the gastrocnemius-soleus muscle complex. Additionally, no difference was observed between intact and control limb vertical force ( $91.2 \pm 7.1$  vs.  $96.8 \pm 4.1$  N/kg, respectively;  $p=0.18$ ). This may be a protective mechanism in the dysvascular transtibial amputee, leading to reduced osteoarthritis risk in the intact limb. **CONCLUSIONS:** These results corroborate the notion of ‘careful’ gait initiation in the dysvascular transtibial amputee, as stability is favored over propulsion, contributing to a reduced steady-state walking velocity. The implications of these findings make proof that gait initiation leading with both limbs should be an avid focus in dysvascular transtibial amputee rehabilitation, as this complex motor task is a critical component of daily living and function.

## CADENCE AS A PREDICTOR OF THE WALK-TO-RUN TRANSITION

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Cadence (steps/min) is strongly related to physical activity (PA) intensity. Researchers have demonstrated that 100 and 130 steps/min are useful heuristic indicators of moderate and vigorous intensity PA, respectively. Preliminary evidence suggests that a cadence of 140 steps/min is associated with the walk-to-run transition (W2R). However, these cadence thresholds do not take into consideration leg length.

Alternatively, the Froude number is used to compare the similarities of locomotion across individuals by incorporating leg length, and provides a theoretical prediction of the W2R at a value of 0.5. **PURPOSE:** To examine whether 140 steps/min is a more accurate predictor of the W2R than a Froude number of 0.5. **METHODS:** 28 healthy adult participants (20 men, 8 women; age  $22.6 \pm 1.9$  years, height  $172.5 \pm 11.8$  cm, weight  $79.3 \pm 18.8$  kg) completed an incremental treadmill protocol consisting of 5-minute trials during which speed increased by 0.5 mph per trial from 0.5-6.0mph. Participants could choose to run or walk each trial, and the protocol was terminated following the first trial at which the participant chose to run.

The analytic sample consisted of two trials for each participant (the running trial, and the walking trial immediately prior) to identify the W2R transition. Cadence was derived by dividing step counts measured by direct observation (hand tally) by 5 minutes. Froude numbers were calculated as  $\text{Froude} = v/(gd)^{1/2}$ , where  $v$ =walking velocity,  $g$ =gravity, and  $d$ =leg length. W2R sensitivity and specificity were calculated.

**RESULTS:** A cadence of 140 steps/min predicted the W2R with a sensitivity of 85.7% and specificity of 100%. A Froude number of 0.5 predicted the W2R with a sensitivity of 35.7% and a specificity of 96.4%.

**CONCLUSION:** A cadence of 140 steps/min was a more accurate predictor of the W2R than a Froude number of 0.5. A cadence of 140 steps/min may be a useful threshold for identifying running behaviors in free-living accelerometer-based data.

Supported by NIH/NIA Grant 5R01AG049024 – CADENCE-Adults study

## TROPOMYOSIN-BASED EFFECTS OF ACIDOSIS ON THIN-FILAMENT REGULATION DURING MUSCLE FATIGUE

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Skeletal muscle fatigue is defined by a loss in the force/power generating capacity of muscle. A portion of the loss in function is attributable to a decrease in activation due to a decrease in sensitivity to calcium ( $\text{Ca}^{++}$ ), but the mechanisms underlying this decrease in  $\text{Ca}^{++}$ -sensitivity are unclear. The exercise-induced decrease in muscle pH (i.e. acidosis) has been hypothesized to play a significant role in this effect. **PURPOSE:** To gain insight into the potential molecular mechanisms underlying the acidosis-induced decrease in  $\text{Ca}^{++}$  sensitivity, and therefore its role in fatigue, we manipulated specific amino acid residues of the muscle regulatory protein tropomyosin to determine its role and the mechanisms. We hypothesized that altering the two histidine amino acids would affect the sensitivity to  $\text{Ca}^{++}$ -sensitivity of regulated thin filaments in an *in vitro* motility assay, because these residues gain a positive charge at low pH.

**METHODS:** We measured the velocity of actin filaments, reconstituted with the regulatory proteins troponin and tropomyosin (RTF), moving over a bed of myosin molecules in an *in vitro* motility assay. This was done as a function of increasing  $\text{Ca}^{++}$  concentrations at both normal (pH 7.4) and a muscle pH experienced during fatigue (pH 6.8). We performed this assay using the normal tropomyosin in muscle, and with tropomyosin molecules that either had one or two histidine residues replaced with alanine residues to test the hypothesis that acidosis-induced charge change of the histidine amino acid governs tropomyosin's pH-dependent decrease in  $\text{Ca}^{++}$ -sensitivity (WT, H153A, H276A, H153A/H276A). **RESULTS:** As expected RTF velocity was significantly reduced by the decrease in pH, particularly at saturating levels of  $\text{Ca}^{++}$  activation ( $p<0.05$ ). However, there were no significant differences in  $\text{Ca}^{++}$  sensitivity between the acidosis-induced decrease in velocity for any of the altered tropomyosin molecules ( $p>0.05$ ).

**CONCLUSIONS:** These data suggest that the acidosis-induced increase in positive charge to the histidine residues on tropomyosin do not mediate the acidosis-induced depression in the  $\text{Ca}^{++}$ -sensitivity of velocity. Thus, this may indicate that charge alterations in tropomyosin do not contribute to the acidosis-induced depression in muscle velocity during fatigue.

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## THE EFFECTS OF HOT EXPOSURE ON NON-OXIDATIVE EXERCISE PERFORMANCE IN MALES AND FEMALES

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**PURPOSE:** This study was designed to determine if a hot environment will affect non-oxidative performance and if gender differences exist among lactate, plasma volume, mean power, peak power, and relative power in recreationally active subjects between the ages of 18 and 26 years.

**METHODS:** Subjects (7 male, 8 female) completed a 5 min warmup, followed by series of 5, 6 sec sprints, separated by a 1.5 min active recovery. The last 1.5 min recovery was followed by one 30 s Wingate Anaerobic Test (Wingate). Subjects were randomly assigned to either a hot or neutral environment for the first testing session. Prior to the testing sessions, was a familiarization session, at this time one 30 sec Wingate was performed. Lactate and plasma volume were measured at baseline ( $T_1$ ), following the last 6 second sprint ( $T_2$ ), and post Wingate ( $T_3$ ). Peak, mean, and relative power were recorded after the 30 sec Wingate. **RESULTS:**

Lactate was significantly different across all time points regardless of gender and environment. A two-way interaction was observed between time and gender in regard to plasma volume. Plasma volume increased from  $T_1$  to  $T_2$  and decreased from  $T_2$  to  $T_3$ . Females had a greater shift in plasma volume compared to males from  $T_1$  to  $T_2$ . The main effect, gender was significant in regard to plasma volume, females had greater mean plasma volume shift compared to males ( $M_F = 3.26$  vs  $M_M = 2.99$ ). No significant difference was observed in mean, peak or relative power in regard to the main effect environment, the hot environment did not positively impact power output. A significant gender difference was observed in mean power and peak power. Males had greater mean power compared to females regardless of environmental condition ( $M_M = 660.86$  w vs  $M_F = 400.25$  w;  $p < .05$ ). Males also had a greater peak power compared to females regardless of environmental condition ( $M_M = 740.14$  w vs  $M_F = 542.06$  w;  $p < .05$ ). **CONCLUSION:** The current study found that power output declined in the hot environment, when mass is considered no gender differences were observed in regard to power.

Supported by: Dr. Headley

## **RESTING AND EXERCISE HEMODYNAMIC CHANGES WHEN YOUNG SEA LEVEL INDIVIDUALS ARE EXPOSED TO ALTITUDE (11,237ft)**

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Hypertension is a major risk factor for cardiovascular disease, and is present in 46% of the US adult population. An increase in one's blood pressure (BP) (~10mmHg) has been observed when individuals are exposed to altitude for 10-12 months. Less is known of the acute effect on BP in young healthy individuals when exposed to altitude. PURPOSE: The purpose of this study was to observe BP changes during rest and exercise in normotensive sea level (SL) individuals after 24 and 96 hours of altitude exposure (11,237ft). METHODS: Nine college students were asked to participate in five trials. Trials 1&2 determined their VO<sub>2max</sub> and 60% HRR workload (WL) at SL, respectively. Trials 3-5 assessed BP, O<sub>2</sub> saturation, heart rate and double product (DP = ((SBP\*HR)/100)) during rest and submaximal exercise. Trial 3 was completed at SL and trials 4&5 were completed at 11,237ft after 24 and 96 hours of altitude exposure. RESULTS: 5 males and 4 females; age=21.9±1.4 y; weight=72.3±14.3 kg; height=174.2±6.1 cm; VO<sub>2max</sub>=43.6±8.3 ml/kg/min, completed the study. Oxygen saturation decreased ( $p=0.00$ ) during rest and exercise at 24h (89±1.68%, 82±2.5%) and 96h (90.3±0.75%, 83.6±0.21%) vs SL (97.7±0.45%, 95.8±0.82%), respectively. Heart rate increased at rest ( $p=0.00$ ) and exercise ( $p<0.05$ ) at 24h (77.2±7.9 bpm, 160.5±3.6 bpm) and 96h (73.5±10 bpm, 155.5±2.2 bpm) vs SL (65.9±8.5 bpm, 139±1.8 bpm), respectively. Resting SBP increased ( $p<0.05$ ) at 24h (119.5±9.5 mmHg) and 96h (122.2±11.6 mmHg) vs SL (115.9±10.9 mmHg). Resting DBP increased ( $p<0.05$ ) at 24h (78.5±8.5 mmHg) and 96h (80.5±8.9 mmHg) vs SL (71.3±9.6 mmHg). Exercise SBP increased ( $p<0.05$ ) at 96h vs SL (160.6±15.6 to 153.4±16.5 mmHg), respectively. Resting DP increased ( $p=0.00$ ) at 24h (91.4±9.6) and 96h (91±12.5) vs SL (77±10). Exercise DP increased ( $p<0.05$ ) at 24h (254.2±8.2) and 96h (249.6±10) vs SL (214.4±10). CONCLUSION: These results demonstrate that when sea level individuals are acutely exposed to altitude (11,237ft), there is a significant decrease in O<sub>2</sub> saturation, and a significant increase in HR, BP and DP after 24h and up to 96h. These hemodynamic changes are attainable in young healthy individuals, but could be concerning in individuals with documented CVD or at high risk for CVD.

## THE IMPACT OF OVERHYDRATION ON ENDURANCE PERFORMANCE

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During long-term endurance events, adequate fluid intake and maintaining electrolyte balance is essential for sustaining steady state exercise and avoiding a decrement in performance. Yet, excessive water consumption, in the absence of electrolyte supplementation, may lead to overhydration, decreases in  $[Na^+]$ , and ultimately cause exercise-associated hyponatremia (EAH). **PURPOSE:** The purpose of the study was to assess if significant changes occurred in urine  $[Na^+]$  over the course of a 90-minute exercise bout in response to consuming a given amount of water. **METHODS:** Trained males ( $n = 4$ ; age =  $32.25 \pm 4.77$  yrs) and females ( $n = 4$ ; age =  $24.25 \pm 0.96$  yrs) completed the study. Subjects underwent two fluid consumption protocols, a control (CON) and an overhydration (OH) protocol. Exercise testing included two, 90-minute exercise bouts on a treadmill at 75-85% of his/her  $\dot{V}O_{2\text{peak}}$  while consuming water ad libitum (CON) or at a rate of 3.5 ml per kg of body weight (OH). Urine  $[Na^+]$  was measured at baseline and immediately post exercise; urine  $[Na^+]$  was calculated every 12 minutes throughout the exercise bout using a predictive equation developed by Montain, Cheuvront, and Sawka (2006). **RESULTS:** No significant interaction ( $p > 0.05$ ) was found to exist between fluid treatment methods and gender; approximately, 48% of the variance in the change in urine  $[Na^+]$  may be explained by the interaction between gender and fluid consumption treatment. Males experienced the greatest change in urine  $[Na^+]$  during OH ( $-10.40 \pm 7.15$  mEq/L) compared to CON ( $-0.52 \pm 0.35$  mEq/L) and females during OH ( $0.38 \pm 7.99$  mEq/L) and CON ( $-0.81 \pm 10.44$  mEq/L). Despite the lack of significance ( $p = 0.057$ ), a decreasing trend in urine  $[Na^+]$  was identified. **CONCLUSION:** While no statistical significance was found, consumption of 3.5 ml/kg of body weight is indicative of a trend leading toward the onset of EAH; one male and female subject experienced the onset of EAH at the 90-minute mark of exercise. If water is consumed at a self-selected pace, equal to the rate of excretion, during prolonged endurance exercise EAH and a decrease in  $[Na^+]$  may be prevented.

Supported by: Springfield College Graduate Student Research Grant

## **Effects of Varied Percentage Body Weight Carriage on Stride Length, Stride Rate and Percent Variance**

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By utilizing equipment and specialized techniques, people have adapted to carrying loads equal to or exceeding their bodyweight (BW). **PURPOSE:** The purpose of this study was to examine the impact of carrying weight based on percentage BW on stride length (SL), stride rate (SR) and percent variance (PV). **METHODS:** Eighteen (N=18) individuals (nine males and nine females) ranging in age from 18 to 22 yrs participated in the study. Their BW were taken and used to calculate 10%, 15%, and 20% of their BW for the weight added to a backpack. A ZENO gait mat using PKMAS software measured subject gait data. Each subject crossed the gait mat three times in random order with no weight, 10% BW, 15% BW and 20% BW, crossing the gait mat a total 12 times. The gait mat recorded data for SL, SR and PV. **RESULTS:** The average SL in centimeters (cm) for males, females and all participants were 130.48, 132.99 and 131.73 respectively with a significance of  $p=0.033$ . SR for males, females and all participants were 115.75, 119.76 and 117.75 with a significance of  $p=0.0002$ . PV for males, females and all participants were 3.70, 2.48 and 3.07 with a significance of  $p=0.996$ . Both SL and SR decreased with increased load weight. SL showed significant differences between the no weight and 15% protocols ( $F = 3.14$ ,  $df = 3$ ,  $p = 0.032$ ). SR showed significant differences between no weight and all loads ( $F=7.82$ ,  $df=3$ ,  $p=.0002$ ). There was no PV difference in stride between the four protocols. **CONCLUSIONS:** The data showed that as weight increased, SL and SR decreased. Subjects took shorter steps at a slower rate to maintain balance and walking efficiency. There were significant differences between the no weight protocol and the weighted protocols. Added weight impacts SL regardless of percent BW. The SR decreased as load increased to keep the center of gravity of the foot. PV showed no difference in the subjects' walking pattern. There was no difference in heel on or toe off stage nor effects on forward and backward sway, nor side to side movement.

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## INFLUENCE OF MENTHOL DOSE ON BODY TEMPERATURE REGULATION, PERCEPTION, AND ENERGY EXPENDITURE

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**PURPOSE:** To assess the influence of High (H, 4.13 %), Medium (M, 2.0 %) and Low (L, 0.1 %) doses of menthol on thermoregulation, perception, and energy expenditure, compared to a Placebo Condition (P).

**METHODS:** This study received approval from the Salem State University Institutional Review Board. Sixteen participants underwent the aforementioned conditions on four separate days. During each test participant's rested supine in thermoneutrality (30°C, 50% rh) for 30-min before 40mL of L, M, H or P gel was applied to the anterior upper body surface. Participants rested 30-min thereafter. Measures included thermal sensation (TS), thermal comfort (TC), irritation (IRR), rectal temperature (Tre), skin temperature (chest, forearm, thigh, calf), and EMG measured at the trapezius, pectoralis major, and sternocleidomastoid (as a surrogate of shivering). Energy expenditure and brown adipose tissue activation were measured indirectly using supraclavicular skin temperature and metabolic measures (VO<sub>2</sub>, VCO<sub>2</sub>, RER, Vt). The area under the curve (AUC) from minute 30 to 60 was compared between conditions using parametric/non-parametric tests as appropriate, with *post-hoc* testing to identify directionality (alpha level = 0.05).

**RESULTS:** A cooling trend in Tre was observed following Placebo gel application, but this significantly ( $p<0.0001$ ) reversed into a heat storage response with medium and high menthol doses. Both TS and TC significantly differed by condition ( $p=0.0108$ ) in a dose-dependent manner, with L, M, and H doses eliciting significantly cooler sensations and more discomfort than P, respectively ( $p<0.05$ ). Irritation significantly differed by condition ( $p=0.0014$ ) in a dose-dependent manner, with L and M eliciting significantly greater irritation than P ( $p<0.05$ ), respectively. No other differences were observed.

**CONCLUSION:** Menthol induced a small but significant dose-dependent heat storage response. This occurred whilst participants felt significantly cooler, despite no change in skin temperature. This can be attributed to menthol-mediated activation of the TRPM8 cold receptor. Menthol also caused greater irritation and thermal discomfort, implicating activation of pain pathways. But in all of the above observations, doubling the menthol dose did not double the observed responses. This raises questions about factors other than dose that influence menthol's forcing function, including body surface area and body region exposed to menthol.

Study supplies were donated by Performance Health LLC (Warrenville, IL, USA).

**THE EFFECTS OF AEROBIC, RESISTANCE, AND INTEGRATED CONCURRENT EXERCISE ON BLOOD PRESSURE AND ARTERIAL STIFFNESS**

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**PURPOSE:** The purpose of this study was to investigate the acute peripheral and central blood pressure, and arterial stiffness (augmentation index) responses following an aerobic, resistance, and integrated concurrent exercise sessions.

**METHODS:** Ten resistance trained males ( $M = 20.8 \pm 1.69$ ) performed aerobic exercise (AER), resistance exercise (RES), and integrated concurrent exercise (ICE) sessions in random order following a familiarization session. The AER session consisted of 45 min of stationary cycling at 70% HR<sub>res</sub> ( $M = 156.13 \pm 2.93$  cpm), while the RES and ICE sessions consisted of the performance of 5 resistance exercises preceded by 2 min of seated rest or stationary cycling at 70% HR<sub>res</sub> respectively. Cardiovascular parameters including central and peripheral systolic and diastolic blood pressures (cSBP, cDBP, pSBP, and pDBP respectively) and augmentation index (AIx) were collected prior to and 0, 15, 30, 45, and 60 minutes post exercise with pulse wave analysis using the Sphygmocor Xcel System.

**RESULTS:** No significant interaction or main effect for condition was found for any of the dependent variables. Significant differences were found for time across the dependent variables cSBP, pSBP, and AIx ( $p \leq .05$ ). These differences represented typical physiological responses to exercise. Augmentation index was significantly elevated following RES 0 and 15 minutes post exercise ( $p \leq .05$ ) but was not found to significantly increase following AER or ICE.

**CONCLUSION:** In conclusion, integrated concurrent exercise resulted in similar acute cardiovascular responses compared to aerobic and resistance exercise.

**EFFICACY OF A RECESS-BASED INTERVENTION ON ACADEMIC AND HEALTH OUTCOMES IN ELEMENTARY SCHOOL CHILDREN**

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Both cardiorespiratory and muscular fitness are important for overall health and may benefit academic related outcomes in children. However, few intervention studies have examined the impact of an intervention that has emphasized both cardiorespiratory and muscular fitness training on academic or cognitive outcomes. Furthermore, school recess may be an ideal time to promote physical activity and fitness and has been a relatively understudied setting in relation to youth fitness and academic performance. **PURPOSE:** To evaluate the preliminary efficacy of a 3-month recess-based combined fitness intervention (INT; consisting of both aerobic and muscular fitness activities) on cognition (inhibition and working memory), classroom behaviors (engaged and off-task behaviors), fitness (cardiorespiratory and muscular), and moderate to vigorous physical activity (MVPA) in elementary school-age children. **METHODS:** Schools ( $n=2$ ) were randomized to either the INT ( $n=27$ , sex: 66.7% male, age:  $8.8 \pm 0.1$  years) or control group (CON;  $n=27$ , sex: 42.3% male, age:  $9.4 \pm 0.1$  years). Baseline and post-intervention measures included a flanker test (inhibition/attention), list sorting test (working memory), classroom behavior observation (on- and off-task behaviors), 20-meter shuttle run (cardiorespiratory fitness), muscular fitness battery (muscular fitness), and accelerometry (MVPA). Process evaluation measures were recorded daily, weekly, and post-intervention. To assess the effect of the intervention, ANCOVA models adjusted for baseline score, age, and other covariates were used. An independent samples *t*-test was used to compare percent of time spent in MVPA during recess between schools. **RESULTS:** Percent of time spent in MVPA during recess was significantly higher in the INT compared to the CON group (INT= $41.7 \pm 2.1\%$ ; CON= $30.4 \pm 0.2$ ,  $p < 0.001$ ). No other significant differences were observed. Although participant enjoyment and INT acceptability was high, the average participation in INT sessions was 19.4% (ranging from 0 to 95.6%). **CONCLUSION:** This pilot study demonstrated some preliminary support that offering a combined fitness program is feasible and can increase percent of time spent in MVPA during recess. Future research is warranted to determine if the INT can impact academic or cognitive outcomes.

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## INFLUENCE OF MENTHOL ON JOINT RANGE OF MOTION

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**PURPOSE:** To use the known topical analgesic menthol to explore the influence of one's perception of muscle tension on joint range of motion (ROM).

**METHODS:** This study received approval from the Salem State University Institutional Review Board. In a familiarization session, 15 participants first completed weight-bearing lunge (WBLT) and active ankle dorsiflexion (AADF) tests (Pre-test) to assess ROM in the soleus-gastrocnemius complex. Participants were always instructed to stretch to a 'maximal tolerable stretch'. They immediately then completed a 6x60s static stretching routine for the ankle plantarflexors, and again completed the WBLT and AADF tests (Post-test). These testing conditions established a control (CONTROL). On two separate occasions participants returned to complete the aforementioned pre-tests, immediately after which they had 5mL of a 4 % menthol gel (M) applied to their soleus-gastrocnemius complex on one visit, and on the other visit they had 5mL of a Placebo gel (P) spread over the same area. Participants then underwent the stretching routine and post-tests as previously described. The following measures were made during each test: ROM, thermal sensation (TS), thermal comfort (TC), and the Hoffman reflex (HR). A two-way RM ANOVA detected differences between time (Pre vs. Post), condition (CONTROL vs. M vs. P), and any interaction, with *post-hoc* testing used to indicate directionality ( $\alpha=0.05$ ).

**RESULTS:** Menthol significantly improved AADF ROM by 2.67 degrees compared to P ( $p<0.001$ ), coinciding with significantly cooler sensations ( $p<0.01$ ) and a loss of thermal comfort ( $p<0.05$ ) with menthol. Similarly, menthol improved WBLT ROM by 2.98 degrees compared to P ( $p<0.01$ ), coinciding with a significant loss of thermal comfort ( $p<0.05$ ) with menthol. No other differences were observed.

**CONCLUSION:** Menthol appears to improve active joint range of motion during stretches that are held to a maximal tolerable tension. This suggests that one's perception of tension *per se*, rather than actual muscle tension, may be more important in determining maximal active joint ROM. It is not clear whether menthol achieves this by specifically reducing one's perception of muscle tension during a maximal stretch, or whether other sensory inputs arising from menthol i.e. TS, TC, divert attention from it.

Study supplies were donated by Performance Health LLC (Warrenville, IL, USA).

## EFFECT OF A NEOPRENE KNEE SLEEVE ON PERFORMANCE AND MUSCLE ACTIVATION DURING A LEG PRESS

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Anecdotal evidence suggests that wearing knee sleeves during lower body resistance training exercise is an effective method for improving performance and possibly reducing injury. There is currently minimal evidence examining whether wearing commercially available neoprene knee sleeves have a positive effect on markers of athletic performance in a recreationally trained population. **PURPOSE:** The purpose of this study was to analyze whether wearing a commercially available neoprene knee sleeve affected repetitions, blood lactate (BL), heart rate (HR), ratings of perceived exertion (RPE), and muscle activation during a leg press exercise. **METHODS:** Nine resistance-trained individuals (seven males and two females; age=21.9±3.3 yrs; mass=78.2±8.7 kg; height=1.7±0.05 m) participated in three testing sessions. All sessions were separated by one week. In the first session, subjects performed 1 repetition maximum (1RM) testing on a leg press machine. In sessions two and three, subjects performed six sets until failure at 80% 1RM with knee sleeves (KS) or without (NKS). The order of the KS and NKS conditions were randomly determined for each subject. Subjects had three minutes of rest between sets and all exercise was preceded by a standardized warm up. BL, RPE, and HR were collected after each set. Surface electromyography (EMG) of the vastus lateralis muscle was recorded to compare muscle activation during KS and NKS conditions. The mean, max and integrated EMG (iEMG) of the middle three repetitions of every set were used for analysis. A one-way repeated measures ANOVA with Bonferroni post-hoc corrections were performed to assess the effect of knee sleeves on BL, RPE, HR, repetitions, and muscle activation. **RESULTS:** No significant differences ( $p\geq 0.05$ ) were seen in both total number of repetitions, number of repetitions per set, BL, HR, and RPE between KS and NKS conditions, within subjects. No significant differences in muscle activation ( $p\geq 0.05$ ) were seen for mean and iEMG. Max EMG was higher in NKS in sets 2, 4, and 5 ( $p=0.027-0.034$ ). **CONCLUSIONS:** These results suggest that wearing compressive neoprene knee sleeves has no effect on improving performance and associated variables during lower body resistance training.

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## HYDRATION AND GENDER DIFFERENCES IN TERMS OF NON-OXIDATIVE PERFORMANCE

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Nonoxidative performance is vital to the performance of many high level athletes (Armstrong, Johnson, McKenzie, Ellis, & Williamson, 2015; Chamari, Chaouachi, & Racinais, 2015). The decrease in performance that accompanies changes in hydration can negatively impact athletes (Cengiz, 2015). **PURPOSE:** The present study examined the effect of hydration status on nonoxidative performance and to examine differences between the genders in terms of nonoxidative performance. **METHODS:** Twelve subjects, 6 males and 6 females, completed three sessions where a Wingate test was performed and lactate was measured. All subjects were NCAA Division III club or varsity athletes. The subjects completed a familiarization trial, a trial in the hypohydrated state and a trial in the hydrated state. The hypohydrated trial was completed after a 12 hr water restriction in order to induce a 2-4% decrease in body weight. No weight was lost prior to the hydrated trial and urine specific gravity was below 1.010. **RESULTS:** No significant difference was found in terms of hydration and nonoxidative performance ( $p = .082$ ). A significant difference was found in terms of gender and nonoxidative performance. Males had a higher nonoxidative capacity (9.01 W/kg + 0.37 vs. 6.58 W/kg + 0.37,  $p = .001$ ), nonoxidative power (13.51 W/kg + 1.12 vs. 9.18 W/kg + 1.12,  $p = .021$ ) and fatigue index compared to females (24.84 W/s + 3.86 vs. 10.28 W/s + 3.86,  $p = .024$ ). **CONCLUSION:** The results from this study indicate that hydration does not influence non-oxidative performance in NCAA Division III club or varsity athletes. These results contradict previous findings that indicated that relative measures of nonoxidative performance did not vary between the genders when represented in relative terms (Maud & Shultz, 1986; Van Praagh, Fellman, Bedu, Falgairette & Coudert, 1990).

## EXPLORATION OF SIT TIME AMONG UNIVERSITY ATHLETES

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Health consequences and prevalence of excess prolonged daily sit time are well established in the literature. However, compared to the general population, highly active populations, including University athletes, have not been sufficiently examined for sedentary. Yet, current search demonstrates that athletes can be both highly active and highly sedentary. **PURPOSE:** The purpose of this study was to determine the average sit time of University athletes, whether there are differences between males and females, as well determine whether there is a correlation between exercise time and sit time. **METHODS:** Sit time data from 192 male and female full-time college athletes age 18-24 were collected from an electronic survey, the Multicontext Sit-Time Questionnaire (MSTQ). Mean sit times were analyzed for differences between total sit time on school days and non-school days, as well as differences between males and females.

Correlation analysis was also completed to determine the relationship between exercise time and sit time. **RESULTS:** Mean total daily sit time for all participants was  $10.47 \pm 2.93$  hours,  $10.85 \pm 2.70$  hours for males, and  $10.07 \pm 3.15$  hours for females. As a percentage of total time awake, the college athletes spent 61% of their waking hours sitting. Results showed no statistically significant difference between school days ( $M = 641.147$ ,  $SD = 196.02$ ) and non-school days ( $M = 613.8$ ,  $SD = 201.51$ ). There was no significant correlation between average total daily sit time and weekly exercise time,  $rs(70) = -0.196$ ,  $p = 0.092$ . Next, there was no significant difference between average total daily sit time between males and females. **CONCLUSIONS:** The outcomes support previous studies that athletes can be both highly active and highly sedentary because exercise was independent of excessive sitting. Future research must focus on determining the prevalence of high total daily sit time among athlete populations, and whether athletes are at a high risk via analysis of cardiometabolic biomarkers, because on average, athletes sit as much or more than individuals defined as physically inactive; therefore, may have a similar level of risk of all-cause mortality and all-cause cardiovascular disease.

**TIME COURSE OF FLUID REGULATORY HORMONES AND THIRST ACROSS WATER DEPRIVATION AND REHYDRATION**

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Total body water regulation is achieved through complex integration of physiological, subjective, and behavioral mechanisms. Physiological mechanisms that include sodium-osmolality-AVP and reninangiotensin II-aldosterone systems regulate drinking behavior in animals and likely thirst perception in humans. Regulators such as copeptin and angiotensin II (AngII), of which high concentrations are related to poor chronic health outcomes, might be directly related to thirst. **PURPOSE:** The purpose of this study was to test the hypothesis that elevated plasma copeptin and AngII concentrations coincide with mild dehydration but not thirst onset. **METHODS:** Healthy males (n=7, 25±5y, 85.8±4.9kg, 176.4±7.0cm) provided thirst ratings (VAS) and blood samples at five timepoints: 1) Day 1 morning during euhydration, 2) upon thirst onset after starting 24h water deprivation, 3) Day 2 morning following completion of 24h water deprivation, 4) after *ad libitum* partial rehydration, and 5) Day 3 after completion of 24h rehydration. Blood was analyzed for plasma osmolality ( $P_{osm}$ ) by freezing-point depression, and for copeptin and AngII by ELISA. Time point differences were analyzed by one-way RMANOVA and post hoc (Sidak) tests. Spearman's rank correlation was used to analyze relationships between thirst and other variables. **RESULTS:**  $P_{osm}$  significantly changed upon 24h water deprivation (8.4±4.9mOsm/kg, p=0.02) but not thirst onset (2.6±5.1, p=0.08).  $P_{osm}$  change upon partial rehydration trended towards significance (- 5.9±5.0, p=0.07), and remained unchanged between partial and full rehydration (0.0±3.4mOsm/kg). Following euhydration, thirst perception onset was statistically discernible (54.3±15.6mm and 84.9±11.8mm, respectively, p=0.01); thirst remained elevated upon 24h water deprivation (86.0±16.7mm), decreased upon partial rehydration (12.9±6.2mm, p=0.001), and trended towards elevation upon 24h rehydration (47.6±27.7mm, p=0.08). Euhydrated plasma copeptin and AngII (4.6±1.5pmol/L and 6.6±6.6pg/mL, respectively) did not change upon thirst onset (4.8±1.8pmol/L and 3.0±6.3pg/mL, respectively), 24h water deprivation (4.7±1.5pmol/L and 4.4±6.1pg/mL, respectively), partial rehydration (4.9±1.7pmol/L and 4.5±6.0pg/mL, respectively), or full rehydration (4.9±1.5pmol/L and 4.5±6.0pg/mL, respectively). Only  $P_{osm}$  change significantly correlated with thirst ( $r=0.49$ ,  $p=0.003$ ). **CONCLUSION:** Preliminary data suggests that during acute water restriction,  $P_{osm}$  may but plasma copeptin and AngII do not correlate with thirst perception. Further, plasma copeptin and AngII did not effectively correlate with hydration state during mild dehydration.

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## ASSOCIATIONS OF PERSONAL, HOME AND FAMILY FACTORS WITH EXERCISE PRESCRIPTION UTILIZATION IN MINORITY WOMEN

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Viewed from a socio-ecological perspective, family and home are important contexts that influence health-promoting behaviors. To date, little is known about home and family factors (e.g. household size, socioeconomic status, home environment) that may affect women's participation in exercise prescriptions in underserved communities. **PURPOSE:** The aim of this study was to explore potential home and family factors as correlates of exercise prescription utilization. **METHODS:** Women ( $\geq 18$  yrs) who had redeemed healthcare provider exercise prescriptions for fitness center access were recruited through a local fitness center in Dorchester, MA (n=26). Using a community based mixed methods design, participants were phone interviewed to collect demographic data and the CHAOS questionnaire (reflective of stress in home and family environment). Gym utilization was defined as the number of check-ins over the period of the ExRx and then averaged per month. Pearson correlations and two-sample t-tests (race and income) were run to determine home and family factors associated with gym utilization. **RESULTS:** The mean $\pm$ SD age of participants was  $42.8\pm13.7$  years. Approximately 73% of participants were African-American (AA, n=19), 15% were Hispanic (n=4), and 12% (n=3) identified as other (Caucasian, Caribbean, or African). Women had household sizes of  $3.7\pm2.2$  individuals, had an average of  $1.3\pm1.4$  financial dependents, and 73% (n=19) of participants reported household incomes  $\leq \$55,000$ /year. The average CHAOS score for these women was  $39.6\pm4.7$  (higher score indicates greater home stress; range 0-60). Average utilization of the fitness facility was  $2.9\pm2.9$  visits per month. No significant correlations were found between CHAOS and gym utilization ( $r=0.07$ ,  $p=0.74$ ), number of children and gym utilization ( $r=-0.15$ ,  $p=0.49$ ), household size and gym utilization ( $r=-0.15$ ,  $p=0.49$ ), or between number of financial dependents and gym utilization ( $r=-0.30$ ,  $p=0.16$ ). There was no statistically significant difference in gym utilization for AA vs. other ( $p=0.17$ ) or  $>\$55,000$  vs.  $\leq \$55,000$  ( $p=0.62$ ). **CONCLUSIONS:** This underserved minority group of women displayed low levels of exercise prescription utilization. While home and family factors were not associated in this small study using quantitative data, future research is planned to explore qualitative data for themes related to home and family factors that may relate to exercise prescription utilization.

## EXAMINING THE EFFECTS OF A DANCE TECHNIQUE CLASS ON POSTURAL STABILITY IN NOVICE COLLEGIATE DANCERS

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Postural stability is an essential skill across many genres of dance to create and maintain specific positions and motions with proper technique, but limited research has examined changes in postural stability following a dance intervention in novice collegiate dancers. This may, in part, be due to use of costly equipment to assess postural stability; the use of balance boards has been shown as a cost-effective alternative. **PURPOSE:** to examine the effects of an introductory dance technique class on postural stability in novice collegiate dancers.

**METHODS:** Balance boards were used to assess postural stability at the beginning and end of a college semester via four 30-second trials: bilateral stance - eyes open (BEO), bilateral stance - eyes closed (BEC), unilateral stance - right leg (UR), and unilateral stance - left leg (UL). The experimental group (EG; n = 8) participated in an introductory dance class involving ballet and modern techniques. Participants in the control group (CG; n = 8) never received dance training. Average center of pressure velocity (vCoP) was compared between groups and pre/post within groups. **RESULTS:** Post-intervention, the EG had a mean vCoP of 0.24 m/s during BEC, 0.05 m/s less than that of the CG, indicating better postural stability in the EG ( $p=0.09$ ). Similar results were seen in BEO post-intervention, in which the EG had a mean vCoP of 0.20 m/s, 0.06 m/s less than the CG, again indicating the EG had better postural stability ( $p=0.07$ ). When comparing pre/post for UL trials, the CG displayed better postural stability at post-testing with a mean vCoP 0.36 m/s less than during pre-testing ( $p<0.01$ ). No other comparisons of vCoP were found significant when comparing within groups pre/post or between groups. **CONCLUSION:** Overall, the EG showed better postural stability than the CG during post-testing BEO and BEC. While no significant improvements were seen in the EG post-intervention, EG postural stability remained intact despite confounding variables present at the end of semester (exams, fatigue, etc.). As participants were healthy young adults, this intervention may be better suited for populations in which diminished postural stability is associated to a high risk of falls.

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**MECHANISMS THROUGH WHICH AGENTS OF MUSCLE FATIGUE, ACIDOSIS AND PHOSPHATE, INHIBIT MUSCLE MYOSIN FUNCTION.**

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**PURPOSE:** During muscle fatigue from intense activity, elevated concentrations of hydrogen ions (acidosis) and inorganic phosphate (Pi) inhibit muscle's ability to generate force and motion. However, it is not clear exactly how these metabolic by-products reduce the force and enzymatic function of muscle's molecular motor, myosin. **METHODS:** To determine these mechanisms we directly measured the effect of these fatigue agents on the force generating capacity of isolated myosin in a laser trap assay and on its ability to hydrolyze ATP in an ATPase assay. **RESULTS:** Acidosis (pH 7.4 vs. 6.5) in a mini-ensemble laser trap assay reduced myosin's average force production by 20% ( $p < 0.05$ ) due to a slowed rate of actomyosin binding. This conclusion was supported by the observation that acidosis slowed myosin's ability to hydrolyze ATP by roughly 90% ( $p < 0.05$ ) in a solution assay. By contrast elevated levels of Pi (0 vs. 10-15mM), in the presence of low pH (6.5), caused a similar reduction in force. However, this was likely due to an accelerated rate of myosin's detachment from actin, because myosin's ATPase rate also recovered back toward the control value (pH 7.4, no Pi) when Pi was added. **CONCLUSION:** Thus, these data provide unique insight into the molecular mechanisms that underlie the loss of muscle function during fatigue. In our current work we are using these findings to explore methods to mitigate these effects *in vitro* in a first step toward attenuating fatigue in diseases such as chronic heart failure.

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## HIGH INTENSITY INTERVAL TRAINING AND ACUTE ALTITUDE EXPOSURE IN A MASTERS ATHLETE: A CASE STUDY

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This study involved an experienced, 64 year-old male mountaineer who trained at sealevel and climbed Mount Kilimanjaro (5,895 m). High Intensity Interval Training (HIIT) is a time-saving mode of exercise consisting of bursts of all-out effort and active recovery which has shown to improve cardiovascular fitness and strength. Hypoxia induces Acute Mountain Sickness (AMS) which poses many health risks to individuals of all age. **PURPOSE:** To assess the effects of a HIIT protocol on a Masters climber and investigate physiologic changes due to altitude exposure and incidence of AMS. **METHODS:** The six-week training program consisted of six alternating rounds of 85-90% max HR progressing from 90-120 seconds followed by 3 minutes active recovery. Subject was tested at: baseline, post-training/pre-climb, and post-climb. For baseline and post-training body composition, pulmonary function, hematology, cognitive function (Stroop Test), reaction time, VO<sub>2</sub> max, and muscle strength were measured. Post-climb all measures were repeated except VO<sub>2</sub> max and strength. While climbing, physiologic and GPS data were collected. At each basecamp, resting SpO<sub>2</sub>, HR, Lake Louise Score (LLS), reaction time, cognitive function, and coordination tests were performed. The LLS is the standard for diagnosing AMS. **RESULTS:** Subject summited and returned healthy. HIIT increased VO<sub>2</sub> max (36.4 to 47.1 ml/kg/min), muscle symmetry, and FEV<sub>1</sub>/FVC increased 0.86%, body fat increased from 7.2 to 8%. Subject experienced mild AMS on days two and three of the ascent. Reaction time increased by 1 second, and the incongruent Stroop test time increased 57 seconds at high camp compared to baseline. On average, SpO<sub>2</sub> and HR dropped 3.2% and 5.8bpm respectively overnight at camps. HR, and RR increased with altitude. Upon return, serum Potassium and Creatine Kinase were elevated (5.4, 268), and FEV<sub>1</sub>/FVC decreased 4.1%, body fat decreased to 3.6%. **CONCLUSION:** HIIT is a safe and effective way to train a Masters athlete for the rigor of high altitude. These findings are of clinical importance for athletes preparing for high altitude mountaineering. Masters athletes are capable of training for, experiencing, and surmounting AMS. With proper training a Masters athlete can complete a high-altitude climb.

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**TITLE: TAI CHI AS ANTIHYPERTENSIVE LIFESTYLE THERAPY: A SYSTEMATIC REVIEW AND META-ANALYSIS**

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Due to limited evidence, professional health organizations are reluctant to recommend Tai Chi to treat hypertension. **PURPOSE:** we conducted a systematic review and meta-analysis to examine the efficacy of Tai Chi as antihypertensive lifestyle therapy. **METHODS:** Tai Chi interventions published in English and Chinese were included when they involved healthy adults, reported pre-and post-intervention blood pressure (BP), and had a non-exercise/non-diet control group. We systematically searched 11 electronic databases through August 1, 2018, yielding 31 qualifying controlled trials. We: 1) evaluated the risk of bias and methodological study quality; 2) performed meta-regression analysis following random-effects assumptions; and 3) generated additive models representing the largest possible clinically relevant BP reductions. **RESULTS:** On average, participants ( $N=3,223$ ) were middle-aged ( $56.6\pm15.1$  years) adults with prehypertension (systolic BP [SBP]  $136.9\pm15.2$ /diastolic BP [DBP]  $83.4\pm8.7$  mmHg). Tai Chi was practiced  $4.0\pm1.4$  sessions/week for  $54.0\pm10.6$  minutes/session for  $22.3\pm20.2$  weeks. Overall, Tai Chi elicited moderate to large reductions in SBP ( $d=-0.75$ , 95% CIs:  $-0.97$ ,  $-0.53$ ;  $-8.7$  mmHg) and DBP ( $d=-0.53$ , 95% CIs:  $-0.71$ ,  $-0.34$ ;  $-4.7$  mmHg) compared to control ( $P<.001$ ). Controlling for publication bias, among samples with hypertension, Tai Chi interventions published in English elicited SBP reductions of 10 mmHg and DBP of 4 mmHg, half of the magnitude of trials published in Chinese with SBP reductions of 19 mmHg and DBP reductions of 9 mmHg. **CONCLUSION:** our results indicate that Tai Chi is viable antihypertensive lifestyle therapy that produces BP reductions that rival or exceed the antihypertensive effects of aerobic exercise of 5-8 mmHg in both the English and Chinese literature. Further investigation is needed to explain the discrepancy in the magnitude of the antihypertensive effects between Tai Chi trials published in English than Chinese.

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NEACSM FALL MEETING ABSTRACT SUBMISSIONS 2018

## MEASUREMENTS OF MUSCLE THICKNESS BY ULTRASOUND IMAGING FOLLOWING BLOOD FLOW RESTRICTED EXERCISE

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Blood flow restricted (BFR) exercise results in transient muscle growth that may be due to metabolite accumulation, hyperemia, and muscle damage and together they may serve as a stimulus for hypertrophy. Understanding the duration of this transient growth is important for the planning of future exercise sessions and measurement of muscle hypertrophy. **PURPOSE:** To measure changes in muscle size via ultrasound throughout a 48-hour period after a session of BFR leg extension exercise. **METHODS:** Twelve college students (6 males and 6 females, age=20.3±1.1 years; mass=69.3±14.0 kg; height=1.73±0.10 m) currently engaged in a resistance exercise routine for the last three months participated in this study. Ultrasound imaging was used to measure the thickness of the vastus lateralis (VL) halfway between the lateral condyle of the knee and the greater trochanter of the femur on each leg. Knee extension isometric maximum voluntary contraction (MVC) torque was measured on each leg before and after exercise. Unilateral one repetition maximum (1-RM) was assessed on a leg extension machine to determine exercise load. Participants performed unilateral knee extensions at 30% 1-RM while wearing a pressurized cuff around the proximal thigh set to 50% of each individual's arterial occlusion pressure. Sets of 30,15,15,15 repetitions were completed and MVC was measured immediately after exercise to assess fatigue. Ultrasound images of the VL of each leg were obtained immediately after exercise and then at 10 minutes, 30 minutes, 1 hour, 3 hours, 8 hours, 24 hours, and 48 hours after exercise. **RESULTS:** MVC decreased by 29.3±10.4% immediately after exercise. There was a significant main effect of time for muscle thickness on the leg that performed the BFR exercise ( $P<0.001$ ) indicating that VL thickness increased from pre exercise 38.9±17.7% immediately after exercise, 32.9±19.6% at 10 minutes, 30.4±20.5% at 30 minutes, and 14.7±10.5% at 3 hours only. VL thickness did not change significantly over time on the resting leg ( $P>0.05$ ) **CONCLUSION:** VL thickness was elevated for at least three hours following BFR exercise. Researchers should consider these transient muscle changes when assessing muscle hypertrophy and prescribing exercise.

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## USING IMMEDIATE BLOOD PRESSURE BENEFITS OF EXERCISE TO IMPROVE EXERCISE ADHERENCE AMONG ADULTS WITH HYPERTENSION

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A single exercise session evokes blood pressure (BP) reductions that are immediate and persist for  $\geq 24\text{hr}$ , termed *postexercise hypotension* (PEH). Self-monitoring of PEH may foster positive outcome expectations to exercise, and thus, enhance exercise adherence among adults with hypertension. **PURPOSE:** To compare the efficacy of self-monitoring of exercise (EXERCISE) versus exercise plus PEH (EXERCISE+PEH) for exercise adherence and BP control among adults with hypertension. **METHODS:** Adults with high BP were randomized to EXERCISE ( $n=12$ ) or EXERCISE+PEH ( $n=12$ ). Subjects underwent supervised, moderate intensity aerobic exercise training for 40-50min/session, 3d/wk for 12wk and were encouraged to exercise at home unsupervised  $\geq 30\text{min/d}$ , 1-2d/wk. All subjects self-monitored exercise using a calendar recording method. EXERCISE+PEH also self-monitored BP before and after exercise.

Adherence was calculated as [ $(\# \text{ of exercise sessions performed} \div \# \text{ of possible exercise sessions}) \times 100\%$ ]. BP was measured pre- and post-training. **RESULTS:** Healthy, middle-aged ( $52.3 \pm 10.8\text{y}$ ) men ( $n=11$ ) and women ( $n=13$ ) with hypertension ( $136.2 \pm 10.7/85.2 \pm 8.9\text{mmHg}$ ) completed exercise training with  $87.9 \pm 12.1\%$  adherence. EXERCISE+PEH demonstrated greater adherence to supervised training ( $94.3 \pm 6.6\%$ ) than EXERCISE ( $81.6 \pm 13.2\%$ ;  $p=0.007$ ). In addition, EXERCISE+PEH performed  $32.6 \pm 22.5\text{min/wk}$  more unsupervised home exercise than EXERCISE ( $p=0.004$ ), resulting in greater overall study exercise adherence ( $107.3 \pm 18.7\%$ ) than EXERCISE ( $82.7 \pm 12.2\%$ ;  $p=0.002$ ). Post- versus pre-training, BP was reduced  $-7.4 \pm 11.3/-4.9 \pm 9.9\text{mmHg}$  ( $p < 0.025$ ) with no statistical difference between EXERCISE ( $-5.2 \pm 13.3/-3.6 \pm 6.1\text{mmHg}$ ) and EXERCISE+PEH ( $-9.9 \pm 11.3/-6.1 \pm 6.9\text{mmHg}$ ;  $p > 0.344$ ).

**CONCLUSIONS:** This study is the first to demonstrate that PEH self-monitoring is an efficacious tool to improve exercise adherence among adults with hypertension. Future research among a larger, more diverse sample is needed to confirm these novel findings and determine whether EXERCISE+PEH translates to better BP control relative to EXERCISE self-monitoring alone.

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