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*Abstracts are listed alphabetically by first author's last  
name*

## UNDERSTANDING PHYSICAL ACTIVITY LEVELS IN AN ETHNICALLY DIVERSE COMMUNITY: A QUALITATIVE STUDY

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**INTRODUCTION:** Research suggests low socioeconomic communities engage in reduced levels of physical activity (PA), have higher percentages of minorities, and lower levels of health literacy. Socio-cultural factors such as collectivism, religiosity, gender norms, familism, expectations of physical appearance, and body image also play a role in the adoption of healthy behaviors. It is therefore imperative to consider cultural influences when studying PA habits in ethnically diverse communities.

**PURPOSE:** The purpose of this investigation was to qualitatively examine experiences and attitudes towards PA in an ethnically diverse, low socioeconomic status community.

**METHODS:** 27 individuals from the local community participated in the study (70% female, 52% >55 years, 59% Hispanic/Latino (a/x), 30% Caucasian, 44% English speaking). Focus groups were conducted in Spanish or English. The semi-structured questions explored knowledge of PA guidelines, influences on, and motivators for PA. Interviews were audio recorded and transcribed verbatim. Thematic analysis was used to identify predominant themes.

**RESULTS:** Several themes emerged during the focus groups: (1) *Health*. Participants reported the importance of participating in PA to improve/maintain health, influence body weight, and reduce pain. (2) *Barriers*. Time and pain emerged as common barriers to PA. (3) *Environmental Factors*. Factors such as weather (hiking on a nice day), or fear of falling when walking outside, influenced PA behaviors. (4) *Motivators*. Technology such as wearable monitors motivated younger participants to engage in PA whereas family influences such as time with grandchildren influenced older participants. (5) *Health Literacy*. Inconsistencies in participant understanding of PA guidelines were noted.

**CONCLUSIONS:** Preliminary results suggest age is an influence on individuals' motivations, attitudes, and adherence to PA participation and that social and cultural factors should be considered when implementing practices to address and reduce barriers to PA. Continued focus group discussions and alterations in questions to obtain saturation is warranted.

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## COMPARISON OF BODY COMPOSITION EVALUATION METHODS IN FEMALE AND MALE COLLEGE ATHLETES

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When determining a client's overall fitness, one's body composition is considered. This is especially important when dealing with competitive athletes. Based on the American College of Sports Medicine (ACSM), all body composition guidelines are based off of skin fold assessment thickness measurements. However, there are numerous ways to assess body composition today, with Dual Energy X-Ray Absorptiometry now considered the gold standard. **PURPOSE:** The purpose of this study was to compare the more commonly used body composition assessments and determine if disparities in body composition could change someone's fitness status based on the current ACSM guidelines in college male and female athletes. **METHODS:** Thirty-nine male college football players (age= $20.0 \pm 2.0$  y,  $97.4 \pm 21.3$  kg;  $179 \pm 6.0$  cm) and forty-seven female athletes from soccer, rugby, field hockey, ice hockey, and cross country ( $19.7 \pm 1.2$  y,  $66.3 \pm 9.5$  kg,  $166 \pm 5.0$  cm) had their body composition assessed five different ways- Skinfold Thickness (SF), Ultrasound Thickness (US), Bioelectric Impedance Analysis (BIA), Dual Energy X-Ray Absorptiometry (DXA) and Underwater Weighing (UWW). All subjects had fasted for 10-12hrs, hydrated to a urine specific gravity of  $\leq 1.02$  and refrained from exercise the day of testing. **RESULTS:** The percent body fat for each method were as follows: SF= $20.0 \pm 6.6\%$ , US= $21.9 \pm 7.0\%$ , BIA= $24.6 \pm 6.7\%$ , UWW= $24.7 \pm 7.9\%$  and DXA= $28.0 \pm 7.6\%$  for all athletes. There were observed differences in percent fat between all five methods ( $p=0.00$ ), except BIA and UWW. Of the different body composition methods, the greatest correlation was observed between DXA and SF;  $r=0.94$  ( $p<0.05$ ), though there was a difference in 8% body fat between the two different methods. **CONCLUSION:** It is important to note large differences exist between different testing methods when assessing body composition. With a difference as great as 8% in body fat as observed in this study, this could change one's ACSM fitness by two categories depending on the method utilized. Based on the results of the current study it is recommended that if you are assessing a client's body composition, it is important to adhere to the same method to track changes. In addition, it is important to use SF assessment to assess body composition if you plan to utilize the ACSM fitness categories.

## THE FRONT AND REAR LEG FORCE DEMANDS OF A SNOWBOARD CROSS RUN

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Snowboard Cross (SBX) is a new Olympic sport which premiered in 2016. Previously, Olympic SBX athletes have been shown to experience lower body strength and power asymmetries. This may have been due to the greater force demands placed on the rear leg during frequently performed turns and landings. It is reasonable to assume the same asymmetries and force production precursors exist while navigating course features such as pumping rollers and performing large heelside turns. However, which course features promote force production asymmetry have not yet been explored in SBX athletes. **PURPOSE:** To describe the front and rear force demands of two youth and two adult SBX athletes in different course features. **METHODS:** Two competitive youth SBX athletes and two adult SBX coaches took part in testing at the athlete's host mountain (Sugarloaf Mountain, ME). During testing athletes wore force sensing insoles inside of their snowboard boots during a SBX run. The relative (to body mass: BM) forces experienced by the athlete's front (lead) and back (rear) legs were then compared during two course features unique to SBX: 1) a banked heel side turn 2) pumping a roller. **RESULTS:** Throughout the run rear leg forces were greater than front leg forces when pumping rollers (rear:  $1.0 \pm 0.33 \times \text{BM}$ , front:  $0.39 \pm 0.12 \times \text{BM}$ , ratio: 2.5) and during banked heel side turns (rear:  $1.3 \pm 0.27 \times \text{BM}$ , front:  $0.44 \pm 0.33 \times \text{BM}$ , ratio 3.0). **CONCLUSION:** Asymmetric force production demands were observed in all participants in both course features. Asymmetry may increase commensurate to skill, allowing greater ability to overcome course features with greater rates of acceleration as driven by the rear foot while minimizing resistance in the front foot, however further investigation is needed to support this. Given characterizations of the present cohort, future research should investigate the mechanisms by which bilateral force production asymmetry manifests in SBX athletes and its role as a predictor of SBX performance.

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## **FITNESS AND BODY COMPOSITION OBSERVATIONS FOLLOWING 8-WEEKS OF STRENGTH TRAINING IN PARTICIPANTS WITH CEREBRAL PALSY**

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**PURPOSE:** Maintaining and improving skeletal muscle mass and function through exercise is important for individuals with cerebral palsy (CP) that are often challenged with limited motor ability. Exercise appears to benefit those with CP, but there is limited information on changes in skeletal muscle mass as an adaptation to training. **METHODS:** Four quadriplegic (3 male, 1 female) and two hemiplegic (2 female) participants ( $22 \pm 5$  yr, mean  $\pm$  SD) completed 8-weeks of moderate to high intensity strength training 2-3 days a week. Strength training programs were developed for each participant based on their physical fitness and the gross motor classification system. Measurements of exercise performance and body composition (InBody 270 & S10) were collected prior to and following training. Data from all participants was pooled and measurements with an  $n \geq 5$  were analyzed using a paired t-test with significance set at  $p < 0.05$ . **RESULTS:** Measurements of muscular fitness improved, including plank variations (pre:  $64 \pm 40$ , post:  $95 \pm 61$ s,  $n = 6$ ), supine sled leg press 1RM (pre:  $225 \pm 69$ , post:  $378 \pm 124$  lbs,  $n = 6$ ) and bench/or sled press 1RM (pre:  $92 \pm 54$ , post:  $115 \pm 58$  lbs,  $n = 5$ ). There was no observed changes in body weight (pre:  $151 \pm 40$ , post:  $151 \pm 42$  lbs,  $n = 6$ ), skeletal muscle mass (pre:  $53 \pm 8$ , post:  $54 \pm 9$  lbs,  $n = 6$ ), upper-body sprint capacity (30-s row test) (pre:  $89 \pm 32$ , post:  $96 \pm 29$  W,  $n = 5$ ) or aerobic capacity (ramped treadmill protocol) (pre:  $303 \pm 136$ , post:  $370 \pm 246$  s,  $n = 4$ ). **CONCLUSION:** A larger sample is needed to draw conclusions, but preliminary data is encouraging that the unique and challenging strength training program employed with these participants can be utilized to gain meaningful improvements in muscular fitness.

## **THE EFFECTS OF SUPERVISED ACTIVITY ZONES ON PHYSICAL ACTIVITY DURING RECESS IN ELEMENTARY-AGED CHILDREN.**

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There is a universal goal to quell the obesity epidemic; habitual physical inactivity is at the center of the problem. Epidemiological data indicates 50% of children (aged 6-11 years old) and approximately 92% of adolescents (aged 12-18 years old) are not meeting the recommended health guideline of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day. Thus, physical inactivity and childhood obesity interventions should target children before inactivity develops in their adolescent years. **PURPOSE:** This study compared changes in physical activity in youth during school recess with supervised and unsupervised activity zones. **METHODS:** 143 third-, fourth-, and fifth-grade boys and girls from two elementary institutions had their physical activity measured using Actigraph-GT3X accelerometers for a total four weeks. Baseline data were collected for one week prior to activity zoning. Afterwards, the playgrounds were divided into six activity zones for two weeks, with activity zones supervised at only one institution. Activity zones were removed and physical activity data were collected for one-week post intervention. **RESULTS:** Supervised third graders significantly decreased time spent in sedentary activity by 15% ( $P<0.001$ ) and increased time in MVPA by 12% ( $P<0.001$ ). Furthermore, unsupervised fifth graders decreased their sedentary activity by 5% ( $P<0.01$ ) and increased their time in MVPA 5% ( $P<.01$ ) which was opposite to their supervised peers which increased sedentary activity by 8% ( $P<0.01$ ). No significant differences were seen among the fourth graders between the supervision conditions and activity zones. Additionally, third graders accumulated 160 more steps on the supervised playground compared to baseline measurements ( $P<0.05$ ) whereas fifth graders decreased their steps by 300 on the supervised playground

( $P < 0.001$ ). No significant differences were seen in step counts for fourth graders.

**CONCLUSION:** Activity zoned playgrounds are an applicable and effective program that can help improve physical activity during school recess for young children. Activity zone supervision increases physical activity in third graders, whereas fifth graders increased physical activity when unsupervised.

## **THE EFFICACY OF A NECK STRENGTHENING PROGRAM ON NECK REACTION TIME.**

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Greater neck strength, in addition to heightened anticipatory muscle activation in response to head impacts, has been associated with a reduced kinematic effect from external forces on the head. **PURPOSE:** The purpose of this investigation was to examine if a 10-week neck strengthening program would improve neck isometric strength and reaction time to external loading. **METHODS:** 25 subjects completed a cervical resistance training program twice a week for 10 weeks. The resistance-training program consisted of full range of motion in cervical flexion, extension, right lateral flexion, and left lateral flexion. Subjects were assessed for maximal voluntary isometric contractions (MVIC) and reflex contractions for flexion and extension (pre and post training). Anticipated and unanticipated reflexes were tested by dropping a 1kg weight down a metal stanchion, cued or blinded. Electromyography (EMG) data was measured for peak force, peak amplitude, and time to muscle activation of the right and left upper trapezius (PS) and right and left sternocleidomastoid (SCM). Paired samples t-tests compared pre and post-test MVIC measures for right and left EMG activation, time to EMG activation in SCM and PS, and MVIC peak force output. Repeated measures ANOVA were performed to measure pre and post-training differences in peak EMG amplitude of right versus left SCM and PS MVIC for peak EMG amplitude, and peak EMG amplitude during anticipated and unanticipated reflex. **RESULTS:** Subjects exhibited an increase in peak force output during MVIC of PS ( $P=0.006$ ), and in SCM EMG amplitudes during MVIC ( $P=0.002$ ). Decreases were observed in the time difference between right and left SCM firing rates during MVIC ( $P=0.021$ ) and in PS EMG amplitudes during both reflex assessments (anticipated  $P=0.001$ , unanticipated  $P=0.003$ ). There was no significant difference for all other measures. **CONCLUSIONS:** Training results in an increased maximal force output generated from PS which results in a reduced kinematic effect from external force on the head. Training allows for faster activation of both SCMs during isometric contraction, minimizing rotational aspect during activation which may play a role in adding stability during a head impact.

## **FIREFIIGHTERS CAFFEINE INTAKE INFLUENCES THE BLOOD PRESSURE RESPONSE TO STRENUOUS PHYSICAL EXERTION**

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Caffeine may diminish the beneficial immediate blood pressure (BP) reductions that occur after a single bout of exercise, termed *post-exercise hypotension* (PEH). Neither PEH nor the influence of caffeine on PEH have been studied in firefighters, who have a disproportionately high risk of sudden cardiac death on the job, partially due to its strenuous nature and poor nutrition.

**PURPOSE:** To examine the influence of caffeine intake (CAFF) on PEH following a maximal bout of exercise in firefighters. **METHODS:** Firefighters (n=15) completed a non-exercise control (CONTROL) and maximal graded exercise stress test (GEST) in random order on separate non-work days. They left the laboratory attached to an ambulatory BP (ABP) monitor for 19hr. CAFF was assessed with the National Health and Nutrition Examination Survey food-frequency questionnaire. We performed repeated measures ANCOVA in SAS to test if the ABP response after GEST vs CONTROL differed by CAFF group categorized by the median as high (806.8±190.7mg) and low (239.3±202.9mg) with baseline ABP as a covariate. **RESULTS:** Firefighters were overweight (29.0±3.9kg/m<sup>2</sup>), middle-aged (40.2±9.5yr) men with elevated resting BP (124.1±10.3/79.6±11.5mmHg). CAFF tended to be positively correlated with resting SBP (r=.478, p=.061) and DBP (r=.466, p=.069). Among the total sample, the systolic ABP (ASBP) (18.0±4.8mmHg, p=.004) and diastolic ABP (ADBP) (9.1±1.5mmHg, p=.0037) changes from baseline were greater after GEST vs CONTROL over 19hr, independent of CAFF (P<sub>s</sub>≥0.05), but with significant interactions among ASBP, ADBP, and CAFF over time (P<sub>s</sub><0.05). These significant interactions revealed that ASBP was consistently greater after GEST vs CONTROL over 19hr in the high CAFF group (p=0.007 GEST vs CONTROL); whereas in the low CAFF group the difference in ASBP after GEST vs CONTROL was variable over time (p=0.0276 GEST vs CONTROL x Time). By contrast, the ADBP response after GEST vs CONTROL over 19hr tended to be greater in the low CAFF (15.3±4.5mmHg, p=.0833) than high CAFF (4.4±2.4mmHg, p=.0503). **DISCUSSION:** Unexpectedly, this small sample of firefighters exhibited post-exercise *hypertension* and caffeine intake appeared to modulate this adverse response. Further investigation is needed in a larger sample of firefighters to confirm our findings and better establish the relationship of the associations we observed.

A Pilot Study: The effects of post-meal walking on glycemic control in young adults with elevated body fat

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The early development of excess body fat is closely linked to the development of cardiovascular disease and diabetes in young adults. Fifteen minutes of Post-Meal Walking (PMW) has been shown to improve glycemic control in laboratory settings. **Purpose/Hypothesis:** The purpose of the following study was to test the hypothesis that PMW would improve glycemic control over a 4-week exercise intervention compared to traditionally prescribed exercise (TPE). **Methods:** Eight participants (age: 27±2 yrs) with elevated body fat (Men: 31.2±3.5% & Women: 45.9±3.4%) completed the exercise intervention. Glycemic control was assessed at baseline and after the exercise intervention using capillary or venous blood samples, and continuous glucose monitoring (CGM) during an oral glucose tolerance test. Participants were randomized into one of the two exercise training groups (PMW, n=5 vs. TPE, n=3), which participants accumulated 180 minutes of moderate intensity exercise. **Results:** While still preliminary, no differences were found in the change in fasting blood glucose from baseline ( $\Delta$ Fasting BG: TPE = 7±6 vs. PMW = -2±2 mg·dL<sup>-1</sup>,  $p=0.10$ ) or CGM derived fasting blood glucose ( $\Delta$ Fasting CMG BG: TPE = 10±2 vs. PMW = -13±8 mg·dL<sup>-1</sup>,  $p=0.13$ ). Glycemic control was not different between TPE ( $\Delta$  Area Under the Curve = 27±0 AU) and PMW ( $\Delta$  Area Under the Curve = -32±29 AU). **Conclusion:** The early preliminary findings suggest no improvement in glycemic control after 4-weeks of TPE and PMW exercise. However, additional data is needed to determine if 4-weeks of PMW improves glycemic control compared to TPE.

**TITLE: Effects of Small Incremental Additions of Non-Functional Mass on Work Capacity.**  
**Robert Brooks, PhD, Sara Carder, Bailey Graychase, Sawyer Smith**

**Purpose:** Participation in a regular exercise is often recommended for individuals who have excessive body fat or non-functional mass (NFM). However, attempting to improve fitness with excess NFM can be difficult simply do to an additional load placed on unfit body. This study examined how changes NFM affect day to day performance, health, and specifically work capacity, in this case simple walking.

**Methods:** Fifteen male (n=10) and female (n=5) subjects were recruited for the study, Subjects (N=15) were asked to carry loads in increments of 1%, 2.5%, 5%, and 10% of the person's body weight. An initial baseline treadmill walking test with no additional load was performed first. Testing occurred over a two week period with at least one rest day between trials. The loaded trials were performed in random order. Subjects carried a small backpack with the added weight on their back while walking. A heart rate monitor was attached to the subject's chest and recorded each minute via link to a computer. The subjects were asked to perform a Modified Balke walking treadmill test at a standard walking speed of 3.5 mph. The grade increased 1% every minute until the person reached a heart rate of 80% of their predicted heart rate.

**Results:** The null hypothesis states there would be no difference between measured time and grade from resting heart to 80% of the predicted heart rate between the different trials of no load 1% 2.5%, 5% and 10% of the subject's body weight. However, subject values show that even small amounts of additional weight can affect work capacity and performance. Between the baseline and 1% there was a difference but not significant. However, load increases to 2.5%, 5% and 10% were significantly different ( $p=.05$ ) when compared calculated to the baseline values.

**Conclusions:** Such differences suggest obvious changes in work capacity. The data is preliminary but suggests that there are implications for person's gaining weight or carrying loads equal to 5% of their body weight or greater.

## **BIOMARKERS DIFFER BETWEEN AND WITHIN STARTERS AND NON-STARTERS THROUGHOUT A COLLEGIATE SOCCER SEASON**

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**PURPOSE:** To observe differences in blood biomarkers (oxygen (O<sub>2</sub>) transport, immune, cardiovascular (CV) health and hematology) between starters (S) and non-starters (NS) over a full NCAA Division 1 collegiate men's soccer season.

**METHODS:** Biomarkers (n = 30) related to O<sub>2</sub> transport (n = 9), immune function (n = 12), and CV and lipid profiles (n = 9) were collected at the start of pre-season (PS), in-season at weeks (W)1, 4, 8 and 12 in soccer players (n = 20, mean ± SD; age = 21 ± 1, height = 180 ± 6 cm, body mass = 78.19 ± 6.3 kg, body fat = 12.0 ± 2.6%, VO<sub>2max</sub> = 51.5 ± 5.1 ml·kg<sup>-1</sup>·min<sup>-1</sup>). A 2 x 5 (group x time) repeated measures ANOVA was used to identify differences between S (n = 10) and NS (n = 10). In the presence of a significant interaction effect (p<0.05), post-hoc one-way ANOVAs and paired tests were used to identify group and time differences with uncorrected alpha level set at p<0.05.

**RESULTS:** A significant interaction effect (group x time) was found for 9 biomarkers (hematocrit [HCT], hemoglobin [HGB], red blood cells [RBC], total cholesterol [Total Chol], LDL cholesterol [LDL], Chol:HDL ratio, non-HDL cholesterol [non-HDL], direct LDL [dLDL] and apolipoprotein B [ApoB]). S demonstrated significant increases in RBC (W1) and Chol:HDL (W8), while NS demonstrated significant increases in HCT and HGB (W4); Chol:HDL (W4, 12). Within-group significant differences were found between PS and W1 for NS (HCT, HGB, RBC, Total Chol, LDL, Chol:HD, Non-HDL, ApoB) and for S (Chol:HDL, non-HDL, dLDL). HCT, HGB, RBC, LDL, Non-HDL, Direct LDL and Apo B were different in NS from W1 to W4, while only Apo B was different in S. From PS to W12, Total Chol, LDL, and non-HDL were significantly different for NS while HCT, HGB, Chol:HDL, and non-HDL were different in S.

**CONCLUSION:** Our findings indicate that there are differences between and within S and NS for many biomarkers related to O<sub>2</sub> transport, immune, CV health and hematology throughout a collegiate men's soccer season. Thus, future analyses should account for playing status as a covariate. From a clinical perspective, while all biomarkers were within normal reference ranges, sports medicine personnel should account for playing status and inter-individual differences when tracking or diagnosing athletes who demonstrate signs of clinical pathologies associated with these biomarkers.

**Table 1. Biomarker Values Between Starters and Non-starters by Week**

Biomarker	Clinical ref. range	Team ref. range	Status	PS	W 1	W 4	W 8	W 12
HCT (%)	36-49	39-54	S	47.17±2.59	46.01±1.96	45.31±1.53	-	45.4±2.73**
			NS	47.24±3.05	44.94±2.64*	47.52±3.04†*	-	47.39±2.82
HGB (g·dL <sup>-1</sup> )	13.2-17.1	12.9-17.1	S	14.99±0.92	14.84±0.61	14.54±0.45	-	14.52±0.86**
			NS	15.19±0.98	14.78±0.79*	15.42±0.84†*	-	15.16±0.76
RBC (10 <sup>9</sup> ·μL <sup>-1</sup> )	4.2-5.8	3.9-5.7	S	5.15±0.34	5.07±0.27†	5.0±0.25	-	5.1±0.36
			NS	4.93±0.39	4.72±0.34*	5.04±0.31*	-	5.17±0.29
Total Chol (mg·dL <sup>-1</sup> )	125-170	115-242	S	158.8±29.90	153.7±31.0	155.8±31.96	158.9±32.98	163.3±31.79
			NS	152.8±19.69	135.7±15.24*	166.2±23.78*	166.2±23.78	173.59±28.29**
LDL Chol (mg·dL <sup>-1</sup> )	<110	44-168	S	87.5±27.28	79.4±27.23	81.3±25.86	82.7±25.1	83.3±26.45
			NS	86.8±17.9	74.0±10.83*	96.9±20.3*	96.4±21.59	100.37±25.53**
Chol HDL Ratio	<OR=5.0	1.9-4.8	S	3.06±0.65	2.63±0.48*	2.65±0.54	3.27±0.56†	2.61±0.56**
			NS	3.27±0.40	3.02±0.37*	3.02±0.37†	2.71±0.49	3.43±0.61†
non-HDL (mg·dL <sup>-1</sup> )	<120	56-191	S	105.9±26.81	95.0±26.78*	96.1±26.45*	99.4±26.21	99.7±28.61**
			NS	106.0±18.67	90.2±12.9*	114.9±23.81*	114.9±24.15	122.19±28.81**
dLDL (mg·dL <sup>-1</sup> )	<110	34-178	S	91.9±30.43	81.6±29.62*	85.2±29.58*	85.5±29.88	87.0±30.98
			NS	99.1±19.66	80.7±13.59*	104.9±21.56*	104.3±20.76	110.67±26.06
ApoB (mg·dL <sup>-1</sup> )	52-109	36-124	S	68.9±19.75	64.4±19.82	70.1±18.47	66.5±17.16	65.3±19.17
			NS	72.8±14.77	63.2±9.02*	79.4±16.66*	79.9±16.31	79.48±18.25

Data presented as mean ± SD

† Different (p<0.05) group x time

\* Different (p<0.05) within group from previous timepoint

\*\* Different (p<0.05) within group from PS to W12

## **FUNCTIONAL BILATERAL ASYMMETRIES IN ADOLESCENT COMPETITIVE SKIERS**

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When skiing both legs function independently and the stresses experienced by both legs is dependent upon the movement being performed (e.g. turning, jumping, landing, ect...). It is well established that greater stress is placed upon the outside leg when turning and initiating tricks and that the magnitude of these forces changes based on the athlete's momentum and the turn radius. Thus, ski athletes are at risk for developing bilateral asymmetries which may put them at increased injury risk due to repetitive training on competition courses and non-symmetrical movement patterns. **PURPOSE:** To determine if a pattern of functional asymmetries are present in adolescent ski athletes from the same training mountain. **METHODS:** Competitive adolescent skiers from Carrabassett Valley Academy in Kingfield, ME (n = 22) performed a series of bilateral of tests to determine dominant and non-dominant lower body strength (isometric mid-thigh pull) and power (vertical jump), rotational power (medicine ball throw) and balance (Y-balance test). Differences between left and right sides of the body were compared using a series of paired (p < 0.05). **RESULTS:** Athletes demonstrated greater rotational power moving towards their non-dominant ( $1115 \pm 680$  W) than dominant side ( $924 \pm 605$  W, p=0.046). However, no differences were observed between dominant and non-dominant legs is lower-body strength (dominant:  $565.5 \pm 38.5$  N, non-dominant:  $549.9 \pm 38.1$  N, p=0.063), lower-body power (p=0.572), or balance in the anterior (p=0.153), posterior-medial (p=0.880), or posterior-lateral (p=0.164) directions. **CONCLUSION:** In the present study adolescent skiers demonstrated asymmetrical rotational power and non-significant trends asymmetrical lower-body strength but no other noteworthy differences in power or balance. In skiing, rotational power is necessary for rapid initiation of turns away from their dominant side. Training to correct this asymmetry may help athletes when turning towards their dominant side.

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## PREVENTION OF BONE DISEASES IN THE VIETNAMESE COMMUNITY

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Asians are at higher risk of osteoporosis and other bone problems compared to other races because of “their lower weight and smaller bone size” (Nguyen, Dinh, Ngo, Tran, & Breitkopf, 2015). With Vietnamese people, prevention is favored over treatment because bone mass at the lumbar spine peaks earlier in Vietnamese women than in non-Asians and the pathogenesis of bone loss is virtually irreversible (Nguyen et al., 2015). Therefore, Vietnamese need improvement in the prevention of bone diseases. **PURPOSE:** The purpose of this study was to look deeply into the preventive bone healthcare of Vietnamese from these perspectives: nutrition, physical activity, and lifestyle. Based on the findings, this research suggests possible actions to improve bone health in the local Vietnamese community. **METHODS:** Twenty healthy Vietnamese adults (mean age  $49 \pm 19.6$  yrs; 40 % male) from two Vietnamese community organizations were interviewed to answer nutrition, physical activity, lifestyle and demographic questionnaires in about 20 minutes. The questionnaires have some adjustments for Vietnamese culture, such as adding some Vietnamese food. After the interview, participants had a chance to receive bone health kits which included calcium-rich food and drink, and resistance bands to promote exercise. **RESULTS:** 75% of the subjects did not achieve the recommended calcium levels and 50% did not achieve the recommended vitamin D levels. Only 11.6% of total calcium was from cultural food. There was no significant relationship between the income level of the subjects and whether they achieved the recommended values for calcium and vitamin D. 85% of subjects achieved a minimum of the recommended 750 MET-min/week. Most reported physical activities were cardio or endurance training, not resistance and balance training. **CONCLUSION:** These results suggest that the Vietnamese community is in need of improving their calcium and vitamin D levels. The subjects were moderately active overall, but do not engage in resistance or balance exercise. Health professionals and researchers should be mindful of cultural aspects of bone health, as culture can develop or diminish a community’s health.

### **Citation:**

Nguyen, N. V., Dinh, T. A., Ngo, Q. V., Tran, V. D., & Breitkopf, C. R. (2015). Awareness and Knowledge of Osteoporosis in Vietnamese Women. *Asia-Pacific Journal of Public Health*, 27(2), 95-105.

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## Acute Cognitive and Hormonal Stress Responses in NCAA Division II Football Player's Offseason Training Session

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An integral aspect of American football training is intense resistance exercise. However, the impact of high-intensity resistance exercise on acute cognitive performance, mood imbalances, and the hormonal stress response has not been fully elucidated. **PURPOSE:** To examine the effects of acute high-intensity resistance exercise on cognitive function, mood, rating of perceived exertion, and cortisol response in collegiate American football athletes. **METHODS:** Fourteen male collegiate American football players ( $21 \pm 1$  years) completed a high-intensity resistance exercise training session overseen and developed by the Merrimack strength and conditioning coaching staff. All study testing and data collection was conducted between 5:30-7:30 a.m. to control for the circadian rhythm of cortisol. Measures of mood (POMS), cognitive function (N-back scores), and salivary cortisol were collected pre, post, and 24hrs after testing. Rating of perceived exertion (CRQ-10) was collected after each set of every exercise throughout testing. **RESULTS:** Rating of perceived exertion progressively increased over the course of the training session; however, no significant difference in POMS scores were seen between baseline, pre, post, or 24 hours after testing. No significant differences in salivary cortisol responses were seen between pre, post, or 24 hours after testing; however, large variance in individual salivary cortisol responses was observed. A significant decrease in N-Back scores was seen from pre to post for the 2N (pre  $66.64 \pm 33.39\%$ ; post  $46.57 \pm 28.99\%$ ;  $p < 0.05$ ) and 3N (pre  $32.71 \pm 17.53\%$ ; post  $11.29 \pm 19.60\%$ ;  $p < 0.01$ ) testing scores. **CONCLUSION:** Single session high-intensity resistance exercise appears to impair acute short-term working memory in collegiate American football players. This impairment, coupled with highly variable individual cortisol responses, may increase the risk for training injuries or contribute to decreased academic performance in division II NCAA football players. Further research is needed to elucidate the magnitude of these impairments as a result of chronic high-intensity resistance exercise.

## USING TEMPOROSPATIAL GAIT PARAMETERS TO EVALUATE ASYMMETRIES AMONG ELITE ADOLESCENT SKI AND SNOWBOARD ATHLETES

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In ski and snowboard sports both legs work independently allowing for greater stresses being placed upon the athlete's dominant leg. Because of the repetitive nature of these sports repetitive sport specific training can predispose the athletes for developing bilateral asymmetries which increase their risk for injury. It is presently unknown if youth ski and snowboard athletes express bilateral gait asymmetries. **Purpose:** The purpose of this study was to determine if any gait asymmetries are present among high level adolescent ski and snowboard athletes. **Methods:** Competitive adolescent ski and snowboard athletes (n=24, 21 and 3 respectively) underwent shoeless walking trials at a self selected pace and starting foot, through a 2 m gait analysis system (OptoGait), until data was recorded for 3 strides of each foot. The OptoGait system assessed step length (SL), step time (ST), and single (SS) and double support (DS) time via line-of-sight LEDs. Step length (SL) was defined as the distance from one foot strike to the next foot strike of the opposite foot. Step time (ST) was identified as the time from one foot contacting the ground to the next foot strike. Stride length (STL) was defined as the distance from foot contact to subsequent foot contact on the ipsilateral side. **Results:** Comparisons of temporospatial gait parameters between self reported dominant and non-dominant sides were made using paired t-tests. Intrasubject right and left SL was significantly different ( $p < 0.01$ , Left SL =  $70.36 \pm 7.1$  cm; Right SL =  $69.3874 \pm 7.22$ ; Figure 3). Between right and left steps, there was no statistical significance in ST, SS, DS or STL. **Conclusion:** As significant gait imbalances have been shown to be linked to ACL injuries which is a common injury in ski and snowboard athletes, gait screening and corrective exercise programs may serve a prehabilitative role with these athletes.

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# THE EFFECTS OF CONTRAST WITH COMPRESSION THERAPY ON THE RECOVERY OF MUSCLE GLYCOGEN AFTER A BOUT OF RESISTANCE EXERCISE

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Contrast with compression (CwC) therapy is commonly used by athletes to reduce pain, swelling and improve the rate of recovery of strength after intense exercise. Muscle glycogen is an important energy source for many athletes and is often a rate limiting factor of performance in prolonged high intensity sports. It is presently unknown if CwC affects the rate of muscle glycogen recovery after exercise. **PURPOSE:** The purpose of this study was to use a recently developed CwC device to determine if its use after an intense bout of resistance exercise affects the rate of intramuscular glycogen recovery. **METHODS:** The study design was a repeated measures within subject design in which 10 men (Age:  $21.5 \pm 2.7$  y; Height:  $181.3 \pm 8.1$  cm; Mass:  $87.7 \pm 19.2$  kg) completed two subsequent single-arm elbow flexor workouts on an isokinetic dynamometer. After the exercise, each participant completed either three 10 min bouts of CwC therapy immediately, 24 hr and 48 hr after the exercise or no therapy (CON). Each participant's diet was recorded using ASA24 diet record system for each day. Intramuscular glycogen was measured before and immediately after the exercise as well as 1, 24, 48 and 72 hrs after the exercise from transverse ultrasound images. At each time point, three images were taken and analyzed using ImageJ software. Comparisons were made over time and between interventions (CwC vs CON) using a 2 x 6 (condition by time) mixed model ANCOVA with Bonferroni post-hoc test ( $p < 0.05$ ). **RESULTS:** There was a main effect of time ( $p = 0.009$ ) where glycogen concentration increased from baseline values after the exercise ( $p = 0.001$ ) and then glycogen significantly increased from post-exercise values at 1 hr ( $p = 0.002$ ) and 24 hr ( $p = 0.003$ ) post exercise. After further investigation, there was no differences observed between conditions ( $p = 0.324$ ) nor an interaction effect seen between conditions over time ( $p = 0.117$ ). **CONCLUSIONS:** Both conditions showed an increase in pixel density from pre exercise to the immediate post exercise time point. There was then a decrease in pixel density 1 hr after exercise. Glycogen was seen to be altered due to the exercise bout but did not significantly recover faster through the use of contrast with compression therapy.

## **RELATIONSHIP BETWEEN SIT-TO-STAND PERFORMANCE AND UPWARDS POSTURAL TRANSITIONS OBSERVED IN A SIMULATED HOME ENVIRONMENT**

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Timed sit-to-stand performance has been shown to be an indicator of knee extensor strength and balance. This type of postural transitions is a common activity of daily living, and one's ability to perform them plays a role in maintaining active, independent living. **PURPOSE:** The purpose of this study was to examine the relationship between sit-to-stand performance and upwards postural transitions (UPTs) observed in a simulated home environment. We hypothesized that completion time of five repeated sit-to-stand transitions (FRSTS) would be positively correlated to the number of daily UPTs performed by an individual in one day. Additionally, we hypothesized that the variability between two timed FRSTS sessions would be positively correlated to the variability in the number of UPTs performed on two separate days.

**METHODS:** 20 young, healthy participants (50% female;  $24.6 \pm 2.7$  years old) completed a 48-hour stay in a camera-equipped simulated domicile and two timed trials FRSTS on separate days. Participants were instructed to complete FRSTS quickly and without using the arms. Completion time was recorded. Video of the 48-hour stay was scored by certified annotators using The Observer XT. The scored direct observations were processed with a custom MATLAB script summing daily UPTs. Separate Pearson product moment correlations were calculated for 1) average UPTs/day and average FRSTS time, and 2) variability in UPTs/day between days and variability in FRSTS time between visits. **RESULTS:** Participants averaged 43.6 UPTs/day (range 20-72.5 UPTs/day), with an average difference of 10.0 UPTs between days. The group averaged 8.72s for the FRSTS (range 6.32-11.78s), varying by 0.9s each visit. Neither correlation revealed significant association: average UPTs/day and average FRSTS time ( $r = 0.059$ ,  $p = 0.81$ ), and the variability in UPTs/day between days and the variability in FRSTS time between visits ( $r = 0.140$ ,  $p = 0.56$ ). **CONCLUSION:** Anticipated associations between FRSTS and daily UPTs were not observed. This could be due to the young, healthy nature of this population or the inherently sedentary nature of the 48-hour stay in a domicile. The relationship between FRSTS and UPTs should be explored in both elderly and/or mobility-limited populations, and in free-living environments.

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## **MODERATE AND HIGH INTENSITY EXERCISE PREVENTS THE NAFLD-INDUCED IMPAIRMENT IN MARKERS OF HEPATIC LACTATE METABOLISM**

Skeletal muscle uptake and utilization of lactate is impaired with obesity. However, this impairment is partially restored in skeletal muscle with exercise training. Whether these exercise training adaptations occurs in the liver in the setting of nonalcoholic fatty liver disease (NAFLD) is unknown.

**PURPOSE:** To determine if NAFLD impairs markers of lactates conversion to pyruvate and ultimately pyruvate oxidation, and whether exercise can rescue this.

**METHODS:** Hyperphagic, obese OLETF rats (age 20 wks; n= 8–10/group) were assigned to sedentary (O-SED), moderate-intensity exercise training (O-MOD; 20 meters/min, 15% incline, 60 min/d, 5 d/wk treadmill running), or high-intensity interval exercise training (O-HIIT; 40 meters/min, 15% incline, 6×2.5 min bouts/d, 5 d/wk treadmill running) groups for 12 weeks. LETO rats in SED (L-SED) conditions were used as a control group.

**RESULTS:** Both MOD and HIIT EX lowered hepatic triglyceride and attenuated weight gain vs O-SED (~45-65%, ~15% respectively,  $p<0.05$ ). The O-SED group had a ~40% reduction in hepatic mRNA expression for *LDHb:LDHa* ratio (indicative of suppression of lactate's conversion to pyruvate to be oxidized) compared to L-SED ( $p<0.001$ ). This reduction in *LDHb:LDHa* ratio was attenuated by both MOD and HIIT, with no differences between intensities. Compared to L-SED, hepatic *pdk1* mRNA expression (marker of pyruvate oxidation) was also reduced with O-SED ( $p<0.05$ ), reductions not witness with either MOD EX or HIIT groups. Furthermore, the *LDHb:LDHa* ratio was negatively associated with extra-mitochondrial fatty acid oxidation ( $r = -0.44$ ,  $p<0.05$ ) and fatty acid synthase protein content ( $r = -.37$ ,  $p<0.05$ ) in the liver, and positively associated with liver protein kinase A protein content ( $r = 0.52$ ,  $p<0.01$ ), regardless of group.

**CONCLUSION:** Here, we show that NAFLD impairs hepatic markers of lactate conversion to pyruvate along with markers of pyruvate oxidation. This impairment was prevented by both moderate and high intensity exercise. Markers of lactate utilization were associated with a decrease in indicators of hepatic lipogenesis. These data suggest that both moderate and high intensity exercise may improve hepatic lactate metabolism in the setting of NAFLD.

## EFFECTS OF 12-WEEKS OF WATER AEROBICS ON BODY COMPOSITION IN THOSE AFFECTED BY BREAST CANCER

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In addition to the impact of cancer itself, treatments for cancer may induce fatigue, losses in muscle strength and endurance, and decreased cardiovascular function. The types and levels of exercises that are most effective for producing positive outcomes in breast cancer survivors without additional risk of lymphedema is still under investigation. **PURPOSE:** Test the effectiveness of a water aerobics program of 12-weeks on body composition for those affected by breast cancer. **METHODS:** Each participant completed body composition analysis at 0, 6, and 12 weeks using InBody's 770 system. **RESULTS:** Ten participants completed body composition testing at weeks 0, 6, and 12. Baseline characteristics were as follows: age ( $59.4 \pm 7.4$  yrs), Wt ( $169.9 \pm 41.7$  lbs), body fat ( $40.2 \pm 9.8\%$ ), body fat mass (BFM) ( $71.3 \pm 31.5$  lbs), lean body mass (LBM) ( $98.7 \pm 13.3$  lbs), skeletal muscle mass (SMM) ( $53.17 \pm 8.09$  lbs), intracellular water (ICW) ( $44.28 \pm 13.3$  lbs) and extracellular water (ECW) ( $28.91 \pm 3.6$  lbs). One-way ANOVA showed no statistically significant differences over time as determined for weight ( $F(2,27) = 0.002$ ,  $P=.99$ ), body fat ( $F(2,27) = 0.004$ ,  $P=0.99$ ), BFM ( $F(2,27) = 0.001$ ,  $P=.99$ ), LBM ( $F(2,27) = 0.013$ ,  $P=.99$ ), SMM ( $F(2,27) = 0.027$ ,  $P=.97$ ), ICW ( $F(2,27) = 0.021$ ,  $P=.98$ ), and ECW ( $F(2,27) = 0.01$ ,  $P=.99$ ) across the 12-weeks. **CONCLUSIONS:** A water aerobics program of moderate intensity for 12-weeks was not enough to observe changes in body composition for breast cancer survivors. Correspondingly, the water aerobics program had no negative affect on ICW or ECW in breast cancer survivors indicating exercise did not increase their risk for lymphedema. Moderate intensity water aerobics may be a safe exercise method for breast cancer survivors at risk for lymphedema but this form of exercise did not enhance body composition in these patients.

## **PILOT STUDY: THE INFLUENCE OF PHOTOBIO-MODULATION ON RECOVERY FROM EXERCISE-INDUCED MUSCLE DAMAGE**

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**INTRODUCTION:** Intense physical activity can result in exercise-induced muscle damage, delayed-onset muscle soreness, and decrements in performance. Photobiomodulation, specifically low-level laser therapy (LT), may enhance recovery from vigorous exercise. **PURPOSE:** To examine the impact of LT on recovery from exercise-induced muscle damage, caused by a sprinting protocol. **METHODS:** In a between-group design, 22 participants performed 40x15m sprints, inducing muscle damage. Immediately following sprinting and in the four days following, vertical jump, agility, and perceptions of muscle soreness were assessed. 11 subjects (mean±sd; age 20.2±1.2 yrs; BMI 26.3±4.5 kg·m<sup>-2</sup>) received LT prior to testing each day, while 11 (mean±sd; age 20.9±1.5 yrs; BMI 26.8±4.6 kg·m<sup>-2</sup>) served as a non-LT control (CON), receiving a sham laser treatment. Measurements were recorded during the five days of recovery from the repeated sprint protocol, and 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 by a two-tailed unpaired t-test for normally distributed data, and a two-tailed Mann-Whitney U for nonparametric data (alpha level = 0.05). **RESULTS:** No significant differences were observed between groups for vertical jump (p=0.21), agility (p=0.55), and quadriceps (p=0.47), hamstring (p=0.33) or calf (p=0.051) soreness. **CONCLUSION:** These preliminary findings suggest that recovery of explosive, short-duration activities is not statistically altered with LT in the same manner as longer-duration, aerobic activities, as has been reported in the literature. LT is thought to exert its effects via mitochondrial biogenesis and increased electron transport chain activity. Therefore, muscles with a higher percentage of type I muscle fibers performing endurance-based tasks may stand to benefit more from the treatment. Until further testing is completed, individuals should seek recovery modalities best-suited to their activities of choice.

## **MENOPAUSE-ASSOCIATED SYMPTOMS AND PHYSICAL ACTIVITY IN MIDLIFE WOMEN**

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The menopausal transition is marked by dramatic physical and psychological changes in women that may be related to increased cardiovascular disease (CVD) risk. Some evidence suggests a relationship between self-reported vasomotor symptoms (VMS; e.g. hot flashes and night sweats), and negative affect (Thurston & Joffe, 2011). The role of physical activity in this relationship is unclear. **PURPOSE:** The purpose of this study was to investigate the relationship between physical activity (PA), psychological symptoms, and VMS in healthy midlife women. **METHODS:** Women aged 44 to 68 were recruited from a cohort of pre-, peri-, and post-menopausal women as defined by STRAW+10 Guidelines (Harlow, et al, 2012). Affect, presence of VMS, and symptom bother were assessed using an online questionnaire. Questions about affect included whether participants had experienced symptoms such as depression, mood swings, and anxiety. Participants rated their experiences of each symptom on a four point scale of severity (not at all, mild, moderate, or severe). Physical activity was measured and categorized using the International Physical Activity Questionnaire (IPAQ). Women were grouped into low, moderate, and high levels of PA. **RESULTS:** Twenty-four women (low active n=2, moderate active n=9, high active n=13) responded to the survey. BMI was similar between groups (low=21.8±1.4, moderate =23.2±0.4, high=22.1±0.6, p=0.362). Moderate- and high-active women reported fewer current VMS than low-active women (low-active, 100%; moderate-active, 22.2%; high-active, 30.8%) and reported fewer past VMS than low-active women (low-active, 100%; moderate-active, 66.67%; and high-active, 76.92%). High-active women reported the fewest psychological symptoms, followed by moderate- then low-active women (low-active, 100%, moderate-active, 66.67%, high-active, 53.84%). **CONCLUSION:** The preliminary data imply a potential relationship between PA and VMS, as well as PA and affect. Further data collection and analysis are needed to better assess the relationship between affect, VMS, and PA.

## EFFECTIVENESS OF A COMMUNITY- BASED PROGRAM ON IMPROVING CHILDREN'S PHYSICAL ACTIVITY EFFICACY AND WEIGHT MANAGEMENT

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**BACKGROUND:** The childhood obesity epidemic remains an issue, and a major contributing factor to this epidemic is a lack of physical activity. Although physical activity self-efficacy is important for physical activity promotion, research regarding this topic and its relationship with relative weight is lacking, especially among children who are overweight or obese. **PURPOSE:** The purpose of this study was to examine the effect of the Rhode Island Food Fitness and Fun (RIFFF), a 14-week family-based intervention for overweight and obese pre-adolescents, on children's physical activity self-efficacy and its relationship with body mass index (BMI) and BMI-z score. **METHODS:** Forty-three children (67.4% female, 50% Minority, age = 7.9±1.5yrs) completed the RIFFF program between 2014 and 2018. Physical activity self-efficacy was assessed by self-report, and BMI and BMI-z score were calculated by using measured height (inches) and weight (lb) at the beginning and the end of the program, factoring in their age, and sex. **RESULTS:** Participants body mass index (BMI) and BMI-z score remained stable overtime even though they grew taller (from 53.05 inches to 53.8 inches, p=0.001) and heavier (from 99.9lb to 102.5lb, p=0.007). Their physical activity self-efficacy improved from 12.2±2.16 to 12.8±2.67 but did not reach statistical significance (p=0.078). There is no statistical significance between physical activity self-efficacy and BMI (r=0.875) or BMI z-score (r=0.061). **CONCLUSION:** RIFFF was effective in improving children's physical activity self-efficacy and maintaining their BMI and BMI-z score, although there is no statistical significant relationship detected between them. In future community-based programs, it is beneficial to emphasize and incorporate self-efficacy into community-based programs in order to help the subjects to be more successful.

This program is currently supported by grants from Blue Cross & Blue Shield of Rhode Island since 2015.

## **EFFECT 8 WEEKS OF HIGH INTENSITY INTERVAL TRAINING ON THE RESTING METABOLIC RATE IN COLLEGE AGED FEMALES**

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Obesity is associated with an increased risk of morbidity and mortality. In order for weight loss to occur, there needs to be a negative energy balance. One possible way to create a negative energy balance would be to increase resting metabolic rate (RMR) PURPOSE: The purpose of this study was to examine if an 8-week high intensity interval training (HIIT) program could increase RMR in college aged females. METHODS: Nine healthy, previously sedentary females completed the HIIT program (mass=64.2±4.3 kg; height=1.6±0.6m). RMR was measured through the use of a Cosmed Canopy and the Cosmed Quark metabolic unit which accurately measures oxygen consumption. Measurements were taken within one week prior to the 8 weeks of exercise and within one week after the 8-week session. Participants arrived fasted to the human performance laboratory shortly after awaking in the morning. Participants trained on ellipticals, 3 times per week for 8 weeks. Each session lasted for 30 minutes (10x; 60 seconds hard; 60 seconds easy). Heart rate (HR) was measured via Polar HR monitors and all HR data was downloaded onto excel spreadsheets. Participants were asked to exercise at HRs above 85% of age predicted maximum during the hard interval. They were also asked to exercise at a “very hard” to a “very, very hard” level during the high intensity interval (>16 in Borg scale units). RESULTS: All participants were able to reach the HR and Borg scale units criteria during the HIIT training. There were not significant changes in RMR Pre and Post HIIT training (1558 kcal vs. 1625 kcal) CONCLUSIONS: These results suggest that an 8-week HIIT training program does not alter RMR in college aged females.

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NEXT

## Exercise Modality Effect on Subjective Rating of Mood and Depression

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Exercise has beneficial effects on general health and research has explored exercise as a potential intervention in the treatment of mood disorder symptoms. However, it is unclear whether one exercise modality is more effective than another in improving mood. **PURPOSE:** This study sought to assess the effects of different types of acute exercise (yoga, body pump, or spin classes) on subjective rating of mood and depression in college students. **METHODS:** 30 study subjects (age:  $20 \pm 1.02$ ) from among the Merrimack College student population participated in the study. Students participated in yoga ( $n=13$ ), body pump ( $n=11$ ) or spin ( $n=6$ ) classes. A 5-question Likert scale survey was distributed to students PRE and POST exercise class to assess changes in subjective rating of mood and depression as a result of the exercise intervention. The survey questions asked students to rate their mood, stress, depression, confidence and hope levels. PRE and POST survey results were analyzed to determine the effectiveness of the exercise intervention in improving subjective rating of mood and depression within and between groups. **RESULTS:** Statistical analysis revealed significant within-group interaction effects ( $F(8.694, 111.369) = 3.269, p=.002$ ). For the group as a whole ( $n=30$ ), pairwise comparisons indicated significant improvement in subjective rating of mood (PRE:  $3.73 \pm 1.14$ ; POST =  $4.47 \pm 0.84, p=.003$ ) and confidence (PRE:  $4.20 \pm 1.32$ ; POST:  $4.70 \pm 1.08, p=.012$ ). For the yoga group, pairwise t-tests revealed significant improvements in mood (PRE:  $4.15 \pm 1.07$ , POST:  $4.84 \pm 0.38, p=.022$ ) and confidence (PRE:  $4.62 \pm 1.45$ ; POST:  $5.23 \pm 0.93, p=.055$ ). For the body pump group, significant improvements were noted in stress (PRE:  $4.82 \pm 1.25$ ; POST:  $4.09 \pm 1.38, p=.054$ ) and depression rating (PRE:  $3.27 \pm 1.61$ ; POST:  $2.30 \pm 1.10, p=.025$ ). For the spin group, no significant improvements were noted from PRE to POST across all survey question categories. **CONCLUSION:** Acute exercise appears to have a beneficial effect on subjective rating of mood and depression in college students. Exercise modality may influence the magnitude of the effect observed, although our results may have been affected by the small n-size within the spin group. Further research is needed to assess the effects other exercise modalities such as resistance exercise on subjective ratings of mood and depression.

Keywords: Exercise, Mood, Depression

## **EXAMINATION OF ENERGY INTAKE IN RESPONSE TO EXERCISE THROUGHOUT A 5-MONTH WEIGHT LOSS PROGRAM**

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Energy compensation research has primarily focused on laboratory-based studies in normal weight or slightly overweight samples; however, it is important to examine this association under free-living conditions, over a longer period of time, and among those with a higher BMI.

**PURPOSE:** To examine whether individuals with severe obesity compensate, or eat more, on exercise versus non-exercise days. **METHODS:** 12 weight loss seeking individuals (BMI:  $45.28 \pm 4.24$  kg/m<sup>2</sup>; age:  $39.25 \pm 8.64$  years) completed a 5-month weight loss program. Participants reported energy intake (EI) on the Body Media website and wore a Body Media armband which objectively assessed physical activity (PA) daily. Participants were prescribed a calorie-restricted diet of 1500-1800 kcal/day and given a PA goal that progressed to 225 min/wk of moderate-intensity exercise. Days were excluded if reported EI was <500 calories or wear time was <8 hours. Exercise days were defined as days with  $\geq 30$  minutes of PA (defined by a MET value  $>3.7$  using proprietary algorithms). Daily steps were totaled and 'high' step days were classified as  $\geq 1$  standard deviation above one's mean and 'low' step days were  $\geq 1$  standard deviation below one's mean. **RESULTS:** There were  $125.6 \pm 37.3$  days included in the analyses and 57% of those were 'exercise days'. By design, energy expenditure and PA minutes on exercise days ( $3393.8 \pm 755.0$  kcals;  $56.9 \pm 14.3$  min) were significantly higher than energy expenditure and PA minutes on non-exercise days ( $3043.3 \pm 690.4$  kcals;  $16.1 \pm 3.7$  min;  $p < 0.001$ ). Despite these substantial differences, mean energy intake on exercise ( $1541.9 \pm 378.4$  kcals) and non-exercise days ( $1518.8 \pm 464.7$  kcals,  $p = 0.68$ ) were comparable. Similarly, participants engaged in significantly more steps on 'high' ( $8896.4 \pm 1012.9$  steps) versus 'low' step days ( $5232.3 \pm 822.6$  steps;  $p < 0.001$ ), yet energy intake did not differ (high step days:  $1609.5 \pm 427.3$  kcals, low step days:  $1559.3 \pm 474.1$  kcals;  $p = 0.33$ ). **CONCLUSION:** Findings reveal that, on average, weight-loss seeking individuals with severe obesity do not compensate by eating more in response to exercise. These findings extend previous reports by moving beyond a laboratory setting and examining energy compensation throughout a weight loss program. While preliminary, this indicates that standard behavioral weight loss programs may not need to be modified to further address compensatory eating behaviors.

## COMPARISON OF EXERCISE INTENSITY IN CONTROLLED AND SELF-REGULATED ENVIRONMENTS

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Studies suggest engagement in moderate-to-vigorous intensity exercise for weight loss and health benefit. Traditionally, exercise is prescribed as a percentage of maximal heart rate (HR); but this can be burdensome to monitor. Thus, it is important to investigate whether individuals self-select an exercise intensity comparable to controlled ‘moderate intensity’ exercise experienced in a laboratory setting. **PURPOSE:** To determine whether exercise intensity at ‘supervised’ exercise visits (in a laboratory setting with HR monitored) differs from self-selected exercise intensity assessed via accelerometry. **METHODS:** 29 females who were inactive at baseline (<60 min/wk) and overweight/obese (age:  $40.4 \pm 10.4$  years, BMI  $31.4 \pm 4.2$  kg/m<sup>2</sup>) participated in 12 weeks of supervised and unsupervised exercise sessions which progressed to 200 min/wk (week 1: 100 min/wk, week 2: 150 min/wk, weeks 3-12: 200 min/wk). During supervised sessions, HR was maintained at 65-75% of age-predicted maximum (moderate intensity) and ratings of perceived exertion (RPE) were recorded every 10 minutes. Supervised sessions occurred 2x/week during weeks 1-4 (weeks 1-2: 30 min/session, weeks 3-4: 40 min/session), and 1x/week during weeks 5-12 (50 min/session). Unsupervised exercise was self-regulated and self-reported, and participants were instructed to exercise at an intensity similar to that experienced during supervised sessions, but HR was not monitored. A physical activity (PA) monitor (SenseWear armband) was worn during all exercise bouts, supervised and unsupervised, to verify exercise completion and quantify exercise intensity using metabolic equivalents (METs). **RESULTS:** Compliance to the exercise prescription was excellent (15.5±1.1 of 16 supervised sessions attended; 186±31.1 min/wk of prescribed 188 min/wk PA completed). On average, participants exercised at a higher intensity during unsupervised ( $4.6 \pm 0.5$  METs) versus supervised sessions ( $4.4 \pm 0.4$  METs;  $p=0.048$ ), despite a comparable mean exercise duration between unsupervised and supervised sessions ( $42.6 \pm 7.0$  vs.  $44.4 \pm 1.4$  min/bout;  $p=0.184$ ). Average RPE during supervised sessions was not correlated with the difference in METs between unsupervised and supervised sessions ( $r=0.11$ ,  $p=0.56$ ). **CONCLUSION:** Individuals self-selected higher intensity exercise during unsupervised sessions compared to supervised sessions. This indicates that exposure to controlled, ‘moderate intensity’ exercise results in the ability to replicate or exceed that intensity in the absence of a HR monitor.

## THE IMPACT OF POST-EXERCISE HOT OR COLD WATER IMMERSION ON HEART RATE VARIABILITY

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Athletes regularly engage in post-exercise recovery strategies, including cold (CWI) or hot water immersion (HWI) to optimize training responses. Post-exercise CWI is thought to reduce inflammation and soreness, while regular HWI is associated with enhanced heat tolerance and improved aerobic performance. It is unknown whether these strategies improve or impair recovery, commonly measured in athletes using first morning heart rate variability (HRV). **PURPOSE:** To examine the impact of CWI and HWI on HRV in well-trained individuals after a bout of intense exercise. **METHODS:** Nine healthy, active individuals (5M, 4F) took part in 3 randomized, counterbalanced trials consisting of interval exercise (~8k treadmill running with 8x400m intervals) followed by a 30 minute treatment of either CWI (13-14°C), HWI (39-40°C), or time control (CON; seated passive recovery). HRV was measured pre-exercise, immediately post-exercise, immediately post-treatment (HWI, CWI, or CON), and the following morning (12h post-exercise) using a commercially available heart rate monitor and the *ithlete*<sup>TM</sup> application. This application collects 1 min of HRV data and assigns a recovery score, with higher scores indicating greater recovery. Results were analyzed using a repeated measures ANOVA with significance accepted at  $p < 0.05$ . **RESULTS:** Post-exercise HRV significantly decreased ( $\Delta\text{HRV} = -25 \pm 8$  A.U.;  $p < 0.001$  vs Pre-exercise) in all groups. Post-treatment, HRV increased following CWI ( $90 \pm 9$  A.U.;  $p = 0.009$  vs CON) and decreased in HWI ( $59 \pm 12$  A.U.;  $p < 0.001$  vs CON) compared with CON ( $81 \pm 10$  A.U.). However, 12h post exercise, HRV was not different between treatments ( $p = 0.997$ ). **CONCLUSION:** While CWI and HWI have an acute impact on HRV, no differences in HRV are seen the following morning. This timeline is important as athletes use first morning HRV to monitor recovery and optimize training load, and these results suggest athletes using post-exercise CWI and HWI will not experience a benefit or detriment in HRV as a measure of recovery.

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## CHANGES IN FRONTAL PLANE MOTION AFTER NOVEL MOTOR TRAINING POST-STROKE: A CASE STUDY

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**INTRODUCTION:** Unilateral lower limb motor impairment is common among stroke survivors. Many use compensatory strategies to walk, such as hip circumduction, to compensate for weak hip flexion, or because of abnormal coordination. Circumduction destabilizes the body by increasing frontal plane motion. **PURPOSE:** The purpose of this study was to determine whether a novel motor training task would improve lower extremity frontal plane motion of a stroke survivor's affected side over 10 training sessions. **METHODS:** The subject of this study was a 72-year-old male who was 61 months post-stroke (height=1.83m, weight=84.4kg). Data were collected during 10, 30-minute training sessions twice each week for 5 weeks, as well as at baseline, mid-training, and post-training sessions. During training the subject walked while stepping over obstacles with the unaffected leg which forced weight-bearing onto the affected leg. This process was repeated over 30 minutes with rest periods given as needed. Baseline, mid-, and post-training sessions were performed at preferred walking speed, chosen during the baseline session. Passive marker motion capture was performed at 100Hz and three-dimensional marker coordinates of the lateral malleolus were calculated for the affected leg (VICON, Oxford, UK). Repeated measures analysis of variance was performed to determine differences in mediolateral motion of the affected leg over the course of the training and within three training sessions ( $p < 0.05$ ). **RESULTS:** Baseline, mid-, and post-training sessions exhibited decreased mediolateral motion in the ankle of the affected side over time ( $p = 0.00117$ ), 59.3, 51.2, 48.5 mm, respectively). The training sessions yielded no significant differences in mediolateral motion over time, suggesting that frontal plane motion of the leg had improved because of the cumulative training with the novel motor training task. **CONCLUSION:** Decreased frontal plane motion over the course of training signified less reliance on the compensatory strategy of hip circumduction, reflecting a safer kinematic strategy.

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## COMPARISON OF PRE-HIGH SCHOOL AND HIGH SCHOOL FOOTBALL QUARTERBACK INJURIES

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**PURPOSE:** To compare the common injuries of pre-high school (Pre-HS) and high school (HS) American football quarterbacks (QBs) within the last 15 years. **METHODS:** A retrospective chart review of all pediatric and adolescent American football QB patients who sustained sports-related injuries at a regional pediatric medical center between 01/01/2003 – 10/01/2018. Patients were identified using *HoundDog* to search the term “quarterback.” Records were then reviewed to identify all QBs  $\leq$  18 years of age. QBs were further classified Pre-HS (<14 years old) and HS (14-18 years old). Non-football related injuries were excluded. Main outcome variables were injured anatomic locations, injury types, surgical status, and settings in which the injury occurred. Descriptive statistics were used to analyze the outcome variables and Fischer's Exact Test was used to determine statistical significance ( $p < 0.05$ ). **RESULTS:** A total of 121 injuries were found in 118 male Pre-HS QBs (mean age:  $12.4 \pm 1.6$ ), while 302 injuries were observed in 256 male HS QBs (mean age:  $15.8.4 \pm 1.4$ ). The top 3 injured anatomic locations for Pre-HS QBs were elbow (20.7%), shoulder (18.2%), and head/neck (14%). For HS QBs, the top 3 injured anatomic locations were shoulder (24.5%), knee (17.5%), and head/neck (15.2%). There were significant differences in proportion of elbow, hip/trunk/upper leg, and knee injuries between Pre-HS and HS QBs (Table 1). Pre-HS QBs had significantly more bony/cartilaginous/labral injuries than their older counterparts (60.3% vs. 46.3%,  $p = 0.009$ ) while HS QBs experienced significantly more ligamentous injuries than Pre-HS QBs (14.2% vs. 5.8%,  $p = 0.015$ ). **CONCLUSION:** QB-associated injuries were distinctively different between Pre-HS and HS QBs. Future studies are warranted to investigate relatively high proportions of elbow injuries as well as bony/cartilaginous/labral injuries found in Pre-HS QBs.

**Table 1.** Anatomic Location of Injury

Location	Pre-HS QBs (<14 yrs) (N=121)	HS QBs (14-18 yrs) (N=302)	P-Values
Head/Neck	17 (14%)	46 (15.2%)	0.758
Back	11 (9.1%)	31 (10.3%)	0.715
Shoulder	22 (18.2%)	74 (24.5%)	0.161
Elbow	25 (20.7%)	32 (10.6%)	0.006*
Lower Arm / Wrist / Hand	12 (9.9%)	34 (11.3%)	0.689
Hip / Trunk / Upper Leg	13 (10.7%)	10 (3.3%)	0.002*
Knee	11 (9.1%)	53 (17.5 %)	0.028*
Lower Leg / Ankle / Foot	10 (8.3%)	22 (7.3%)	0.731

## **TRACKING CALORIES: VALIDITY OF WEARABLE ACTIVITY MONITORS**

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The use of commercially accessible activity monitors has increased over the past few years. Assessing the accuracy of these devices is necessary to inform recreational consumers about the validity of these products. **PURPOSE:** To assess the validity of four activity monitors (LetsFit, Garmin Vivosmart 4, Fitbit Charge 3, and the Polar H7) for energy expenditure data (EE). **METHODS:** Twenty-one subjects (8 male and 13 female), with the average age of 20.2 years performed three exercise protocols: walking at 3.0 mph, running at 6.0 mph, and a HIIT workout for ten minutes each. Each exercise bout was followed by seated rest period until subjects returned to pre-exercise MET values. EE measured in kcal and METs was measured by the Parvo Metabolic Cart and compared with four activity monitors. EE from activity monitors was recorded from apps in kcals upon completion of the testing. Descriptive statistics were performed for all variables. Coefficient of determination ( $R^2$ ) was used to assess the validity of EE in kcals for all devices. **RESULTS:** FitBit was the most accurate device with the  $R^2$  of 0.68 for walking, 0.62 for HIIT and 0.59 for running. LetsFit activity monitor showed the weakest correlations for the running (0.27), and the HIIT (0.34) protocols but was comparable to FitBit for walking (0.64). The Garmin Vivosmart 4 was the least accurate for walking ( $R^2 = 0.246$ ) and showed low validity for running and HIIT (0.36 and 0.47 respectively). The Polar H7 was most accurate for higher intensity activities such as running (0.68) and HIIT (0.67). **CONCLUSION:** FitBit was consistently the most accurate out of tested devices. However, results of this study demonstrate invalid assessment of EE by all wearable devices. None of the activity monitors met the correlational standard of 0.7. The FitBit Charge 3 was the most consistent activity monitor. Future research should continue to assess the validity of these devices to provide accurate information to recreational consumers.

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## **A RANDOMIZED CONTROL TRIAL COMPARING TWO DIFFERENT APPROACHES TO PRESCRIBE EXERCISE: RATIONALE AND PROTOCOL**

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The Physical Activity Guidelines for Americans (PAG) recommend 150-min/wk of moderate-intensity aerobic physical activity (PA) plus two days of muscle-strengthening PA for health. Yet, 26% of Americans and 36% of college students do not perform any leisure-time PA. Theory-based strategies have been modestly successful at increasing PA; however, practical alternatives are needed to increase PA levels in these segments of our society. **PURPOSE:** To conduct a randomized controlled trial (RCT) labeled, *HEAT*, which will compare two different approaches of exercise prescription (ExR<sub>x</sub>) to increase PA volume among college students. **METHODS:** Subjects will be 60 sedentary, healthy college students  $\geq 18$  yr without eating disorders or depression. They will be randomized to two groups: (1) HEAT-1 emphasizes striving to meet the PAG recommendation via the *F*requency, *I*ntensity, *T*ime, and *T*ype or *FITT* principle of ExR<sub>x</sub>; and (2) HEAT-2 emphasizes an alternative ExR<sub>x</sub> approach founded in integrated behavioral change theory that consists of social-cognitive and motivational strategies to increase autonomous motivation, and thereby PA, by connecting the intention to exercise with the behavior. HEAT-1 will progress students from being sedentary to meeting the weekly PAG recommendation over a 12wk structured *FITT* ExR<sub>x</sub>; and HEAT-2 will progress students from being sedentary to becoming regularly physically active over a 12wk ExR<sub>x</sub> consisting of ways to integrate similar types of PA as HEAT-1 without following a structured *FITT* ExR<sub>x</sub> but instead increasing movement throughout the day/week with their preferred PA. The primary outcome for both groups will be the change in PA volume in response to the two 12wk ExR<sub>x</sub> approaches as assessed objectively via accelerometer and subjectively via the Paffenbarger Physical Activity Questionnaire. Psychosocial mechanisms for the changes in PA volume will also be investigated. **RESULTS:** We hypothesize that college students in HEAT-2 will increase PA volume more than HEAT-1 in response to the two 12wk ExR<sub>x</sub> approaches due to higher autonomous motivation. **CONCLUSION:** If our hypothesis proves correct, the public health ExR<sub>x</sub> approach can be used as an alternative to the PAG recommendation to increase the PA among college students, and should be tested among the general American population.

## **ACTIVE SCIENCE! STUDENTS PERCEPTIONS OF PHYSICAL ACTIVITY WITHIN AND BEYOND THE SCHOOL DAY**

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The lack of physical activity (PA) among children and adolescents is a public health concern. Increased sedentary time, accompanied by imbalance of calories consumed and expended, greatly contributes to obesity rates in youth populations. When aiming to address this epidemic, using simple, enjoyable, activities appropriate all skill levels can improve children's confidence and skills. Enhancing children's perceptions of PA, both in and outside of school, can positively influence their likelihood to be active and continue behavior into adulthood. **PURPOSE:** The purpose of this study is to gain insight of elementary school student's perceptions of physical activity during the school day and outside of the school day and also evaluate the impact of Active Science on student's perceptions. **METHODS:** Subjects of this study included third and fourth grade elementary school students from Lawrence, Massachusetts, who actively participated in Active Science during their physical education (PE) classes. Perceptions were evaluated with written surveys consisting of quantitative and qualitative measures. A one-way ANOVA was computed determining the mean differences of student's perceptions of PA in and outside of school and with the influence the impact Active Science with school. **RESULTS:** Students perceived PE as a key factor of PA during school. Outside school, students enjoy playing sports or unstructured PA, often with friends and family. Active Science was positive addition to PE and influenced students to be more active. Student's perceptions of PA were enhanced using Active Science. **CONCLUSION:** While lack of time is concern in both settings, structured elements of PA during school may increase children's perceptions of PA compared to outside school. Providing students the opportunity to track their PA data in real time, interacting with peers while doing so, contributes to strengthen perceptions of PA with Active Science participation. Implementing a program designed toward increasing PA in school-age children can further improve their perceptions of PA. Heightened perceptions of PA during childhood may lead to greater activity levels, increasing lifelong healthy behaviors.

## THE EFFECTS OF CONTRAST WITH COMPRESSION THERAPY ON MUSCLE RECOVERY POST EXERCISE

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Intense eccentric exercise causes muscle damage that leads to a decrease in subsequent performance that may last for up to four days. Complete muscle recovery between bouts of exercise is essential for optimal athletic competitive performance. Accelerating muscle recovery minimizes the risk of injury while participating in subsequent bouts of activity. **PURPOSE:** The purpose of this study was to determine if the contrast with compression (CwC) therapy proprietary device by Solid State was able to improve muscle recovery post intense eccentric exercise. **METHODS:** Ten physically active men (age =  $21.3 \pm 2.1$  years; height =  $182 \pm 8.5$ cms; weight =  $88 \pm 19.5$ kg; body fat =  $17.2 \pm 7\%$ ; Lean Mass in CwC arm =  $4.13 \pm 0.68$ kg; Lean Mass in Control Arm =  $4.11 \pm 0.72$ kg) completed two separate single-arm elbow flexor workouts on an isokinetic dynamometer. After one workout each participant received contrast with compression (CwC) therapy immediately after, 24h and 48h after the workout. After the other workout the same person received no treatment(CON). Post-exercise recovery of selected characteristics were measured at 1h, 24h, 48h and 72h. Comparisons were made between the CwC and CON groups using a repeated measures ANOVA ( $p \leq 0.05$ ). A Bonferroni post-hoc test was used to assess timepoint differences in between interventions in recovery post eccentric exercise. **RESULTS:** CwC therapy post exercise resulted in a significantly faster recovery rate of strength and power to baseline levels ( $p=0.00$ ) as well as a greater recovery of overall relative strength ( $p=0.004$ ). Treatment with CwC significantly suppressed the post-exercise inflammatory response ( $p=0.05$ ) and significantly reduced the secondary muscle damage response as measured by levels of Creatine Kinase post exercise. CwC therapy also resulted in a significantly quicker recovery of the maximal elbow flexion range of motion ( $p=0.00$ ) within the hour post exercise. Lastly, participants experienced significantly less soreness 48 hours and 72 hours post-exercise with CwC therapy. **CONCLUSION:** Contrast with compression therapy significantly increases the recovery rate of muscle strength and power post eccentric exercise. CwC is also effective at reducing exercise associated muscle damage, delayed onset muscle soreness and mitigates the loss of range of motion post intense exercise.

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## **A SURVEY OF THE CURRENT USE OF SPORTS SCIENCE IN MAJOR LEAGUE SOCCER**

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While the scientific literature regarding soccer is increasing exponentially, it's unclear as to what end sports science has been integrated into major league soccer (MLS).

**PURPOSE:** The purpose of this study was to determine how sports science is integrated into MLS teams and the experiences of those who implement these programs.

**METHODS:** Representatives were systematically identified from their official team website based on job title and contacted via publically available email, LinkedIn and/or social media and asked to complete a brief online survey. **RESULTS:** Of the 24 MLS teams, sports science representatives from 8 teams completed the survey. While 23/24 MLS teams posted a position we identified as being related to sports science no more than 3 shared the same title and only 12/24 had the word "science" or "scientist" in their title. Survey results indicated that 5/8 responding teams had a person on staff that could be identified as a sports scientist and that their job responsibilities generally focused around athlete monitoring and training load adjustment. The typical person responsible for implementing science into practice has graduate degree (8/8), has played soccer (n=8) and attained most of their knowledge from personal experience, but regularly attends conferences (n=8) and reads scientific journals (7/8). However, only 6/8 had a degree in an exercise/sports science related field, 4/8 played soccer at least the semi-professional level, 4/8 had a soccer coaching license/diploma and professional organization certification and interaction varied greatly. **CONCLUSION:** While sports science is integrated into most MLS teams its emphasis varies greatly between teams, as does the background of those responsible for integrating scientific concepts.

## VALIDITY OF WRIST-WORN ACTIVITY TRACKERS

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The use of physical activity monitors in population-based research has increased dramatically in the past decade. Wrist-worn activity monitors are often used to monitor heart rate (HR) for exercise intensity. Assessing the validity of these devices is important for accurate exercise prescription and user safety. **PURPOSE:** The objective of this study was to assess the validity of three common wrist-worn physical activity monitors for measuring HR during three modes of exercise. **METHODS:** Twenty-one participants (seven males, fourteen females) completed the study. Inclusion criteria for participation were:  $\geq 18$  years of age, have no history of cardiovascular or chronic disease (assessed by PAR-Q+), and have the ability to run for 10 minutes at 6mph. HR data was recorded for FitBit Charge 3, Garmin Vivosmart 4, and LetsFit during 10 minutes of walking at 3mph, running at 6mph, and High Intensity Interval Training (HIIT) session consisting of body weight series of exercises. HR data was collected every minute and compared against Polar H7 chest strap to assess validity.  $R^2$  values were calculated for each device and each mode of exercise. **RESULTS:** FitBit was the most accurate device with  $R^2$  of 0.733 for running and 0.678 for walking. Garmin data showed moderate  $R^2$  for running (0.54) and walking (0.44). LetsFit HR data was unreliable. HIIT was the least accurate for each monitor ( $R^2$  range 0.098-0.124). **CONCLUSION:** These results demonstrate that the accuracy of the devices for tracking HR increases with increasing intensity of steady-state activities. HR data during HIIT was unreliable possibly due to excessive movements. Assessed physical activity monitors in this study are not very accurate for tracking HR during walking, running, and HIIT particularly when used for patient monitoring. The cheapest monitor (LetsFit Fitness Tracker) had a very weak correlation, meaning that consumers should consider spending the extra money for more accurate HR readings for steady-state activities. More research needs to be done to further explore the accuracy of activity monitors for a wider range of modalities and intensities.

## **THE ROLE OF INCENTIVES ON PHYSICAL ACTIVITY PARAMETERS IN ELEMENTARY SCHOOL CHILDREN IN URBAN COMMUNITIES**

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Childhood obesity is a serious health concern in the United States putting children and adolescents at risk for poor health. It is recommended that children and adolescents ages 6 to 17 years participate in 60 or more minutes of moderate-to-vigorous physical activity daily, yet only 26% of children met this recommendation. **PURPOSE:** The study was designed to examine the role of incentives on physical activity parameters among elementary school students, as well as students' perceptions of physical activity. **METHODS:** Participants will include male and female elementary school students in third grade from Guilmette Elementary School participating in Active Science in physical education class. The school and classes were selected based on teacher and administrator willingness to participate in data collection. **RESULTS:** Four, paired samples t-tests were used to determine the mean differences in physical activity parameters including: total steps, distance in miles, total activity time, and moderate to vigorous physical activity (MVPA) pre and post incentives. A significant mean difference was determined for all physical activity data ( $p < .05$ ; Table 1). **CONCLUSION:** Motivation plays a big role in physical activity participation among children. Students who are influenced by autonomous factors, which means engaging in certain activities that influence your personal goals, are 20% more active in physical education than those students who were motivated by external factors. Data from this study showed that there was an increase in third grade elementary school students physical activity parameters (steps, distance in miles, time and MVPA) after incentives were implemented into the study.

## **VARYING POSTPRANDIAL, POSTEXERCISE NUTRIENT TIMING: EFFECTS ON SUBSTRATE OXIDATION AND PROTEIN RETENTION IN RESISTANCE-TRAINED MEN**

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Dietary protein and/or carbohydrate consumption augments postexercise recovery by facilitating the rebuilding of damaged contractile tissues and restoring energy reserves, particularly in a postabsorptive state. What is unknown is how altering postexercise nutrient timing when in a postprandial state affects the shift towards fat utilization and changes in net protein retention after a resistance training bout. **PURPOSE:** To examine the effects of immediate versus delayed postexercise nutrient intake in the postprandial state on postexercise fat and carbohydrate oxidation, nitrogen balance, and cortisol levels during 3 hours of recovery. **METHODS:** In a single-blinded, crossover design, resistance trained ( $\geq 1$  y) men ( $n=10$ ,  $22\pm 2$  y,  $83\pm 10$  kg) consumed a mixed, eucaloric meal 2 hours before performing a resistance exercise bout (3 sets of 6 exercises stimulating major muscle groups, 2-3 minutes rest). Participants then consumed one of the following three postexercise beverages: immediate consumption of a whey protein concentrate (0.35 g/kg) and dextrose (1.0 g/kg) beverage (IMM), delayed consumption (2 h) of a whey and dextrose beverage (+2H), or placebo (flavoring with water) (PLA). Participants recovered (3 h) while expired carbon dioxide and oxygen were analyzed. Substrate oxidation (carbohydrate and fat) was determined and body protein breakdown was investigated via analyses of salivary cortisol and urinary nitrogen excretion. **RESULTS:** Nitrogen balance in PLA ( $-0.02\pm 0.01$  g) was significantly lower than +2H ( $5.21\pm 0.63$  g,  $p<0.001$ ,  $ES=11.61$ ) and IMM ( $5.21\pm 0.64$  g) ( $p<0.001$ ,  $ES=11.59$ ) during the three-hour recovery. There were no significant differences in nitrogen balance between IMM and +2H ( $p=1.0$ ). Carbohydrate oxidation in IMM was significantly higher than +2H at 60 minutes postexercise ( $0.21\pm 0.13$  g/min vs.  $0.11\pm 0.12$  g/min, respectively;  $p=0.014$ ). Fat oxidation was higher in +2H than IMM at minute 90 ( $p>0.05$ ,  $ES=0.60$ ), minute 120 ( $p>0.05$ ,  $ES=0.40$ ), and minute 150 ( $p>0.05$ ,  $ES=0.50$ ). There were no significant differences in salivary cortisol among groups (all  $p=1.0$ ). **CONCLUSION:** In the postprandial state, +2H promoted higher fat utilization than IMM, whereas IMM promoted greater carbohydrate oxidation earlier in the recovery period. Additionally, both interventions resulted in similar net protein retention. Thus, postponing postexercise nutrient intake when in a postprandial state may be implicated in body composition improvements.

## RELATIONS AMONG LIFESTYLE VARIABLES AND WEIGHT RETENTION IN POSTPARTUM WOMEN

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Excess gestational weight gain (GWG) is associated with postpartum weight retention. Women with excess GWG are at a higher risk for obesity, unfavorable outcomes for a future pregnancy and risk of obesity after a subsequent pregnancy. Having a balanced diet and participating in physical activity (PA) are both major components of a healthy lifestyle that should be incorporated prior and during pregnancy as well as throughout the postpartum period. There should be an emphasis on lifestyle rather than solely weight to determine postpartum health.

**PURPOSE:** The purpose of this study was to examine relations among lifestyle and postpartum weight retention (PPWR) in postpartum women. **METHODS:** Twenty-nine women met the inclusion criteria (18+ yrs, not currently pregnant,  $\leq 1$  year postpartum). Women completed an online survey consisting of demographics, recent pregnancy information, PA assessed by the short version of validated International Physical Activity Questionnaire, diet quality assessed by validated Fruit and Vegetable intake Five-Factor screener, and postpartum lifestyle questions. Descriptive statistics were determined for all variables. Spearman correlations were used between PPWR and Time Since Postpartum. Lifestyle variables were categorized by meeting PA guidelines of at least 495 MET-min/week, meeting Fruit and Vegetable (FV) Recommendations of at least 5 cups/day, and a median split of at least 5.5 hours of sleep/night. Chi-square analyses were performed for PPWR and Lifestyle variables. **RESULTS:** Mean age of participants was  $32.3 \pm 5.2$  yrs. PPWR was  $-8.12 (\pm 13.9)$  lbs. Seventy-nine percent of women meet PA guidelines and 65.5% met FV recommendations. The average amount of sleep per night (hrs) was  $5.62 (\pm 1.3)$ . Spearman correlation for PPWR and Time Since Postpartum was not significant ( $p=0.09$ ). Relations between the PPWR and lifestyle variables were no significant. However, meeting PA recommendations reached significance at  $p=0.070$ . **CONCLUSIONS:** These results demonstrate that sleep and diet quality were not related to PPWR. Meeting PA recommendations during the postpartum period almost reached significance for this sample of active women. In our study 79.3% met PA recommendations compared to 53.3-63% national data. Future studies should examine population reflective of the national PA levels as well as additional lifestyle variables such as social support and mental health.

## **THE EFFECTS OF A 16-DAY COURSE ON IMPROVEMENT IN ARMY PHYSICAL FITNESS TEST SCORES**

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Despite guidelines on the benefits of physical activity on improved quality of life and reduced levels of stress, an increasing number of adults do not meet the guidelines of at least 150-minutes of moderate physical activity per week. This may be a contributing factor relating to a growing population of military personnel who are unable to pass the Army Physical Fitness Test (APFT). **PURPOSE:** With this challenge in mind, we aimed to determine how attitudes, motivation, and knowledge of general health and wellness influenced a soldier's ability to successfully pass the APFT. **METHODS:** Thirty-six national guard reservist men and women (age =  $27 \pm 5$  yrs; weight =  $91.2 \pm 17.4$  kg; height =  $1.7 \pm 0.1$  m) attended a 16-day course on health, wellness, and physical training. During the course, subjects had their body composition assessed via bioelectrical impedance. The APFT was completed five times over the course of four with the first test occurring at the beginning of the course. **RESULTS:** Passing rate in the APFT increased from 8.3% at the first test to a 22.7% passing rate after four months with the run having the highest failure rate of the three events (push-ups, sit-ups, 2-mile run). On average, subjects lost  $2.6 \pm 3.9$  kg which was statistically significant ( $p < 0.05$ ) and saw a mean reduction of  $1.6 \pm 2\%$  body fat percentage. **CONCLUSION:** The educational course was successful in increasing the passing rate of the push-up and sit-up tests but not the 2-mile run. Lifestyle changes were successful in promoting a small but statistically significant weight loss. Future studies need to explore the challenges of improving the two-mile run.

## THE EFFECTS OF EXOGENOUS KETONE ESTER SUPPLEMENTATION ON EXERCISE CAPACITY AND HEMODYNAMIC RESPONSE TO EXERCISE IN T2DM VS. NON-DIABETIC INDIVIDUALS

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Type 2 Diabetes (T2DM) is a disease involving insulin resistance and impaired glucose utilization. Ketone bodies provide a non-insulin dependent fuel source and can be administered as ketone ester supplementation (KES). **PURPOSE:** The current research was designed to investigate the effects of KES on time to exhaustion (TTE) and the hemodynamic post exercise response in individuals with T2DM (DM) and non-diabetic (NDM) individuals. **METHODS:** Subjects ( $N = 18$ ,  $n = 9$ ) completed aerobic exercise to exhaustion under placebo and KES conditions. TTE was compared between groups and conditions, in addition to post exercise central systolic and diastolic blood pressure (CSBP & CDBP), rate-pressure product (RPP), augmentation index (AIx), pulse wave velocity (PWV), blood glucose (BG), blood ketone, and blood lactate responses. **RESULTS:** No significant 3-way interactions were found for any measured variables. TTE was not different between groups or conditions ( $p > .05$ ). CSBP and CDBP were lower at 45 min post exercise following KES compared to placebo. Blood ketones were higher in KES compared to placebo for all time points ( $p < .05$ ) except Pre-Drink. Blood ketones were higher in DM compared to NDM in KES condition ( $p < .05$ ). No other significant 2-way interactions were found. BG was higher in DM compared to NDM ( $p < .05$ ). Significant main effects for time ( $p < .05$ ) were found for BG, blood lactate, RPP, and PWV reflecting changes post exercise. **CONCLUSIONS:** In the current study, there was no effect of acute exogenous ketone ester supplementation on TTE or post exercise PWV, AIx, RPP, or blood lactate with continuous treadmill exercise for either persons with or without T2DM. Acute KE supplementation resulted in a greater post exercise decrease in CBP for both groups.

## **INTRADIALYTIC EXERCISE INCREASES CARDIAC POWER INDEX**

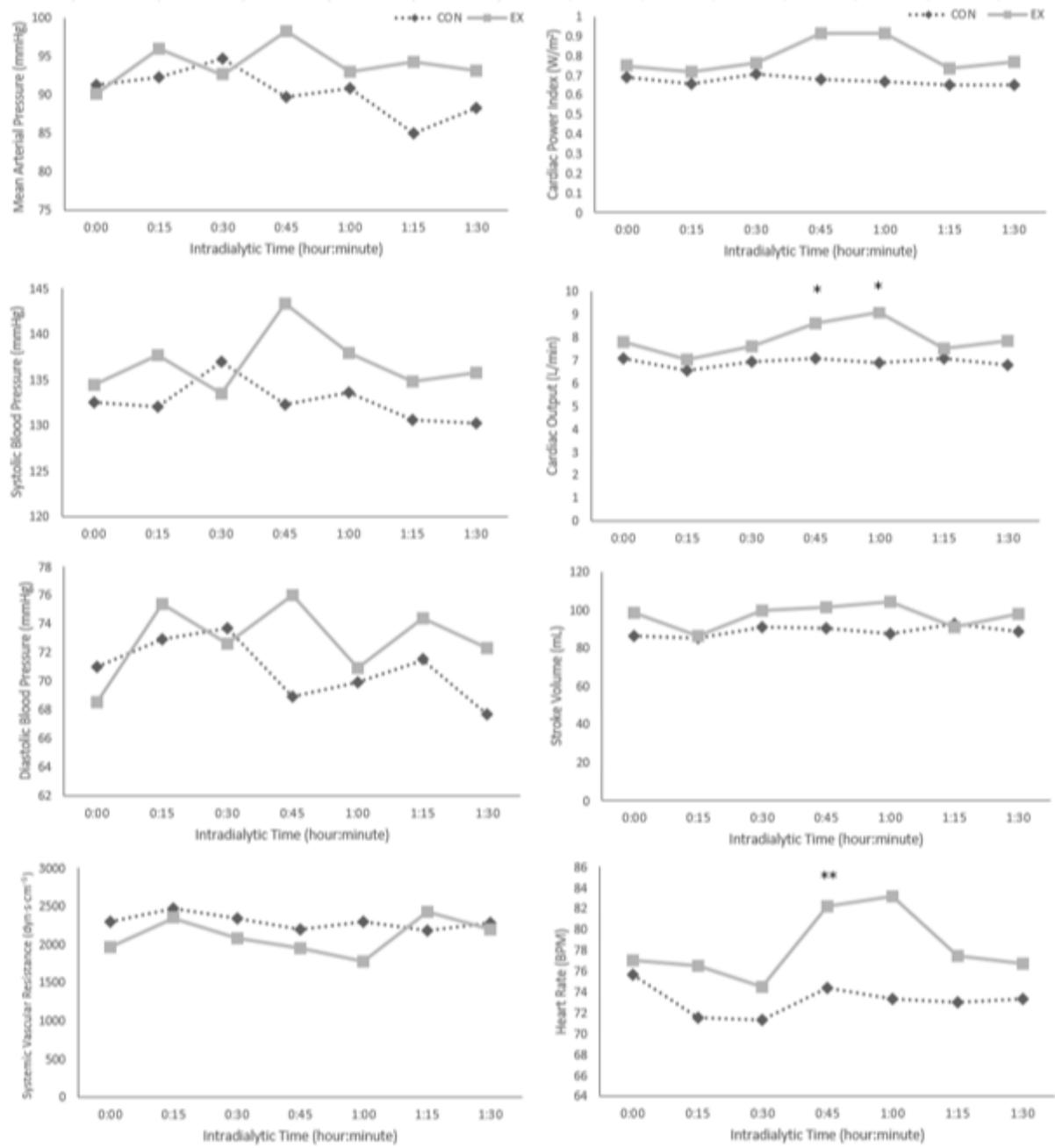
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Hemodynamic instability with transient myocardial ischemia is prevalent in ESRD patients undergoing traditional hemodialysis treatment. **PURPOSE:** The purpose of this study was to investigate acute changes in hemodynamics in subjects with end-stage renal disease (ESRD) during exercise. **METHODS:** Subjects ( $N = 10$ ) were monitored for 1.5 hr during hemodialysis treatment during a control (CON) and an exercise (EX) session. Subjects cycled using an ergometer strapped to the reclining dialysis chair at an RPE of 11-13 for 30 min during the EX session beginning at 30 min into dialysis and ending at 60 min. Data for systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were collected using an automated blood pressure cuff attached to the hemodialysis machine. Data for cardiac output ( $\dot{Q}$ ), cardiac power index (CPI), stroke volume (SV), systemic vascular resistance (SVR), and heart rate (HR) were collected using the NICaS bioelectrical impedance device. **RESULTS:** During the EX session compared to CON values for the following variables were significantly greater ( $p < .05$ ), CPI ( $0.79 \text{ W/m}^2 \pm 0.03$  vs.  $0.67 \text{ W/m}^2 \pm .04$ , , 95% CI = 0.045, 0.200),  $\dot{Q}$  ( $7.91 \text{ L/min} \pm 0.49$  vs.  $6.90 \text{ L/min} \pm .048$ , 95% CI = 0.606, 1.409), SV ( $96.99 \text{ mL} \pm 4.39$  vs.  $88.73 \text{ mL} \pm 3.99$ , 95% CI = 4.175, 12.340), and HR ( $78.23 \text{ BPM} \pm 4.19$  vs.  $73.21 \text{ BPM} \pm 4.26$ , 95% CI = 1.870, 8.159). Additionally,  $\dot{Q}$  was significantly ( $p < .05$ ) greater at 45 min and 60 min compared to 15 min. HR was significantly ( $p < .05$ ) greater at 45 min compared to 90 min. No significant interactions were found for MAP, CPI,  $\dot{Q}$ , HR, SV, SBP, DBP, or SVR. **CONCLUSION:** Exercise during dialysis may decrease the likelihood of experiencing ischemic or hypotensive events by enhancing myocardial perfusion through increasing CPI and  $\dot{Q}$ .



**Figure 2.** Changes in hemodynamic parameters between the control (CON) and exercise (EX) sessions in hemodialysis patients. \* indicates significant ( $p < .05$ ) compared to the 0:15 timepoint; \*\* indicates significant ( $p < .05$ ) compared to the 1:30 timepoint.

# WHICH LOWER HALF PITCHING MECHANICS LEAD TO THE GREATEST BALL VELOCITIES? A PILOT STUDY

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Pitching velocity is an essential quality of baseball pitchers. From 2010 to 2018, Major League Baseball has seen the average 4-seam fastball spike from 92.3 mph with 841 pitches reaching over 100 mph to 93.2 with 1017 pitches exceeding 100 mph. While the throwing arm has been the focus of many studies, the kinetic chain mechanics that originate from the ground are key to achieving high ball velocities. **PURPOSE:** Expanding on recent studies that focus on ground reaction forces, the goal of this study is to determine if greater ball velocities can be achieved from a force primarily derived from the rear leg of a pitcher or force primarily derived from the front leg. **METHODS:** Reflective markers were placed on three Division III collegiate pitchers based on the Vicon Full Body Plug-in-Marker Set and a plastic baseball was wrapped in reflective tape. Each pitcher threw the baseball three times emphasizing force derived from the rear leg and three times emphasizing force derived from the front leg. A 3D motion capture system synchronized with two AMTI force plates was used to measure total body motion and the force being generated from each leg. Joint mechanics and center-of-mass velocity of each pitcher was calculated throughout the motion using Vicon's Plug-in-Gait analysis. The velocity of the ball was recorded at the moment of release. A short questionnaire was used to gauge the pitchers' experience and comfort with the two pitching methods. **RESULTS:** Analyses are currently being conducted to calculate efficiency of the pitch by comparing total body impulse to ball momentum, and to identify energy flows through the kinetic chain. Pitching mechanics that emphasized the rear leg resulted in greater ball velocities than those that emphasized the front leg, but only when the pitcher used proper hip mechanics. **CONCLUSIONS:** It appears that the energy derived behind the pitchers allows greater movement in the forward direction, which terminates in an increased angular velocity of the body's kinetic chain at the final point of release of the ball. Completion of the analyses will further clarify mechanisms of energy flow during different pitching techniques.

## PERCENTILE NORMS FOR PUSH-UPS IN THE STANDARD POSITION IN COLLEGE FEMALES

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Knowledge regarding normal levels of muscular strength and endurance in females is limited. In recent years, females' participation in muscular strength and endurance activities has increased, and collection of more muscular fitness data describing this population is warranted.

**PURPOSE:** Push-ups are a traditional measure of upper body muscular endurance, but since many females lack the strength to perform a single standard push-up, they are often tested and trained using push-ups from the modified knee position. Accordingly, the majority of available normative data for females use the modified knee position. The purpose of this study was to develop percentile norms for push-ups in the standard position in college females. **METHODS:** Healthy, non-pregnant females (n = 200) were recruited from the student populations of CCSU and YSU. Subjects were excluded if they had any medical conditions that would prevent them from participating in strenuous activity. After a brief warm-up, subjects completed push-ups to exhaustion from the standard position, with weight supported on the hands and balls of the feet. A repetition was counted only if the subject's chest came within 1 inch of the floor. **RESULTS:** The subjects had a mean age of 20.1 years (SD ± 2.1, range 18-28), and performed an average of 10.2 push-ups (SD ± 9.8), with a range of 0 to 50 push-ups before exhaustion. Percentile rankings were as follows: 10<sup>th</sup> percentile (1 push-up), 20<sup>th</sup> percentile (2 push-ups), 30<sup>th</sup> percentile (3 push-ups), 40<sup>th</sup> percentile (5 push-ups), 50<sup>th</sup> percentile (7 push-ups), 60<sup>th</sup> percentile (10 push-ups), 70<sup>th</sup> percentile (13 push-ups), 80<sup>th</sup> percentile (19 push-ups), 90<sup>th</sup> percentile (24 push-ups). **CONCLUSIONS:** The present data demonstrate that 50% of college females are capable of 7 or more push-ups from the standard position. Additional data should be collected from this population, and from populations outside this age range, but it is clear that females can be tested and trained using standard push-up protocols.

## EFFECTS OF WEIGHT STIGMA ON CARDIOVASCULAR REACTIVITY AMONG WOMEN WITH HIGH AND NORMAL BLOOD PRESSURE

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We recently reported in a systematic review evidence that exercise and nutrition professionals stigmatize their patients due to their weight in 81% of the 31 qualifying studies. Being weight stigmatized is associated with adverse cardiovascular health consequences for reasons that are unclear; but may be due to the heightened cardiovascular reactivity that accompanies both obesity and hypertension. **PURPOSE:** We examined the influence of two video exposures, one containing scenes of weight stigma (STIGMA) and the other non-stigmatizing neutral (NEUTRAL) scenes, on cardiovascular reactivity as assessed by resting (BP) and ambulatory blood pressure (ABP) and heart rate (HR), among women with obesity and high BP (HBP;  $n=24$ ) or normal BP (NBP;  $n=25$ ). **METHODS:** Women completed three visits: a screening visit and two randomized visits which involved watching a 10-min STIGMA and NEUTRAL video exposure. Laboratory BP and HR were measured before, during, and following the videos. ABP and HR were measured upon leaving the laboratory for the awake (10hr), sleep (9hr), and 19hr. A repeated measures ANCOVA tested the differences in the BP and HR changes from baseline between the two BP groups after STIGMA versus NEUTRAL controlling for BMI and baseline BP and HR in the laboratory and over ambulatory conditions. **RESULTS:** Women with HBP (systolic/diastolic BP [SBP/DBP]= $122.9\pm 13.6/73.5\pm 11.2$ mmHg) were  $37.5\pm 9.1$ yr and obese (Body Mass Index [BMI]= $37.8\pm 6.1$ kg•m<sup>2</sup>); women with NBP (SBP/DBP= $106.9\pm 7.4/65.0\pm 7.1$ mmHg) were  $34.1\pm 8.9$ yr and obese (BMI= $33.6\pm 4.9$ kg•m<sup>2</sup>). Women with HBP increased laboratory SBP/DBP by  $5.5\pm 7.3/2.4\pm 8.8$ mmHg more than NBP after STIGMA versus NEUTRAL ( $P_s<0.05$ ), with no difference in HR ( $P\geq 0.05$ ). Women with HBP also increased ABP more than NBP after STIGMA versus NEUTRAL over sleep (SBP/DBP= $4.2\pm 20.6/4.7\pm 14.2$ mmHg;  $P_s<0.05$ ) and 19hr (SBP/DBP= $0.9\pm 15.2/0.4\pm 10.8$  mmHg;  $P_s<0.05$ ). During sleep, women with HBP increased HR by  $7.5\pm 15.7$ bpm more than NBP after STIGMA versus NEUTRAL ( $P<0.05$ ). **CONCLUSION:** Exposure to a weight stigma video resulted in heightened cardiovascular reactivity among women with obesity and HBP than NBP in the laboratory and under ambulatory conditions, most notably during sleep. Our findings reveal the importance of educating health professionals about weight stigma, and its immediate, yet persistent adverse cardiovascular health effects, and developing interventions to mitigate weight stigma.

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## **IDENTIFICATION OF RESISTANCE TRAINING USING HIP AND WRIST ACCELEROMETERS**

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Accelerometer-based sensors are frequently used to assess physical activity (PA). However, these sensors do not accurately identify resistance training (RT) exercises. **PURPOSE:** To use machine learning models to identify types of RT from accelerometer data. **METHODS:** Twenty-two participants (Age:  $20.85 \pm 1.31$ , 50% male) were video-recorded for one-hour exercise sessions while wearing ActiGraph GT3X+ accelerometers on the right hip and non-dominant wrist. Periods of RT were identified and annotated for specific types of RT exercises performed (e.g. squats). Four features from the raw hip and wrist acceleration data (i.e. mean, standard deviation, angle, angle standard deviation) were computed in 1-second intervals and used as predictors in six classification models to classify type of RT exercise. We used the hip, wrist, and a hip-and-wrist combined dataset for the models. Models were trained using 75% of the total participants and evaluated on the remainder as a test set. A true positive classification rate of  $>0.85$  was considered acceptable. **RESULTS:** We saw that the random forest (RF) model classified RT exercises with the highest accuracy and using a hip and wrist combined dataset gave the highest accuracy across all models. Our RF model gave us 75.1% accuracy in classifying RT exercises, 81.9% accuracy in classifying muscle groups, and 90.28% accuracy in classifying joints used. **CONCLUSION:** The RF model showed us that using both hip and wrist accelerometers provides us with the highest accuracy in predicting RT exercises, muscle groups used, and joints used, all of which can be used to improve estimates of an individual's physical activity. Future research should use additional RT exercise data and optimize the combination of hip and wrist datasets to improve model performance.

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# DIFFERENCES IN STEPPING BIOMECHANICS WHEN CARRYING LOADS OF VARIED COOPERATION

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Each day we perform tasks that involve various combinations of complex musculoskeletal synergies, commonly referred to as ADLs (Activities of Daily Living). The performance of ADLs requires stability for balance, a framework for ambulation, and strength to carry objects. While much is known about how the mass of a carried load affects gait biomechanics, less is known about the impacts of the moral and physical dynamics of the loads. **PURPOSE:** The purpose of this study was to determine how carrying loads of varying social and moral dynamics affect gait biomechanics, and ability to perform ADLs. **METHODS:** A total of 23 parents (7 fathers; 15 mothers) walked across a linear path that required them to step up and down platforms of varying heights. Parents carried their child (weighing 5.79- 11.99 kg), who was cooperative, familiar and valuable; a bucket of water, which was uncooperative, unfamiliar, and only moderately valuable; and a sack of groceries, which represented relatively neutral cooperation, and familiarity. A 3D motion capture system synchronized with two AMTI force plates was used to measure average and loading velocity, spatiotemporal parameters, and peak vertical ground reaction forces during a step up and down a 12-inch box. **RESULTS:** A varied hierarchy in average and loading velocities was found when stepping up, with water being carried the slowest ( $p=0.004$ ), followed by the child ( $p= 0.015$ ), and finally, groceries ( $p<0.001$ ). Similar results were found when stepping down, although significant differences were only found between water and groceries ( $p<0.001$ ). Even while walking slower with water, less time was spent in single-leg support of the leading leg than with the child and groceries ( $p<0.001$  and  $p=0.001$ ). The difference between the push off and loading peak GRFs was significantly lower for water than the child and groceries during both the step up and the step down. **CONCLUSION:** Water carriage mechanics pointed to a greater amount of care being taken in comparison to more familiar objects, even when one had a greater value attached to it. Nevertheless, the moral and physical dynamics of objects involved in ADLs should be taken into account when assessing body mechanics.

## **PREDICTION OF 400-M RUNNING PERFORMANCE VARIABLES IN COLLEGIATE TRACK AND FIELD ATHLETES**

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The 400-m event in track and field is physiologically complex as it requires substantial involvement of all three energy systems: adenosine triphosphate/creatine phosphate (ATP/CP) system, glycolysis, and aerobic metabolism. For example, successful 400-m athletes must be able to generate substantial amounts of power, achieve high maximum velocities, as well as maintain their respective velocities for an extended period of time. It may be for this reason both sprinter and middle distances specialists have succeeded in the 400-m at the highest levels of professional competition. Although research on long sprint performance is limited compared to other distances, there is a small body of evidence to suggest the predictive ability of numerous performance and physiological variables for the 400-m race. **PURPOSE:** The purpose of this study was to evaluate the predictive ability of several performance and physiological variables on 400-m performance. We hypothesized that measures of anaerobic capacity would be the best predictors of 400-m time. **METHODS:** Thirty-eight collegiate male ( $N = 18$ ) and female ( $N = 20$ ) track and field athletes of various event disciplines (short sprinters, long sprinters, jumpers, and distance runners) participated in the study. The variables included were measures of anaerobic power (relative average power (RAP) and relative fatigue index (RFI)) via the Running-based Anaerobic Sprint Test (RAST),  $\dot{V}O_2$ peak (modified McConnell treadmill test), vertical jump, body fat percentage (BF%), and prone hip extension range of motion (ROM). All variables were collected during one of three testing sessions during the pre-competitive portion of the indoor season. Variables that significantly correlated with 400-m performance were entered into a hierarchical regression analysis. **RESULTS:** BF% ( $\beta = 0.52$ ), RAP ( $\beta = -0.67$ ), and RFI ( $\beta = 0.34$ ) were found to be significant ( $p < .05$ ) predictors of 400-m sprinting performance ( $R^2 = 0.829$ ;  $Zy' = 0.52X_{BF} - 0.672X_{RAP} + 0.31X_{RFI}$ ). **CONCLUSION:** Our results suggest that the analysis of body composition and anaerobic capacity may be useful in predicting long sprint capabilities in trained track and field athletes. Adding these, or similar tests, to a regular evaluation schedule may help provide insight into future 400-m performances.

## Using a 3D-Accelerometer to Assessment Consistency of Movement

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**PURPOSE:** Traditional fitness assessments utilize a standard test battery to find movement capacity. Additionally, triaxial accelerometers (TA) may provide tracking of human movements in 3 dimensions. The purpose of this initial inquiry was to establish how TAs may provide more robust measures of movement.

**METHODS:** Male subjects (N=4) wore TA & Heart Rate (HR) monitor while performing 4 tasks (squat (SQ), Jump rope (JR), pushup (PU) & rowing (RW)) at a moderate intensity. Measures of workload (WL), target HR (THR), & acceleration (Ac) were collected at 30 second intervals. For each task the mean (M), STDV, & ANOVA were compiled for amplitude (G) & time (s) for each rep.

### RESULTS:

**S1** (53 yo, 155 lbs)

SQ: 65 lbs **WL**, 1.02 **G** +/- .05, 1.93 **s** +/- .09

JR: 135 **HR**; 7.97 **G** +/- .51, .49 **s** +/- .02

PU: 123 **HR**, 1.12 **G** +/- .06, 1.14 **s** +/- .04

RW: 184 **Watts**, 1.7 **G** +/- .07, 2.16 **s** +/- .19

**S2** (32 yo, 129 lbs)

SQ: 55 lbs **WL**, 1.05 **G** +/- .05, 1.91 **s** +/- .09

JR: 143 **HR**; 6.74 **G** +/- .35, .53 **s** +/- .35

PU: 133 **HR**, 1.83 **G** +/- .07, 1.08 **s** +/- .04

RW: 129 **Watts**, 1.4 **G** +/- .27, 2.41 **s** +/- .67

**S3** (42 yo, 183 lbs)

SQ: 75 lbs): **WL**, .92 **G** +/- .15, 2.70 **s** +/- .14

JR: 138 **HR**; 8.13 **G** +/- .72, .42 **s** +/- .01

PU: 125 **HR**, .81 **G** +/- .05, 2.20 **s** +/- .24

RW: 169 **Watts**, 1.66 **G** +/- .09, 2.23 **s** +/- .13

**S4** (33 yo, 175 lbs)

SQ: 70 lbs **WL**, .65 **G** +/- .07, 3.01 **s** +/- .11

JR: 132 **HR**; 5.06 **G** +/- .47, .46 **s** +/- .03

PU: 125 **HR**, 1.02 **G** +/- .14, 1.90 **s** +/- .08

RW: 155 **Watts**, 2.82 **G** +/- .37, 1.81 **s** +/- .42

All 48 task-comparison ANOVAs were significant ( $p=.05$ ). Post hoc tests revealed the following were NOT significant: **SQ-G**: S1-S2, S1-S3, S2-S3; **SQ-s**: S1-S2; **JR-G**: S1-S3; **PU-G**: S1-S4; **RW-G**: S1-S3; **RW-s**: S1-S2, S1-S3, S1-S4, & S2-S3, S2-S4.

**CONCLUSION:** Task comparisons revealed that subjects utilize different Ac to complete movement. S1 had the most consistent G & s values. S2 tended to favor higher G over s per rep. S3 tended to have high variance in either Ac or s. S4's upper body tasks tended to have greater G, shorter s, and greater consistency than lower body tasks. Between-subject comparisons of each variable (G & s) suggest that subject

movements are unique. Movement performances with high internal consistency, or which have similar movement patterns throughout, are seen as non-significant. Successfully quantifies 3D measures of Ac, the potential applications from these findings could be used for measure of movement fatigue, feedback, or assessment of training.

## MODEST WORKWEEK SLEEP RESTRICTION IMPAIRS GLUCOSE TOLERANCE AND DECREASES LIGHT PHYSICAL ACTIVITY.

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Insufficient sleep and inadequate amounts of physical activity (PA) are common lifestyle behaviors in the US, but there is a paucity of research examining the interaction between insufficient sleep and PA.

**PURPOSE:** To establish how sleep restriction affects PA, and the role this plays in sleep restriction-induced glucose intolerance in overweight individuals.

**METHODS:** Ten overweight adults, who regularly sleep 7-9 h/night, underwent two study conditions; 5 days of sleep restriction (6-h time-in-bed, SR), and 5 days of SR+exercise (SREX). Sleep (actigraphy) and PA (actigraph) were monitored for 7 days prior to each condition, throughout each condition, and during the weekend period (SRal, SREXal). Blood samples were collected during a mixed meal tolerance test (MT) after baseline (B), SR/SREX, and SRal/SREXal. Exercise was 45 minutes of treadmill walking (65%  $\text{VO}_2$ peak).

**RESULTS:** Subjects slept  $8.1 \pm 0.2$  hours during B weekdays (SR,  $5.9 \pm 0.1$ ; SREX,  $5.9 \pm 0.0$ ) and  $7.6 \pm 0.2$  hours on weekend (SRal,  $7.5 \pm 0.4$ ; SREXal,  $8.4 \pm 0.4$ ). Step counts were maintained during SR ( $7,345 \pm 745$ ; B,  $7,773 \pm 833$  steps/day) but increased during SREX ( $12,814 \pm 912$  steps/day,  $p < 0.001$ ). Subjects performed less light PA during SR ( $p = 0.033$ ) and tended to do less during SREX ( $p = 0.064$ ). Sedentary PA tended to be higher during SR compared to B ( $p = 0.067$ ) but was reduced during SREX ( $p = 0.049$ ). Moderate-vigorous PA (MVPA) was elevated during SREX ( $p < 0.001$ ) but was similar between SR and B. Glucose concentrations during 2-h MT tended to be higher for SR than B ( $p = 0.063$ ) with time points 45 ( $p = 0.003$ ) and 60 ( $p = 0.009$ ) elevated during SR; SREX glucose concentrations during 2-h MT were not different than B or SR. SRal reduced glucose concentrations from SR ( $p = 0.003$ ) with times 10-90 minutes being lower ( $p < 0.05$  for all), SREXal was not significantly lower than SREX. Compared to B, glucose AUC was elevated during SR ( $p = 0.040$ ) but recovered after SRpal ( $p = 0.385$ ); SREX(al) AUCs were not different than B.

**CONCLUSION:** Subjects replaced light PA with either sedentary activity (SR) or MVPA (SREX) during the 5 days of SR. Modest SR negatively impacted glucose tolerance, which was restored by weekend ad libitum sleeping. Exercise did not mitigate the impact of SR on glucose tolerance while weekend catchup sleep restored glucose tolerance.

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## **USE OF AMERICAN HEART ASSOCIATION RECOMMENDATIONS FOR PRE-PARTICIPATION SCREENING IN NEW YORK STATE HIGH SCHOOLS**

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Sudden death in young competitive athletes is relatively uncommon but tragic when it occurs. Most deaths are cardiac and many are preventable. The American Heart Association (AHA) “12-Element AHA Recommendations for Preparticipation Cardiovascular Screening of Competitive Athletes” is considered standard of care, and is comprised of three sections: personal medical history, family medical history, and physical examination. The extent to which the AHA recommendations are actually followed by individual high schools is not completely known. **PURPOSE:** We sought to query New York State Public High School Athletic Association (NYSPHSAA) schools to determine if, and to what extent the AHA 12-Elements are used. **METHODS:** From June 2017 to May 2019, athletic administrators were contacted by phone and email. Random sampling was attempted but due to low response rate, the survey was sent to all NYSPHSAA schools (N = 788) in the 11 geographic sections and divisions (Class AA- D). **RESULTS:** Seventy-one high schools from all sections and divisions participated. Only one school used all 12 AHA elements. For personal section, 75% and 86% respectively asked about a history of chest pain or unexpected syncope/near syncope. Family history of cardiac conditions was asked by 29% and for exam, 47% listened for heart murmur, 12% for femoral pulses, and 17% for physical stigmata of Marfan’s. A physician filled out the preparticipation form 71% of the time and verified that the student may compete in 44% of the time; a registered nurse verified 55% of the time. A physician determined disqualification 80% of the time and verified return to competition 76% of the time. Thirty-nine percent of schools kept screening forms beyond the current season, 95% kept track of adverse events, and 70% reported events, with most reporting to school administration. **CONCLUSIONS:** Our results suggest that there is low compliance with the AHA guidelines for preparticipation screening in New York State high schools. The reasons for this are unclear but may be due to existence of several screening protocols, lack of knowledge, or under appreciation of the role in screening to prevent adverse cardiac events in young competitive athletes.

## COMPARISON OF TWO METHODS FOR ASSESSING PHYSICAL ACTIVITY

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Recent studies are using ecological momentary assessment (EMA) methodologies to capture self-reported physical activity (PA) in real-time. EMA is advantageous as it limits recall bias when compared to retrospective reports of PA. However, few studies have compared EMA-assessed PA to a direct measure of PA, such as an accelerometer. **PURPOSE:** To compare EMA-assessed PA minutes to a direct measure of PA over a 14-day monitoring period.

**METHODS:** 49 women who were overweight or obese and weight loss-seeking (BMI:  $31.8 \pm 4.4$  kg/m<sup>2</sup>; age:  $49.4 \pm 8.8$  years) were asked to respond to semi-random surveys, delivered via text message, 5 times per day over 14 days. Participants were asked to report on the number of exercise minutes performed ‘since the last survey’, using one of the following response options (<10, 10, 20, 30, 40, 50, >60 min). The total number of PA minutes reported was computed. Over this same 14-day period, participants wore a Sensewear armband, and minutes spent in bout-related moderate-to-vigorous intensity PA were calculated ( $\geq 10$  minutes and  $\geq 3$  METs).

**RESULTS:** Compliance to wearing the armband ( $13.5 \pm 1.3$  days;  $14.4 \pm 1.5$  hrs/d) and answering the EMA surveys was high (89.1%), and unrelated to PA minutes as assessed via the armband ( $r=0.03$ ) or EMA respectively ( $r= -0.07$ ;  $p>0.84$ ). Over the 14-day period, EMA and armband-assessed PA minutes were significantly correlated ( $r= 0.55$ ,  $p<0.001$ ) and did not differ from one another at the group-level (armband:  $253.2 \pm 219.3$  min; EMA:  $220.4 \pm 205.4$  min;  $p=0.26$ ). However, at the individual level, EMA and armband PA minutes differed by  $142.4 \pm 146.6$  min (approximately 10 min/day), as assessed by the absolute difference between measures.

**CONCLUSION:** EMA and armband measures of PA exhibited good agreement at the group level but much less agreement at the individual level. These findings suggest that for studies which seek to compare group means, these PA assessment methods can be used interchangeably. However, caution should be used in future studies when selecting an assessment technique, as results may be dissimilar between measurement methods at the individual level.

## **ESTIMATING ENERGY EXPENDITURE USING ACCELEROMETERS DURING HIGH INTENSITY INTERVAL TRAINING.**

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Accelerometers are objective monitors that can be used to estimate energy expenditure (EE) during steady state exercise. However, high intensity interval training (HIIT) has received more attention because of its similar benefits to longer duration, steady state, less intense exercise. The accuracy of accelerometer-estimated EE during HIIT has yet to be examined. **PURPOSE:** The purpose of this study was to discern the differences between criterion-measured EE and accelerometer-estimated EE (kCals) during a HIIT session. **METHODS:** Nine participants (mean age=20.4 yrs, Body Mass Index=24.7 kg/m<sup>2</sup>, males=8), completed a preliminary and HIIT session within 2 weeks. Each participant wore an ActiGraph GT3X+ accelerometer on their right hip while EE was measured using portable indirect calorimetry (Oxycon Mobile) during both sessions. Data from the preliminary session were used to determine relative exercise event intensity during the HIIT session (treadmill speed at which the participant reached 95% HR max). The HIIT session comprised of 5 bouts: each bout included a 45-second exercise event and 90-second rest event. Data analysis was conducted using custom R scripts and paired T-tests to determine significant differences between criterion measure and accelerometer estimates of EE during the HIIT session. **RESULTS:** On average, the accelerometer underestimated total EE (92.76±0.33 kCals) compared to the criterion measure (108.73±3.99 kCals) for the entire HIIT session by 15% (p=0.0507). The criterion measure EE during rest (14.64±2.81 kCals) events was much greater than exercise (7.10±1.82 kCals) events (p<0.001), but no significant difference in EE between exercise (8.99±1.99 kCals) and rest (9.56±2.86 kCals) events as measured by the ActiGraph was detected (p=0.08). **CONCLUSION:** Compared to the criterion measure, the accelerometer underestimated total EE for the HIIT session due to the underestimation of EE during rest events. Future studies should further investigate the accelerometer's underestimation to develop an algorithm better at predicting total EE during interval training.

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## **EFFECT OF KETTLEBELL EXERCISE ON BLOOD PRESSURE AND ARTERIAL STIFFNESS IN MALES WITH HIGH BLOOD PRESSURE**

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**PURPOSE:** The purpose of this study was to investigate the acute blood pressure and arterial stiffness responses in males with elevated blood pressure or stage 1 hypertension following 12 min bouts of kettlebell exercise (KB) and aerobic exercise (AER) of equal intensity.

**METHODS:** Ten males with elevated blood pressure or stage 1 hypertension completed both KB and AER at an average intensity of 75% age-predicted maximal heart rate. Subjects were monitored for 60 min post-exercise following both exercise sessions. Data for systolic blood pressure (SBP), diastolic blood pressure (DBP), central systolic blood pressure (CSBP), central diastolic blood pressure (CDBP), and augmentation index (AIx@75) were collected 5 min, 10 min, 15 min, 30 min, 45 min, and 60 min post-exercise using the SphygmoCor XCEL machine.

**RESULTS:** No significant interactions were found for SBP, DBP, CSBP, CDBP, and AIx@75. However, both exercise conditions resulted in a downward trend for SBP, CSBP, and AIx@75.

**CONCLUSIONS:** In conclusion, a short, 12 min bout of KB exercise, matched for intensity, produces similar post-exercise blood pressure and arterial stiffness changes as continuous aerobic exercise in males with elevated or high blood pressure.

## **THE RELATIONSHIPS BETWEEN OBJECTIVE MEASURES OF PHYSICAL ACTIVITY AND SLEEP IN YOUTH: A SYSTEMATIC REVIEW**

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Adult studies have provided support that increased sleep quality is associated with higher levels of physical activity (PA), and vice versa. Whether the same is true in youth has yet to be determined. Furthermore, most studies measure PA and sleep subjectively, typically with self-report or parent-report, which often overestimate true measures of sleep and PA. **PURPOSE:** The aim of this systematic review was to explore the associations between objective measurements of PA and sleep in youth. **METHODS:** An initial database search with predefined search criteria for articles published between January 1, 1980 and July 15, 2019 in PubMed, PsycINFO, and Web of Science was performed. Articles were included if they reported data for participants between 0 and 18 years, were written in English, reported observational data (cross-sectional or longitudinal studies with objective measures of PA and sleep) or experimental data (acute bout or intervention studies with objective outcome measures of PA or sleep). Articles that only reported data for participants above 18 years, were case study/series reports, or were primarily conducted in a clinical population were excluded. To assess the quality of evidence, the GRADE framework was used. **RESULTS:** Inclusion criteria were met for 25 articles reporting 28 studies/analyses in youth in 26 countries. Most studies included pre-adolescents (n=14) and adolescents (n=11), whereas fewer included preschoolers (n=7), toddlers (n=2) and infants (n=2). Among the 17 studies that examined objective PA outcomes (9 observational, 3 acute experimental and 5 chronic experimental), 6, 8, and 3 reported positive, mixed, and null findings, respectively. Among the 11 studies that examined objective sleep outcomes (1 observational, 1 acute experimental and 9 chronic experimental), 3, 3, and 5 reported positive, mixed, and null findings, respectively. There were no longitudinal observational studies in this review. Study quality varied from low to high, among study designs and outcomes. **CONCLUSION:** Although there is evidence of associations between sleep and PA in youth based on objective measures, overall findings lack an accurate conclusion. Future work should include higher quality studies with longitudinal, acute-bout experimental, and sleep- or PA-specific intervention designs with objective measures to improve on these weaknesses.

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## COMPARING PHYSIOLOGICAL DIFFERENCES BETWEEN SEXES DRINKING TO THIRST VERSUS DRINKING TO A GENERIC SCHEDULE

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**PURPOSE:** Thermoregulation and hydration have been linked for decades, resulting in athletes to rely on following hydration guidelines instead of their thirst mechanism. The purpose of this study was to examine sex differences in the physiological effects of drinking to thirst (Thirst) versus a generic schedule (Scheduled) during 2 hours of running. **METHODS:** In a randomized crossover study, eleven male (age=39.4±13.3yr, ht=176.4±7.7cm, wt=77.1±10.2kg, body fat=16.6±7.4%,  $VO_{2max}=60.4 \pm 7.7$ ml/kg/min) and eleven female (age=36±9.3yr, ht=152.8±32.3cm, wt=60.2±9.9kg, body fat =21.0±8.4%,  $VO_{2max}=52 \pm 8.5$ ml/kg/min) runners completed two experimental trials and a baseline assessment. Participants ran at 60%  $VO_{2max}$  in a climate-controlled chamber (21°C and 40% RH). Heart rate and core temperature were monitored continuously. In Thirst, participants drank when they felt a desire to drink and stopped when satisfied. The Scheduled trial, based on the 2000 NATA fluid replacement guidelines, required water consumption as follows: 600mL 2 hours pre-trial, 300mL 20min pre-trial, and 300mL every 10min during running. Blood samples were taken pre-trial, mid-trial, post-trial, and 20min post-trial, and analyzed for sodium. Nude body weight, sweat rate and urine volume were also obtained. Data was analyzed by two-way and one-way ANOVA and then correlated T-tests with a Bonferroni correction, and  $P < 0.05$ . **RESULTS:** Blood sodium showed a significant difference between female scheduled and male scheduled ( $P < 0.04$ ). For body weight change female thirst was different from female scheduled ( $P < .01$ ) and male thirst was different from male scheduled ( $P < .01$ ). Performance time in female thirst was different from female scheduled and male thirst was different from male scheduled, all  $P < .05$ . Significant differences were also seen between the sexes and trials for sweat rate, urine volume, and fluid intake. There were no significant differences in core temperature between the trials. **CONCLUSION:** Both sex groups experienced weight gain and dilution of blood sodium in response to drinking according to the 2000 NATA guidelines. However, all participant's physiological measures remained within normal limits when following their thirst mechanism, demonstrating that drinking to thirst is the safest hydration strategy as mentioned by the 2017 NATA fluid replacement guidelines.

## COLLEGIATE CLUB FIGURE SKATER LOWER EXTREMITY PERFORMANCE ASSESSMENT BILATERALLY IN AND OUT OF SKATES

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Prior research has demonstrated that the most prominent injury among all figure skaters involved the ankle. This finding is surprising in that the skate boot itself is quite stiff with lateral rigidity meant to offer medial-lateral support to the ankle joint. A clinical literature review suggested that there should be emphasis placed on properly fitting skate boots, intrinsic foot and ankle strengthening, and lower extremity flexibility. **PURPOSE:** To determine if the skate boot plays a role in ankle range of motion, balance or lower extremity power, all three of which may be linked to ankle injuries. **METHODS:** 20 members of the Merrimack Figure Skating Team participated in the study. Testing was conducted with skates on followed by skates off. Odd numbered participants started with their dominant leg, even numbered participants started with their non-dominant leg. Weight bearing dorsiflexion (DF), Y-balance test (YB), and single leg hop for distance (SL) were performed and measured bilaterally. **RESULTS:** No significant interaction was reported for DF, YB, or SL between skate type (no skate vs. skate) and leg dominance (dominant vs. non dominant), ( $p > .05$ ). DF, YB, and SL were significantly higher when subjects were in no skates ( $M_{DF-NOSK} = 28.8$ ;  $M_{YB-NOSK} = 93.61$ ;  $M_{SL-NOSK} = 123.45$ ) compared to when in skates ( $M_{DF-SK} = 11.15$ ;  $M_{YB-SK} = 85.89$ ;  $M_{SL-SK} = 101.51$ ), ( $p = .00$ ). SL was also higher on the dominant leg ( $M_{SL-DOM} = 114.21$ ) compared to the non-dominant leg ( $M_{DF-NONDOM} = 110.75$ ) ( $p = .01$ ). DF and YB were not statistically different between the dominant and non-dominant leg. **CONCLUSION:** The results suggest with lower extremity performance testing in collegiate figure skaters leg dominance does not impact ankle range of motion or balance. However, with lower extremity power, leg dominance does play a role. The findings that range of motion, balance, and power are greater without skates than with the skates, it is plausible to conclude that the skate boot does in fact play a role in these three measurements. Further research is needed in order to examine the specifics of how the skate boot affects each of these measurements.

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## **HORMONAL, PSYCHOLOGICAL, AND MUSCLE DAMAGING EFFECTS OF AN ACUTE BOUT OF FARMERS' WALK RESISTANCE EXERCISE**

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The Farmers' Walk (FW) exercise may help to enhance resistance training programs by incorporating movements which supplement functional tasks such as lifting and carrying weight over various distances. Minimal information exists in the literature concerning the intramuscular responses associated with FW performance, which may negatively promote perception and application of this exercise in prescribed protocols. **PURPOSE:** To investigate the hormonal, psychological, and muscle damaging effects of an acute bout of the Farmers' Walk Carry (FWC) when compared to an individual's unloaded walking pattern (NWC). **METHODS:** Fifteen participants (mean  $\pm$  SEM; age:  $21.6 \pm 0.5$  y; height:  $172.5 \pm 2.4$  cm; weight:  $81.8 \pm 4.0$  kg) completed a series of testing sessions. In the initial session, participant's demographic information, anthropometrics, body composition, lower body power, and strength were measured. Subsequently, participants completed two counter-balanced conditions during which they performed 10 repetitions of a 20 m walk while either carrying 70% of their 1-repetition maximum deadlift or non-weighted walk. Participants were allowed a 30 s rest period after odd-numbered repetitions, and 2 min of rest after even-numbered repetitions. Participants provided self-reported evaluations of muscle soreness (VPMS), blood sampling for myoglobin (Mb) and creatine kinase (CK-MB), and saliva samples for testosterone (T), which were collected prior to the exercise protocol, immediately after the exercise protocol, and 30- and 60-min after completion of the exercise. Post-exercise assessment consisted of blood sampling, saliva, countermovement jump (CMJ) height, and VPMS scores collected at 24 h, 48 h, and 72 h in both conditions. **RESULTS:** Increases were observed for overall ( $p < 0.001$ ) and upper body VPMS measurements ( $p < 0.01$ ) along with decreases in CK-MB ( $p = 0.04$ ) during the FWC. No significant differences were revealed for Mb, T, or CMJ height. **CONCLUSIONS:** The discrepancy found between upper- and lower-body muscle soreness (VPMS) during the FW may be related to differences in primary muscle recruitment and their joint concentric, eccentric, and isometric muscle actions. These variances may have indirectly minimized post-exercise muscle damage, hormonal responses, and neuromuscular inhibitions of lower body performance.

## **RELATIONSHIPS BETWEEN PHYSICAL ACTIVITY AND SLEEP IN EARLY CHILDHOOD: A SYSTEMATIC REVIEW**

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Although systematic reviews have provided evidence of interactive relationships between sleep and physical activity (PA), these reviews have reported on studies conducted in adults and older children. **PURPOSE:** The aim of this systematic review was to examine the relationships between PA and sleep in early childhood. **METHODS:** Using a list of predefined search terms, a systematic literature search for articles published between January 1, 1980 and July 15, 2019 was conducted in PubMed, PsycINFO, and Web of Science. Inclusion criteria were publications that reported data for participants under 6 years, were written in English, included analyses between PA and sleep variables, and used observational (cross-sectional or longitudinal) or experimental (acute bout or intervention) study designs. Exclusion criteria were publications that reported data only for participants age 6 years and older, used case study or case series report study designs, or were conducted primarily in clinical populations. To assess quality, the GRADE framework was applied. **RESULTS:** Twenty-four articles reporting on 29 studies/analyses in young children in 18 countries met the search criteria. Among all studies, most included preschoolers (n=22), with fewer studies conducted toddlers (n=8) and infants (n=5). Sixteen studies (6 observational and 10 chronic experimental) examined PA/fitness outcomes with 4, 5, and 7 reports of favorable, mixed, and null findings, respectively. Thirteen studies (7 observational and 6 chronic experimental) examined sleep outcomes with 4, 8, and 1 reports of mixed, null, and negative findings, respectively. There were no longitudinal observational studies or acute bout experimental studies. Among all observational studies, sleep and PA were both measured objectively in only 5 studies. Among the experimental studies, all studies examined multi-component health interventions and outcomes were measured objectively in 10 studies. Study quality ranged from low to moderate among study designs and outcomes. **CONCLUSION:** There is no consistent relationship observed between PA and sleep. Study limitations and research gaps may limit the ability to draw conclusions regarding the relationships between PA and sleep in young children. Higher quality, longitudinal, acute bout experimental, and sleep- or PA-specific intervention studies are needed.

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## INFLUENCE OF EXERCISE INDUCED HYPOHYDRATION AND FLUID RESTRICTION ON TIME TRIAL ENDURANCE PERFORMANCE

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Hypohydration is defined as a decrease in total body water while dehydration has been defined as the act of losing body water. **PURPOSE:** The aim of this study was to evaluate the difference in various physiological variables and performance between exercise induced hypohydration (EI) and fluid restricted hypohydration (FR). **METHODS:** Twenty two subjects ( $N = 22$ ) completed the current study, performing a familiarization session, a pre-experimental exercise session, and two time trial testing session. The EI time trial was completed after performing exercise in hot environment to lose three to four percent of body weight and replenished at 1.5% of water lost. The FR time trial was completed after 12 hours of fluid restriction. **RESULTS:** No significant differences were found between EI and FR in terms of heart rate ( $\eta_p^2 = .006$ ), plasma volume ( $\eta_p^2 = .004$ ), and RPE ( $\eta_p^2 = .036$ ). Core temperature was significantly greater in the FR trial ( $37.58 \pm .06^\circ\text{C}$ ) compared to the EI trial ( $37.31 \pm .11^\circ\text{C}$ ). Distance covered was significantly less at the end of the EI time trial compared to the end of the FR time trial ( $p < .05$ ). **CONCLUSIONS:** EI hypohydration has been associated with a decrement in performance. Athletes and exercising individuals should weigh themselves pre and post exercise and adequately replace the fluid lost.

## SITTING TIME COMPARISON BETWEEN STUDENT ATHLETES AND STUDENT NON-ATHLETES

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Sitting time among young college athletes may be greater than or equal to individuals considered inactive and not meeting Physical Activity (PA) recommendations. Meeting or exceeding PA guidelines alone may not be enough to overcome the deleterious cardiometabolic effects of high sitting time. In part, this may be made evident by an independent relationship between sitting time and PA. **PURPOSE:** To determine the sitting time of college athletes at an institution, compare the sitting time of the athletes to the non-athletes, as well as determine the relationship between average daily moderate-to-vigorous physical activity (MPVA) time and sitting time. **METHODS:** Data from 163 full-time college students aged 18-24 were collected. Sitting time was collected using sitting time questions which asked for typical daily sitting time within six different contexts. Physical activity data was collected using questions asking for typical weekly exercise frequency, hours and minutes of MVPA on an average exercise day, and typical hours and minutes of Light PA (LPA) by asking for time spent performing daily leisure and living activities. Mean sitting times and LPA were analyzed for differences between athletes and non-athletes. Correlation analysis was completed to determine the relationship between exercise time and sitting time. **RESULTS:** Mean daily sitting time was  $10.96 \pm 2.98$  hours, and as a percentage of total wake time,  $58.86 \pm 0.08\%$  of wake time was spent sitting. No statistically significant difference in mean sitting time was shown between athletes ( $M = 629.91$ ,  $SD = 171.657$ ) and non-athletes ( $M = 677.76$ ,  $SD = 182.506$ ), as the mean difference was  $M = -47.854$ , 95% CI [-110.216, 14.508],  $t(129) = -1.518$ ,  $p = .131$ ,  $d = .27$ . There was no significant correlation between daily sitting time and (MVPA) time,  $r_s(53) = .195$ ,  $p = 0.154$ . Next, there was no significant difference in daily LPA between athletes ( $M = 102.45$ ,  $SD = 75.209$ ) and non-athletes ( $M = 111.87$ ,  $SD = 100.481$ ), as the mean difference was  $M = -9.414$ , 95% CI [-41.204, 22.377],  $t(129) = -.586$ ,  $p = .541$ ,  $d = .10$ . **CONCLUSIONS:** These outcomes support previous studies showing that athletes can be highly active and highly sedentary because of the independent relationship between MPVA time and sitting time. Research must continue with other athletic populations, preferably using accelerometry, and include the collection of cardiometabolic risk biomarkers to determine the potential for athletes to be at risk despite their high activity level.

## PRELIMINARY ANALYSIS OF TRIAXIAL ACCELEROMETER-DERIVED QUALITY OF SLEEP IN SMOKERS WITH AND WITHOUT COPD

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Poor sleep quality (e.g. fragmented sleep) in chronic obstructive pulmonary disease (COPD) correlates with low quality-of-life, but little information are available in literature. Triaxial accelerometers have been recently used to monitor and characterize sleep patterns in COPD. The DynaPort model (McRoberts, NL) can detect body postural changes, number of movements (validated against polysomnography, ICC=.84) and their duration during sleep, among others. In the *Muscle Health Study*, an ancillary study of COPD Gene, we monitored for 7-day a large cohort of elderly smokers with and without COPD. **PURPOSE:** We aimed to characterize the sleep pattern in smokers. We hypothesized that a disturbed sleep (i.e. short night rest duration and a high number of nocturnal body movements or transitions) is associated with increased disease severity, and poor quality of life. **METHODS:** Current and former smokers with COPD (GOLD 1/2/3/4 n=32/38/32/14; 67±9 yrs), with normal spirometry (CTRL, n=87; 61±9 yrs) and never smoker controls (NS-CTRL, n=26; 60±11 yrs) from the Harbor-UCLA COPD Gene cohort volunteered. Seven-day triaxial accelerometry assessed: 1) night rest (i.e. lying >3-hour, not interrupted for more than 15min) and postures assumed (e.g. supine, prone, left and right side); 2) out-of-bed periods; 3) number of transitions (i.e. any change >10 degrees in body inclination); 4) duration of every phase. Validation cut-off was fixed as >5-night. Health-related quality of life was measured with: SGRQ, SF-36, HADS and CAT questionnaires. Disease severity was determined by spirometry. One-way ANOVA was used for comparisons among groups. Correlates of night sleep parameters were sought using univariable linear regression. **RESULTS:** COPD and CTRL differ neither for night sleep duration (average: 8±0.3h) nor for number of transitions (average: 50±33). No significant differences were found also across COPD GOLD stages. A significantly reduced quality-of-life (inferred from questionnaires) was found for severe COPD stages compared to NS-CTRL and CTRL and GOLD 1-2 (p<0.05). Univariable linear regression showed that total night duration and number of night transitions were positively correlated with age (r=0.04; p<0.01). **CONCLUSIONS:** Contrary to our original hypothesis, preliminary analyses did not reveal a significant decrease in night sleep duration in severe patients compared to smokers without COPD.

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## **KINEMATIC AND EMG ANALYSIS OF ACL STABILITY DISPARITY BETWEEN MALE AND FEMALE ATHLETES**

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There are over 100,000 ACL tears in the US each year with incidence among female athletes 8 times greater, making this one of the most prevalent knee injuries among athletes. This study involved a sample of NCAA Division I athletes who completed dynamic testing under EMG and kinetic analysis to determine the differences in male and female neuromuscular activity that leaves female athletes more vulnerable to ACL injury. **PURPOSE:** To analyze neuromuscular differences in female and male athletes in order to determine what factors predispose female athletes to ACL injury. **METHODS:** A convenience sample of 12 male and 14 female uninjured D1 soccer players were recruited. Electrodes were placed on the quadriceps (Q: rectus femoris, vastus lateralis and medialis), and hamstrings (H: semitendinosus, and long head of the biceps femoris) to record EMG data. Retro reflective markers were placed over bony landmarks on the trunk, pelvis, and upper and lower extremities for kinematic analysis. Subjects completed a modified T-T test as fast as they could. A 60 second rest period was allowed for full recovery between each trial. EMG data was analyzed at max knee valgus and 100 ms before initial contact during planting and direction change maneuvers. **RESULTS:** The Q/H ratio was significantly higher in females than males at maximum knee valgus ( $p=0.006$ ). At initial contact, female athletes use their rectus femoris muscle significantly more than male athletes with respect to the vastus lateralis and vastus medialis ( $p=0.031$  and  $p=0.015$ , respectively). Upon analysis of the kinematic data, it is evident that at the point of maximum knee valgus female athletes have greater extension in the knee joint in the sagittal plane than male athletes ( $p=0.001$ ). **CONCLUSION:** Female athletes display a neuromuscular maladaptation that leads to an increased Q/H ratio which is lead predominately by the rectus femoris. Additionally, they plant and decelerate with a more extended knee. Together, these practices lead to increased ligamentous load on the knee joint and lengthening strain on the ACL joint. This combination of events leads female athletes to be more vulnerable to ACL injury.