Accuracy and Practicality of a NIRS Device on Blood Lactate Levels

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Historically, cyclists have relied upon blood lactate analysis and/or metabolic testing to determine their fitness level and training zones. However, these methods are now being challenged by Near Infrared Spectroscopy (NIRS). The BSX Insight is a wearable NIRS device that claims to predict lactate threshold by analyzing changes in muscle oxygenation. **PURPOSE:** The purpose of this study was to compare the accuracy of the BSX Insight against blood lactate and ventilatory threshold analyses. **METHODS:** Nine highly trained cyclists (18-55 years of age) performed a graded exercise test while wearing the Insight and data was simultaneously collected via the TrueOne 2400 metabolic cart and Lactate Plus analyzer. Lactate threshold heart rate (HR) and power as predicted by the Insight was compared with blood lactate threshold (LT) as determined by the Dmax method and with the ventilatory threshold (VT) as determined by the respiratory exchange ratio (RER) method ,V-slope method, and ventilatory equivalency (VEQ) method. **RESULTS:** Average LT power output as determined by the BSX Insight was not significantly different when compared to Dmax, RER, VEQ, and Vslope (P = 0.811). Average LT power output from the Insight showed a positive correlation with Dmax (r = 0.869), RER (r = 0.964), VEQ (r = 0.970), and Vslope (r = 0.949). Average LT HR as determined via the BSX Insight device was not statistically different when compared to Dmax, RER, VEQ, and Vslope (P = 0.386). The average percent difference of LT HR from the Insight compared with all other methods was within 5% (Dmax = 2.29%, RER = -2.56%, VEQ = -2.74%, Vslope = 0.545). **CONCLUSIONS:** The wearable BSX Insight device is good at predicting LT HR and power output during a cycling test and muscle oxygenation can be used to estimate LT. The BSX Insight device may be an extremely helpful tool for those cyclists who do not have the ability or access to utilize more expensive testing protocols.

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Cardiovascular Endurance Among College Students: How is it Related to Overall Fitness?

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PURPOSE: To determine the relationship between cardiovascular endurance and other fitness measures among college students. **METHODS:** A convenience sample of 364 college students (43% females, 57% males; average age 21.84 *SD= 4.22)* participated in a free fitness assessment between the 2012 and 2015 academic years. The students performed a battery of standardized physical fitness tests which included the Cooper 12-minute run/walk test, maximal volitional push-up and abdominal curl-up tests, YMCA sit-and-reach test, and gender-specific 3-site skinfold measurements. Pearson's correlation coefficient was used to examine correlations between cardiovascular endurance (VO_{2max}), percent body fat, muscular endurance, and flexibility. **RESULTS:** The analysis showed a slight negative correlation between VO_{2max} and percent body fat (r = -.208, p<.001). Additionally, the data revealed a positive correlation between VO_{2max} and muscular endurance for push-ups (r =.224, p<.001) and curl-ups (r =.208, p<.001) performed. However, no correlation was found between VO_{2max} and flexibility (r = -.045, p =.395). Percent body fat was found to have a significant inverse relationship with muscular endurance (r =-.504, p<.001; push-ups) (r =-.258, p<.001; curl-ups), as well as with flexibility (r = .138, p=.009). **CONCLUSION:** The results of this study emphasize the role of

overall muscular fitness and a healthy body fat percentage related to cardiovascular endurance. By including exercises to increase overall muscular fitness and decrease body fat percentage, cardiovascular endurance can be improved, thus decreasing morbidity and mortality.

Correlations				
	Push-ups	**Curl-ups**	**YMCA sit-and-reach (inches)**	**% Body Fat**
VO_{2max} (ml/kg/min)	**r = .224** p < .001**	**r =.208** p < .001**	**r = - .045** p = 0.395	**r = -.208** p < .001**

Effects of Dynamic Cycling on Motor Function, Gait, and Balance in Individuals with Parkinson's Disease

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Parkinson's disease (PD) is a progressive neurodegenerative disease that affects more than half a million people in the United States and leads to difficulties in performing activities of daily living, such as standing and walking. Dynamic high cadence cycling has been shown to improve motor function; however, it is not known if multiple bouts of dynamic cycling lead to improvements in gait and balance in individuals with idiopathic PD. **PURPOSE:** To assess if six bouts of dynamic cycling, on a motorized recumbent cycle, improves motor function, gait and balance in individuals with PD. **METHODS:** Sixteen subjects (9 males and 7 females; age 70 ± 7 years; Hoehn and Yahr score of 1.57 ± 0.51) with moderate idiopathic PD were randomized into a dynamic cycling or a control (stretching) group. For the dynamic cycling sessions, a motorized recumbent bicycle was programmed to maintain various revolutions per minute (RPM). Dynamic cycling consisted of a 5 minute warm-up at 50 rpm, 30 minutes of high cadence cycling between 75-85 rpm, and a 5 minute cool down at 50 rpm. Motor function, balance and gait were assessed after every cycling bout using the UPDRS Motor III scale, Kinesia One, Timed up and Go (TUG), and the Modified Clinical Test of Sensory Interaction in Balance (mCTSIB). **RESULTS:** Six bouts of dynamic cycling significantly improved UPDRS scores (P= .030), kinetic tremor (P= .001), hand movement amplitude (P= .006), rapid alternating hand movement speed (P= .001), gait (P= .004), and TUG time (P= .012) from baseline testing to end of treatment. Additionally, a significant interaction for main effect of group occurred in UPDRS scores (F= 20.051, P= .001), kinetic tremor (F= 6.141, P= .027), hand movement amplitude (F= 10.879, P= .005), rapid alternating hand movement speed (F= 16.579, P= .001), gait (F= 9.417, P= .008), and TUG (F= 6.977, P= 0.12). Lastly, six bouts of dynamic cycling resulted in a 17% improvement in UPDRS scores, 11% improvement in kinetic tremor, 36% improvement in hand movement amplitude, 23% improvement in rapid alternating hand movement speed, 60% improvement in gait, and 22% improvement in mobility from baseline testing to end of treatment. However, six bouts of dynamic cycling did not improve balance in individuals with PD. **CONCLUSION:** Six bouts of dynamic cycling improves motor function and gait in individuals with PD.

Blood Pressure Responses to Metaboreflex Activation During Acute and Chronic Volume Loading

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The metaboreflex is a powerful blood pressure (BP) raising reflex that is activated during acute exercise and limb ischemia; byproducts of metabolism activate the metaboreceptors (group IV sensory fibers) located within the skeletal muscle. However, it is not known if acute or chronic volume loading alters the BP response during metaboreflex activation. **PURPOSE:** To test the hypothesis that acute and chronic volume expansion would exaggerate BP responses during metaboreflex activation. **METHODS:** Metaboreflex function was isolated using post exercise ischemia (PEI). Acute volume expansion was achieved with a 23-minute infusion of lactated Ringers (0.15 mL/kg/min; 239±9 mL) in 17 subjects (age: 23±1 yrs, BMI: 24.0±0.9 kg/m^2, 9 men). Chronic volume expansion was achieved with 7 days of a high sodium diet (compared to low sodium diet, order randomized) in 16 subjects (age: 39±4 yrs, BMI: 23.2±0.5 kg/m^2, 7 men). The BP response to PEI was assessed before and after the acute and chronic volume expansion. **RESULTS:** Estimated plasma volume was expanded similarly in response to both the acute (6.4±2.7%) and chronic (3.2±2.2%) volume expansion ($p = 0.39$). During the acute trial, the systolic BP response to PEI was greater following the infusion (Δ 22±4 vs. 16±2 mmHg; $p = 0.01$). Likewise, during the chronic trial, the systolic BP response to PEI was greater after the high sodium diet (Δ 28±2 vs. 24±3 mmHg; $p = 0.02$). **CONCLUSION:** BP is raised to a greater extent during metaboreflex activation when plasma volume is expanded acutely and chronically.

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Influence of Anthropometric Variables on Three Different Maximal Oxygen Consumption Units: NHANES 2003-2004

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Maximal oxygen consumption (VO_2max) has traditionally been reported in absolute units (L/min) or units relative to total body mass (mL/kg/min). However, expressing VO_2max relative to fat free mass (mL/kg$_{FFM}$/min) has recently become more common due to the belief that this unit is a more direct measure of muscle aerobic capacity and is less influenced by other anthropometric measures. **PURPOSE:** To determine the influence of common anthropometric measurements on VO_2max measurements expressed in three different units: absolute, relative to total body mass, or relative to fat free mass. **METHODS:** Data from the 2003-2004 NHANES were used. All subjects included in the analysis were between the ages of 18-35 (mean: 24.8±5.6) and had complete data for the following variables: VO_2max, waist circumference, height, weight, body mass index (BMI), percent body fat, and fat free mass. Bivariate correlations between three different VO_2max units (L/min, mL/kg/min, and mL/kg$_{FFM}$/min) and other previously mentioned variables were performed by weight class (normal [N], overweight [OW], and obese [OB] by BMI). **RESULTS:** Height has moderate correlations with absolute VO_2max values (N = 0.596, OW = 0.697, OB = 0.578; all $p<0.01$) and VO_2max relative to total

body mass (N = 0.345, OW = 0.332, OB = 0.280; all $p<0.01$), but has little impact on VO_2max relative fat free mass (N = 0.111, OW = 0.024, OB = -0.057; N only $p<0.05$). Body fat percentage primarily has a moderate negative correlation with absolute VO_2max (N = -0.061, OW = -0.584, OB = -0.403; all $p<0.01$) and VO_2max relative to total body mass (N = -0.565, OW = -0.460, OB = -0.452; all $p<0.01$), but has little impact on VO_2max relative to fat free mass (N = -0.129, OW = 0.044, OB = 0.135; N and OB only $p<0.05$). Significant relationships between the various anthropometric measurements assessed and VO_2max values were generally weakest with VO_2max as expressed relative to fat free mass. **CONCLUSIONS:** VO_2max expressed relative to fat free mass ($mL/kg_{FFM}/min$) has less co-linearity with common body anthropometric measurements then VO_2max expressed in absolute terms (L/min) or relative to total body mass (mL/kg/min). Therefore, VO_2max units expressed relative to fat free mass should be reported when comparing subjects of different weight classifications.
Authors have no disclosures to report.

The Acute Effect of Intermittent Fasting on Resting Energy Expenditure in College-Aged Males.

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Intermittent fasting has recently gained considerable attention within popular press as a dietary method for weight and/or fat loss. The protocol for these diets often recommends completely abstaining from food consumption for anywhere from 16 to 20 hours per day, sometimes for multiple days of the week. There appears to be a limited amount of research which examines the effect of fasting for such a time period on resting energy expenditure (REE). **PURPOSE:** The purpose of the study was to examine the short-term effect of fasting for three different time-points on REE in active college-aged males. **METHODS:** This study was a cross-over design where eleven subjects (age, 21.55 $\pm$ 1.33 years), who were instructed to consume a eucaloric diet, fasted for 10-12, 16, or 20 hours separated by a one- to two-week wash-out period. REE was measured after each fast via a ventilated hood technique. **RESULTS:** Results for REE for 10-12, 16, and 20 hour fasts were 2048.53 $\pm$ 274.31 kcal/day, 1976.64 $\pm$ 181.42 kcals/day, and 2064.00 $\pm$ 254.54 kcals/day, respectively. No statistical significance was found between conditions, though REE did decrease slightly for the 16-hour fast, and increase slightly for the 20-hour fast. **CONCLUSION:** The results suggest that one day of fasting while maintaining a eucaloric diet for up to 20 hours does not negatively impact REE.

Differences in Male and Female Scapular Strength and the Relationship to Sprint Swimming Performance

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During freestyle swimming, the hand enters the water as the body rotates around the longitudinal axis, and the scapula protracts and upwardly rotates. Once at full reach, the scapula retracts, initializing the stroke's catch, and continues to retract through the stroke. It is currently unknown if the amount of strength produced from these movements is directly related to, and important for propulsion and sprint swimming performance. In addition, as males are generally stronger than

females, it is not known if scapular strength plays an important role in sprint swimming performance for both sexes. **PURPOSE:** To examine the relation between scapular strength and swimming performance in males and females. **METHODS:** Eleven female (21.0 ± 2.3 years, 167.0 ± 6.8cm, 62.8 ± 8.7kg) and 7 male (21.3 ± 2.4 years, 179.6 ± 6.6cm, 74.8 ± 7.7kg) healthy swimmers completed an isokinetic dynanometer test to assess scapular protraction (SPro) and retraction (SRet) strength (60^{o}/s, 5 repetitions each). Variables included peak force (PkF), peak force normalized to weight (PkFW), time to peak force (TPkF), distance to peak force (DPkF), and average power (AvP). Subjects also swam 50 and 200 yard (yd) swims for time. All data were assessed for normality using Shapiro-Wilk tests. Gender differences in strength were compared using independent T-tests or Mann-Whitney U tests, as appropriate. Pearson and Spearman correlation coefficients were calculated, as appropriate, to analyze the association between both the 50 and 200 yd performance swims. Statistical significance was set at $p < 0.05$ *a priori*. **RESULTS:** TPkF ($p < 0.001$) and DPkF ($p = 0.006$) were statistically different when comparing SPro between genders, and PkF ($p = 0.039$) when observing SRet between genders. A statistically significant correlation was found between male 50 yd swim to SPro PkFW ($r = 0.872$; $p=0.022$); and while not significant, male SRet PkFW ($r = 0.730$; $p = 0.062$) was also related to 50 yd swim time. **CONCLUSION:** The PkFW was not statistically different between genders, however male PkFW was found to correlate with faster times over the shorter sprint distance, suggesting that males utilize this to aid 50 yd freestyle performance. A lack of correlation at 200 yard freestyle suggests that longer distances may not be influenced by peak scapular strength.

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Performance Measures in Female Collegiate Soccer Players According to ACL Injury Status

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Prevalence of noncontact Anterior Cruciate Ligament (ACL) injuries has been increasing in women's athletics. Prescreening testing through functional performance measures has been recommended to help identify which athletes may be at a greater risk for ACL injury or reinjury. **PURPOSE:** To compare performance measures in NCAA division 1 female collegiate soccer players who have had an ACL injury and those who have not. **METHODS:** NCAA division 1 collegiate female soccer players (n = 12) aged (18.9 ± 1 yrs), BMI (21.2 ± 1.5kg·m^{-2}), and body fat percentage (19 ± 3.2%) underwent agility and functional hop testing. 4 had a previous ACL injury (left leg n = 2, right leg n = 2). Prior to testing, subjects performed a general warm-up around a 124 m track followed by practice trials for each test before completing the T-test, single-leg hop, triple leg hop, and triple crossover hop tests. Max distance hopped was recorded to the nearest 0.25 in. and the symmetry of the limbs was calculated as a percentage for each hop test. Data was assessed based on ACL injury status (injured vs. uninjured) and ACL injury site (injured leg vs. uninjured). Kruskal-Wallis test was used to compare groups. Significance was set at $p < 0.05$. **RESULTS:** There were no differences ($p > 0.05$) in injury status groups in all test measures. No differences were found between T-test time, hop test distances, and triple hop

or crossover hop leg symmetry between injury site. However, those with a left leg ACL injury had a lower symmetry (89.5 ± 2.1%, p = 0.04) on the single leg hop test than both those with a right leg ACL injury (98.5 ± 0.7%) and no injury (96.1 ± 1.8%). **CONCLUSION:** Those with a left leg ACL injury had a poorer symmetry between legs on the single leg hop test. These results suggest that these individuals may be at a greater risk of reinjury

The Effects of Self-Selected Music on Exercise Performance

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Existing research has shown that listening to music may improve aerobic exercise performance, however, music's effect on anaerobic exercise performance has not been fully investigated. **PURPOSE:** The purpose of this study is to investigate the effects of self-selected music on anaerobic exercise performance. **METHODS:** Fifteen (8 men; 7 women) healthy college-aged students between 18-25 years old (20.1 ± 1.79 yrs) participated in this study. The testing consisted of three sessions: one initial familiarization trial followed by two testing trials [with music (M) and without music (NM)] completed in a randomized order. During the familiarization trial the participants' body composition (bioelectrical impedance analysis) and one-repetition maximum (1RM) bench press were determined. Each participant also submitted five songs to be used during the music trial. These songs were reviewed to ensure an upbeat tempo (> 120 bpm). During each testing trial, the participants performed a warm-up at 50-60 % 1RM for 5-10 repetitions. Each participant then performed the bench press for a maximal number of repetitions using 70% 1RM for five sets with a 1 min and 15 sec rest period between sets. After a 10 min rest period, a 30 sec Wingate test was used to determine total work, and relative peak power. **RESULTS:** During the M condition there was a significant increase in total work (M: 16121.8 ± 4287.3 kJ; NM: 15021.7 ± 4370.6 kJ; p= .024), relative peak power (M: 44.6 ±8.4 W; NM: 41.4 ± 8.4 W; p= .014), and the total number of bench press repetitions (M: 41.7 ± 8.7 reps; NM: 38.3 ± 8.1 reps; p=. 001). **CONCLUSION:** Overall, self-selected music had a positive effect on anaerobic exercise performance. The results from this study may help to enhance exercise performance by using self-selected music as a motivational tool.

Ball Release Velocity and Pre-Release Range of Motion for Five Types of Softball Pitches

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Softball pitchers utilize several types of pitches, but previous research has focused primarily on the fastball technique. **PURPOSE:** The purpose of this study was to build upon previous findings for the fastball, change-up, and screwball pitches by adding information about ball release velocity (VR) and pre-release range of motion (ROM) for the curveball and riseball techniques. **METHODS:** Five female NCAA Division II softball pitchers participated in the study. Participants performed five pitches for each of the five pitch types. The velocity of the ball was computed from videos of the pitches using Logger Pro software. The three best attempts for each pitch type (based on VR) were used in the analysis. Differences between measures were tested for statistical significance using ANOVA (criterion of p = 0.05). **RESULTS:** Figure 1 shows that pitchers achieved the largest VR values using the fastpitch (26.2 ± 1.4 m/s), while the smallest VR values were obtained using the change-up (18.7 ± 1.6 m/s). The fastball, screwball,

curveball, and riseball VR values were not significantly different from each other, but VR values for the change-up technique were significantly smaller than all the other techniques. Figure 2 shows the relationship between VR and ROM for all pitch types. Excluding the change-up technique, results show that an increase in ROM leads to an increase in VR. **CONCLUSION:** For a small sample of NCAA Division II softball pitchers, release velocities are very similar (24-26 m/s) for the fastball, screwball, curveball and riseball pitch types. The change-up pitch has distinct VR and ROM characteristics and future studies should investigate other factors that make the change-up such a unique pitching style.

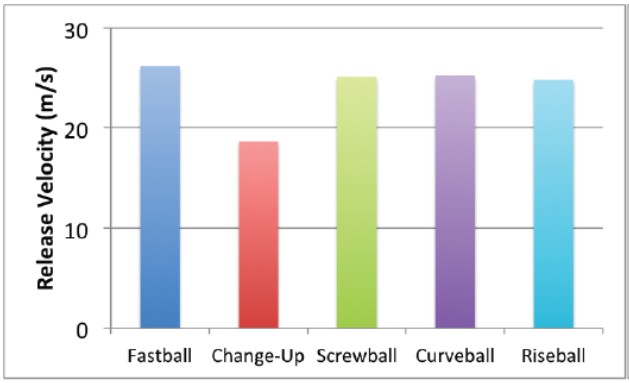

Figure 1. Ball release velocities for the five pitch types analyzed in the study.

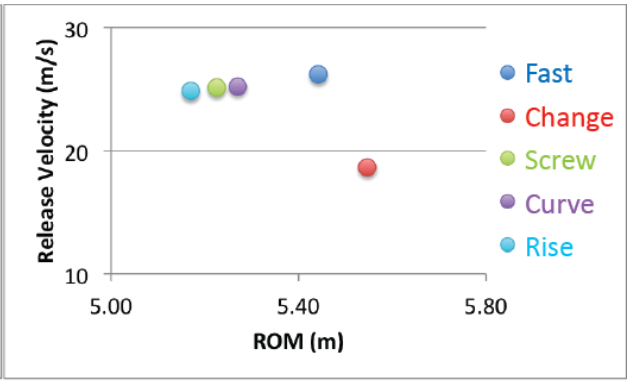

Figure 2. Relationship between ball release velocity and pre-release range of motion.

A System for Evaluating Powerlifting and Other Multi-Event Performances

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Current Powerlifting scoring unequally rewards the 3 different lifts and the Wilks formula is neither transparent nor easily updated. There is no provision for comparing across sex. **PURPOSE:** The purpose of this study was to provide a statistically sound method for evaluating Powerlifting performance which could also be used with other multi-event sports. **METHODS:** Data were collected on the top 50 (men) or the top 30 (women) individual scores in each weight class for each of the three Powerlifting lifts. Means and standard deviations were then calculated for each lift and weight class by sex. **RESULTS**: Mean and (standard deviation) for each weight class for women and men for each lift in kilograms. The z-score for the highest lift is also shown (n=30, except as shown, n=50 for men).

Wt Class (kg)	Mean (SD)			Top Z-score		
	Squat	Bench	Deadlift	Squat	Bench	Deadlift
44	84.1 (16.7)	52.5 (10.5)	106.9(16.9)	2.46	2.61	2.13
48	108.8 (10.9)	66.1 (4.6)*	139.2 (8.0)	2.84	8.28	2.90

52	136.4 (16.9)	79.9 (8.0)	157.3 (11.2)	2.72	3.23	2.47
56	146.7 (12.0)	90.4 (9.0)	170.4 (13.7)	2.97	2.55	2.60
60	163.0 (14.2)	94.8 (7.4)	181.4 (12.2)	3.46	5.56	2.54
67.5	174.2 (12.0)	114.7 (11.7)	198.1 (16.2)	3.26	2.16	2.58
75	194.4 (12.2)	122.0 (9.4)	211.6 (12.5)	2.66	1.74	2.48
82.5	194.7 (16.2)	125.6 (11.4)	213.2 (15.3)	3.10	2.31	2.54
90	189.1 (18.3)	120.4 (12.2)**	211.3(17.5)	3.30	3.52	2.63
SHW	208.7 (28.5)	128.6 (22.2)	216.7 (17.1)	3.02	3.19	2.96
			Men			
	Squat	Bench	Deadlift	Squat	Bench	Deadlift
56	187.8 (25.1)	137.6 (15.3)	214.1(20.6)	2.73	3.15	3.44
67.5	222.6 (12.3)	160.7 (9.6)	254.2 (14.9)	2.40	3.30	4.15
75	253.8 (18.1)	181.0 (11.9)	280.5 (15.3)	3.77	3.84	2.92
82.5	277.8 (14.9)	199.3 (11.4)	300.6 (12.7)	3.12	4.64	4.60
90	306.0 (16.3)	213.9 (12.8)	321.3 (15.9)	3.59	3.32	4.29
100	345.0 (21.1)	230.4 (9.7)	341.7 (17.2)	3.32	3.61	3.90
110	347.1 (15.5)	242.1 (12.8)	351.1 (14.9)	2.57	4.35	3.44
125	361.4 (17.7)	260.3 (13.0)	357.1 (13.5)	4.28	3.53	3.15
140	372.5 (22.0)	261.5 (14.9)	354.0(15.9)	4.32	3.79	3.04
SHW	386.9 (27.7)	271.5 (17.0)	364.9 (16.6)	2.64	3.30	2.86

*N=29, **N=28; SHW= super heavy weight

Powerlifting performance can be evaluated by the sum of the three z-scores for the three lifts divided by three (the highest score wins). **CONCLUSION:** The raw z-scores reflect a dimensionless number which can be used to evaluate each lift and for the total of the 3 lifts regardless of weight class or sex. This approach can be updated easily as more data become available, particularly for women. Although the means and standard deviations should be relatively stable, this computation is transparent and can be readily updated as lifters improve. This system overcomes many of the measurement challenges in evaluating among athletes in multi-event sports, in multiple weight divisions and between sexes. We recommend its use. This research was not funded.

Effects of a Sedentary vs. Active Lifestyle on Blood Glucose Uptake

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Leading a sedentary lifestyle has shown to increase the risk of developing cardiovascular and metabolic disorders. **PURPOSE:** To examine the effects of sedentary (SED) vs. active (ACT) lifestyles on blood glucose (BG) uptake at rest and during the recovery phase of exercise to identify whether a possible predisposition for metabolic or cardiovascular disease exists in young adults. **METHODS:** Seven SED (age 21.0 ± 0.6 years; height 164.8 ± 6.2 cm; weight 57.9 ± 8.5 kg; % body fat 16.7 ± 5.6%) and thirteen ACT (age 20.3 ± 1.0 years; height 173.3 ± 9.5 cm; weighing 66.8 ± 9.7 kg; % Body Fat 13.0 ± 6.2%) individuals participated in the study. After obtaining baseline measures, BG was monitored at 15 minute intervals under two separate

conditions; resting (R) and exercise (E). Before, during, and after E conditions, subjects' heart rate (HR), blood pressure (BP), and rate of perceived exertion (RPE) were also measured. All subjects performed the R condition followed by E condition. Each condition was separated by a minimum of 24 hours. A 2 x 2 ANOVA was performed to make comparisons between groups (SED vs. ACT) and conditions (R vs. E). **RESULTS:** For the baseline measure, significantly higher resting HR was seen in SED when compared to ACT (SED 95.3 ± 13.9 vs ACT 79.9 ± 14.5 bpm). Furthermore, a trend of higher BG was shown in SED throughout the hour post exercise when compared to ACT. However, these differences were not significant.

Blood Glucose	SED		ACT	
($mg \cdot dl^{-1}$)	REST	POST EXERCISE	REST	POST EXERCISE
Resting	83.3 ± 17.1	88.5 ± 14.3	81.9 ± 9.0	85.5 ± 9.6
Minute 15	115.0 ± 14.1	125.5 ± 21.4	121.3 ± 25.4	121.7 ± 18.7
Minute 30	135.5 ± 53.5	148.0 ± 50.6	144.0 ± 28.9	135.3 ± 21.5
Minute 45	136.0 ± 38.4	145.5 ± 54.8	137.2 ± 29.3	135.5 ± 21.6
Minute 60	118.8 ± 27.5	117.7 ± 18.4	116.9 ± 24.5	116.7 ± 20.4

CONCLUSION: Sedentary lifestyle in young adults may lead to alterations in cardiovascular function. Although the difference in metabolic function between SED and ACT groups was less clear, a shift towards an active lifestyle should still be considered to promote an individual's health and well-being.

The Impact of a 30 vs. 60 Second Passive Recovery Period on Vertical Jump Performance

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The vertical jump (VJ) test is commonly utilized to determine how high a person can jump and what their resulting power will be. Thus, it is important that the VJ test is administered correctly for a person to jump as high as possible. The standard time between subsequent jumps is usually 30 seconds (secs) with a completion of 3-6 jumps. But, if an individual is not fully recovered before their next jump, it is possible that jump may be lower vs. the first or earlier jumps. If a longer recovery period is granted between each jump, the individual may potentially jump as high as or even higher than their previous attempts. However, to the best of the researchers' knowledge, the impact of a 30 vs. 60 secs passive recovery period on VJ performance has not been assessed. **PURPOSE:** To investigate the potential differences between a 30 vs. 60 secs passive recovery period on VJ performance in no less than averagely fit college-age males. **METHODS**: After having descriptive data (ie. Ht., Wt., BF%, age) recorded, 31 averagely fit college-age males had their reach height measured and then participated in an 8 min dynamic warm-up. Subjects were then given a four minute passive recovery (PR) period after the warmup and then completed four familiarization jumps (ie. trials) using a VJ measurement device. After another 4 min PR period, subjects completed two series of jumps (ie. four trials apiece) in a counterbalanced order with either 30 (THIR) or 60 (SIXT) secs of PR between each jump. The THIR and SIXT jump series were separated by 4 min of PR. Excluding the first jump/trial for each series, the highest jump for THIR vs SIXT were compared using Paired-Samples t-Tests with significant differences occurring at $p \leq 0.05$. **RESULTS:** No significant differences (p =

0.44) occurred between SIXT (70.01 ± 10.36 cm) and THIR (69.97 ± 9.86 cm). **CONCLUSION:** The current results suggest that 30 or 60 secs of passive recovery between jumps is optimal recovery for peak performance to occur during the vertical jump test using averagely fit college-age males. However, further research may be necessary to assess the impact of 30 vs. 60 sec passive recovery on vertical jump performance using averagely fit college-age females. Also, future studies may need to exam the effects of a shorter or longer recovery period vs 30 or 60 seconds on vertical jump performance in male and female athletes.

Aerobic exercise attenuates risk of coronary artery disease and improves mobility in SCI

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Coronary artery disease (CAD) risks are significantly greater in persons with SCI, largely due to neuromuscular paralysis and its subsequent impact on body composition, cardiometabolic profiles, and activity levels. Exercise is seldom prescribed for this population because appropriate dose parameters are not known. **PURPOSE:** To assess the effect of aerobic exercise using arm crank ergometry (ACE) in high motor complete (ISNCSCI A/B) SCI as CAD risk profiles, aerobic capacity, and functional abilities. **METHODS**: Ten previously untrained patients (M8/F2, Age 36.7 y) with high motor complete SCI (C7-T5; cervical=3; thoracic=7) underwent ACE exercise training 30 min/d x 3d/wk for 10wks at 70% VO_{2Peak}. Baseline and post-intervention aerobic capacity (VO_{2Peak} and peak power), body profile measurements (%body fat [%BF], %fat free mass [%FFM]), functional ADLs and community mobility (bed-to-wheelchair [WC], car transfer, time to traverse a 100ft-5° ramp, 12-minute WC propulsion test), serum lipid profiles (total cholesterol, HDL, LDL), oral glucose tolerance (insulin resistance and area under the curve of glucose), and resting plasma glucose and insulin were measured. Normality was assessed with Shapiro-Wilks and Wilcoxon signed rank tests were used to evaluate the effects of the intervention. $\alpha<0.05$. **RESULTS:** Baseline to post-intervention relative VO_{2Peak} (12±3 vs. 13±3; p=0.027); absolute VO_{2Peak} (831±247 vs. 919±256; p=0.028), 12-minute WC propulsion (2061±959 vs. 2397±1053; p=0.028), peak power (43±15 vs. 54±14; p=0.026), respiratory quotient (0.95±0.13 vs. 0.77±0.02; p=0.028), insulin resistance (13.0±4.7 vs. 7.7±1.8; p=0.028), resting glucose-to-insulin ratio (9.13±3.97 vs. 13.69±2.49; p=0.028), and abdominal skin folds (26.8±9.0 vs. 23.8±6.2; p=0.043) all significantly improved. HDL (p=0.066), %HDL (p=0.074), and energy expenditure (p=0.074) trended towards significance. There were no changes in %BF or %FFM ($P>0.05$). **CONCLUSIONS:** Ten weeks of aerobic exercise at 70% VO_{2Peak} in high motor complete SCI using ACE demonstrated improvements in aerobic capacity, community mobility, and carbohydrate metabolism. This preliminary analysis emphasizes the importance of physical activity as a means to reduce obesity-related comorbidities and improve functional performance following SCI.

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Influence of Aerobic Exercise on Ghrelin-o-Acyltransferase in Normal Weight and Obese Adults: A Pilot Study

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Obesity is a major public health issue in the United States (US), affecting an estimated 78 million US adults. Aerobic exercise (AE) is recommended by the American College of Sports Medicine to prevent and treat obesity, yet the effect of AE on circulating hunger hormones, including ghrelin and its biological catalyst, ghrelin-o-acyltransferase (GOAT), are less known. **PURPOSE:** To determine the influence of AE on circulating GOAT in normal weight and obese adults. **METHODS:** A preliminary power analysis was performed to detect a medium to large effect size with 80% power. A sample size of nine was determined to be able to detect a medium effect size of 0.50 with 84% power, and was used as the pilot sample for this study. Of the pilot sample, four were normal weight (NW) (body mass index [BMI] = 21.3±1.3 kg/m^2) and five were obese (OB) (BMI = 38.9±6.2 kg/m^2). Physical characteristics were measured at baseline with a health fitness assessment. Participants then returned to the laboratory on three separate occasions, separated by ≥ 48 hours to perform AE and control sessions in a random counter-balanced order. AE sessions were performed on cycle ergometers at 30% and 60% oxygen uptake reserve for 40 minutes. Control sessions were performed with seated rest and no AE for 40 minutes. Fifteen mL of blood was taken pre-and-post-AE and pre-and-post-control, and were assayed in duplicate. Mixed factorial analysis of variance (ANOVA) was used to determine whether mean differences existed between NW and OB for GOAT in response to AE and control. Alpha levels were set *a priori* at $p<0.05$. **RESULTS:** No significant mean difference was found between NW and OB ($F[1, 4] = 0.66$, $p = 0.44$) AE and control ($F[2, 4] = 0.05$, $p = 0.96$), or the interaction between body weight and treatment condition ($F[1, 8] = 0.75$, $p = 0.49$). **CONCLUSION:** We found the change in GOAT to be similar between NW and OB across treatment and control conditions in this pilot study. Our findings indicate that further investigation of GOAT is warranted in combination with other appetite regulating hormones in response to exercise. Such investigations should expand upon our findings and implement study designs that include larger samples of men and women to better understand the role GOAT may play as a biological catalyst in the suppression of appetite.

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Subconcussive Head Impact Results in a Unique Circulating Exosomal MicroRNA Signature

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A large segment of the population participates in sports (e.g. football and soccer) and endure hundreds to thousands of low level head impacts over their lifetime. While a continuously growing body of evidence indicates concussive head injury can lead to long term medical problems, little is known about the effects of subconcussive head impact. Subconcussive head impact is defined as mild head impact that does not result in a clinical indication of concussion.

While little evidence exists, recently our group has shown that subconcussive head impact results in acute vestibular dysfunction. Thus, the possibility exists that not only does high magnitude head impact like concussions lead pathological changes, but also repetitive subconcussive head impact. Recent research has shown that small circulating molecules termed exosomes contain cargo including microRNAs that may be indicative of pathological events and signaling occurring in the tissue they were released from. **PURPOSE:** To identify a unique circulating exosomal microRNA profile indicative of subconcussive head impact. **METHODS:** We used a common soccer heading task as a controlled head impact model to elicit subconcussive head impact in college males (n=6), in which subjects headed a soccer ball 10 times at a set velocity from ~30 meters away. Pre, immediately post, and 24 hours post blood samples were collected. Exosomes were isolated from blood, and microRNA was isolated from exosomes. Small RNA Next generation sequencing (NGS) was performed on microRNAs in pre and 24 hour post plasma to unbiasedly identify alterations in levels of exosomal microRNAs. To verify NGS results quantitative real time polymerase chain reaction (qPCR) was performed on microRNAs of interest. **RESULTS:** A unique microRNA signature in circulating exosomes was identified 24 hours following subconcussive head impact. Specifically, based on abundance and fold change a small unique panel was identified including 3 microRNAs that were increased 4 fold or more, and 4 microRNAs that are decreased 3 fold or more. **CONCLUSION:** Subconcussive head impact leads to a unique panel of circulating exosomal microRNAs that could potentially be indicative of head injury following repetitive subconcussive head impacts.

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Differences between Two Commonly Measured 'Suprailiac' Skinfold Sites

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Skinfold measurement is an accepted method of body composition assessment. Despite accurate guidelines set by the American College of Sports Medicine indicating specific skinfold sites, inconsistency may arise in the interpretation of these guidelines. Current guidelines may lack precision, particularly in the identification of the suprailiac skinfold site. **PURPOSE:** To examine potential error associated with the measurement of the suprailiac skinfold site at two commonly interpreted locations within ACSM guidelines. **METHODS:** College-aged students from Slippery Rock University were recruited. Three skinfold measures were taken at each of three distinct anatomical sites using standard collection methods by a single criterion anthropometrist. One trial (SUPRA1) of three measures was taken at a site inferior to the anterior axillary line (a requisite component of the ACSM site definition) as the investigator observed from the sagittal plane. A second trial (SUPRA2) was taken at a site visually identified as the anterior axillary line from the frontal plane. A reference trial (SUPRA3) was taken at a site marked by hanging a plumb bob at the anterior axillary line. A repeated-measures analysis of variance test was conducted to compare the differences in measured skinfold thickness between sites, using a Bonferroni adjustment. An a-priori α-significance level was set at 0.05. **RESULTS:** Forty-six, young, apparently healthy individuals (20.9±1.2 y; 24.3±4.7 kg/m^2) participated. A greater average distance was measured between SUPRA1 and SUPRA3

compared to SUPRA2 and SUPRA3 (6.7±1.5 v. 1.3±0.9cm, respectively). Significant differences in measured skinfold thickness were recorded between SUPRA1 and SUPRA3 (-11.8mm; $p<0.05$), and SUPRA 2 and SUPRA3 (3.1mm; $p<0.05$). **CONCLUSION:** Site identification may have a marked effect on the measurement of the suprailiac skinfold site. Further studies are needed to determine if potential differences in suprailiac site identification affect the validity of body composition assessment.

An Analysis of Governed vs Different Focal Points on Vertical Jump Performance in Collegiate Males

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Previous research has suggested that overhead goals (ie. overhead focal point) can have a positive impact on drop jump performance. It stands to reason that with an increase in jump height, there is an increase in power output. However, there appears to be limited research on focal points and their impact on vertical jump performance (VJ). **PURPOSE:** To compare the potential differences between no set focal point, a set focal point (ie. governed), and a sport specific focal point on VJ performance in no less than averagely fit males. **METHODS**: Thirty-four averagely fit collegiate males participated in this study. After descriptive data and reach height was recorded, subjects completed an 8-min warm-up on a leg cycle ergometer followed by 4-min of passive recovery (ie. standing still). Subjects then completed 4 practice (ie. familiarization trials) counter-movement jumps (CMJ) utilizing a VJ Measurement Device. Upon completion of 2-min of passive recovery the subjects then completed, in a counter-balanced order, three different jump series consisting of four maximal effort CMJs with 30-secs between each jump. The various jump series were as follows: No Set Focal Point (FPN), Focal Point (FP), and Sport Specific Focal Point (FPS). The highest jumps for FPN, FP, and FPS were compared using ANOVA statistical techniques with an alpha level of 0.05. **RESULTS:** FPS (69.19 $\pm$ 9.40 cm) was significantly different ($p = 0.001$) than FPN (67.77 $\pm$ 10.08 cm). Also, FPS was significantly different ($p = 0.0003$) than FP (67.92 $\pm$ 9.92 cm). Conversely, there was no significant difference ($p = 0.308$) between FPN and FP. **CONCLUSION:** The results suggest that individuals who use a sport specific focal point tend to jump higher than those who use no set focal point or a goverend focal point. Therefore, it may be prudent to suggest that a sport specific focal point, as selected by the subject, should be utilized during VJ assessment. Future studies should assess the impact of a sport specific focal point on VJ performance using male athletes who participate in sports with jumping movements.

The Influence of Proximal versus Distal Strength on Balance Control in Athletes versus Non-Athletes

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Minor correlations between measurements for lower-extremity muscle strength and balance in individuals, regardless of the age, have been revealed. Similarly, maximal strength and balance have been individually investigated between an athletic population and a non-athletic population. However, comparisons between lower extremity strength (specifically ankle strength and hip strength) and balance between an athletic versus a non-athletic population have not been

established. **PURPOSE:** The purpose of this pilot study was to find correlations in hip strength and balance versus ankle strength and balance in an athletic (NCAA athletes) and non-athletic population. **METHODS:** Twelve NCAA Division-1 athletes (age: 20.42 ± 1.51 years, height: 179.27 ± 11.2 cm, mass: 79.07 ± 14.89 kg, gender: 6M, 6F) and twelve healthy college students (age: 22.58 ± 2.47 years, height: 171.65 ± 8.00 cm, mass: 72.72 ± 14.21 kg, gender: 6M, 6F) participated. Following informed consent, balance on the dominant leg was measured using a BOSU ball in timed trials with eyes open and eyes closed. Using a Biodex System 4 Isokinetic Dynamometer, the isokinetic muscular strength and directional torque of eight muscle groups in the sagittal and frontal planes were measured. Lastly, multivariate regression models were performed (α=0.05). Eyes open and eyes closed analyses were performed separately. **RESULTS:** Athletes had a higher ability to balance (athletes: 61.61 ± 42.67s vs non-athletes: 26.48 ± 27.19s)(p=0.030) in the eyes open trial and presented a correlation for ankle dorsiflexion (R=0.674)(p=0.008) when regressed with eyes open and ankle eversion (R=0.833)(p=0.002) with eyes closed. Meanwhile, non-athletes demonstrated a correlation for hip extension when regressed with eyes closed (R=0.705)(p=0.005). **CONCLUSIONS:** This study revealed a stronger correlation for ankle strength and balance in an athletic population while a stronger correlation between hip strength and balance was observed for a non-athletic population. Hence coaches, clinicians, or physical therapists can use these findings to tailor exercise protocols specific to individual cases and potentially increase balance to prevent injuries and falls.

Effects of a Three-week Core Training Program on Different Unstable Platforms

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The untested InertiaCore Balance Trainer (ICT) is designed to improve core function. Users engage the core musculature to maintain balance on the unstable device; its stability is adjusted by adding weight. This flexibility makes the ICT appropriate for all fitness levels. **PURPOSE:** To compare the effects of a 3 wk core training program completed on the ICT or a stability ball (SB). **METHODS:** Thirty two active college age students (19.4 ± 1.4 yrs and 65.2 ± 11.0 kg) were divided into the ICT and SB groups, each of which completed various medicine ball throws, crunches, and Russian twists. Subjects trained 3 $d \cdot wk^{-1}$for 3 wk; medicine ball weight and repetitions increased during the program's midpoint. Changes in core power and strength were measured across time with the Front Abdominal Power Throw (FAPT) and a Cybex dynamometer. Data were analyzed using repeated measures ANOVA. Dependent t-tests were used to examine changes across time within groups. **RESULTS:** The ANOVAs revealed no significant main effects between the time points or groups for any dependent variable. A significant interaction was found for flexion power (p=0.036), indicating opposing trends between the two groups across time. A similar relationship was found for flexion work, but the interaction only approached significance (p=0.059). The dependent t-tests revealed significant

increases in flexion (p=0.047) and extension (p=0.018) power only for the SB group. **CONCLUSION:** The ICT did not improve core function relative to the SB. This study focused on unstable training, but using more weight on the device, thereby increasing stability and resistance, may alter outcomes.

A Comparison of Self-Reported Pain Levels in Minimally-Shod vs Traditionally-Shod Runners

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Distance running is a popular recreational activity in the US, yet the rate of overuse injury is very high. Barefoot running is proposed as a tactic to avoid injury and allow for a more natural run by decreasing the loading rate on the lower extremity. We previously reported that minimalist runners with distinctive forefoot types were likely to experience pain in specific locations; however, no clear relationship has been established between the relationship of shoe type and pain. Therefore, the **purpose** of this study is to compare self-reported pain in specific regions of the lower limbs between minimalist runners and traditionally shod runners. **Methods:** 42 experienced runners participated (age: 26.5 ±8.7 yrs, hgt: 171.7±10.8 cm, mass: 71.4±16.6 kg, gender: 16M/26F). All participants reported running at least 10 miles a week for the past three months. Following consent, runners completed a visual analog scale (VAS) concerning the amount of pain they experience in five common sites of injury: knee, ankle, calf, shin, and foot. Runners with a score of ≥3 on the VAS were considered to be in pain. The manufacturer and model of the running shoe was recorded, and the runner was categorized as either minimalist (midsole drop <4mm) or traditional (midsole drop>4mm). Separate chi-square analyses were performed to determine if shoe type (minimalist, traditional) was related to pain (yes, no) as well as if shoe type was a factor in pain in specific locations in the lower limbs (α=0.05). **Results:** A greater percentage of minimalist runners reported pain (83.3% to 50.0%; p=.026). However, more traditionally shod runners reported knee pain than minimalist runners (5.6% to 33.3%; p=.015). No significant relationship was established on the type of shoe and the incidence of pain in other locations. **Conclusion:** More minimally shod runners may experience pain in their lower limbs than traditionally shod runners. This is contrary to previous research claiming that barefoot running may decrease pain in the lower limbs due to a reduction in loading rates. However, the study also indicates that knee pain is more prevalent in traditionally shod runners. Future research should investigate differences between foot anthropometry in both traditionally shod and minimalist runners who are injured compared to those who are uninjured.

Changes in Balance Measures During a Six-Month Senior Citizen Walking Program

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Balance is an important component of senior citizens' overall health and wellness. **PURPOSE:** To assess the effects of a pedometer-based, six-month walking program on several balance measures. **METHODS:** Sixteen senior citizens (age = 73 ± 5 years) participated in the walking

group, while five (age = 69 ± 4 years) participated in a non-walking control group. Participants completed test batteries at baseline, 3, and 6 months. A follow-up assessment was conducted at 9 months. The assessments included Balance Self-Efficacy Scale (BSE), Single-Leg Balance (SLB), and Get-Up-and-Go (GTAG). Differences between measures were tested for statistical significance using repeated measures ANOVA (criterion of $p = 0.05$). **RESULTS:** The BSE, SLB, and GTAG results are shown in Figures 1-3. Both groups were similar at baseline on BSE, but over the 6-month intervention period, the walking group increased confidence while the control group did not. The walking and control groups differed on the SLB measure across the duration of the study. The walking group participants did not differ on the SLB measure between limbs, while the control group exhibited variability between right and left legs. The groups differed in GTAG in the early phase of the study, but did not differ at the 9-month follow-up. **CONCLUSION:** Participants improved their SLB score by roughly 50% and decreased their GTAG time by 1 to 2 seconds over the course of a 6-month walking program. The current study utilized a small sample size and only one male participant. Future studies will be needed to determine if the effects found in the current study are also present in male participants.

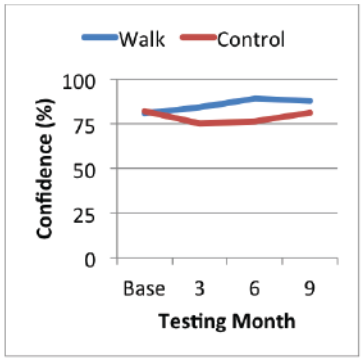

Figure 1. Balance Self-Efficacy Scale results.

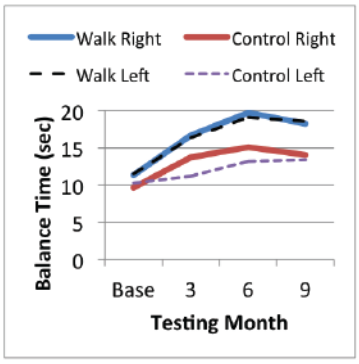

Figure 2. Single-Leg Stance Balance results.

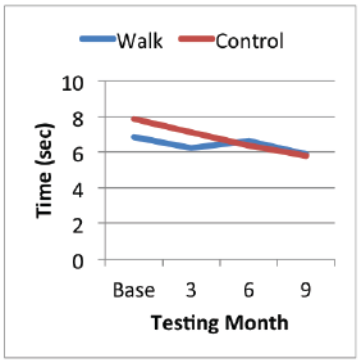

Figure 3. Get-Up-And-Go assessment results.

Oral TRP Agonists Delay Cramp Onset and Decrease Muscle Soreness in a Self-induced Cramp Model

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Exercise associated muscle cramps (EAMC) affect up to 95% of active people. Despite their high prevalence, effective prevention and mitigation of EAMC are elusive. Activation of oral TRPV1 and TRPA1 channels has been efficacious in decreasing the intensity of electrically-induced muscle cramps, likely by reflexively decreasing α-motor neuron hyperexcitability. In a previous study, we developed a model for reproducible voluntary static EAMC and showed efficacy of oral TRP channel agonists in reducing the intensity-duration profile of EAMC. **PURPOSE:** To conduct a cross-validation study on the efficacy of oral and mucosal TRP receptor activation in mitigating voluntary muscle cramps in young, healthy, cramp-prone subjects. **METHODS:** In a randomized, double-blind, placebo controlled study, men and women (18-30 yr) with a history of EAMC attempted to produce a muscle cramp in the triceps surae via

maximal isometric muscle contraction (maximum of 5 x 90s attempts with 10 min rest) on 5 separate occasions. After 3 lead-in trials, participants ingested either the active treatment (A: 50 mL of a beverage with known TRPV1 and TRPA1 activators) or a vehicle control (V) in counter-balanced order. Time and isometric force to elicit a cramp, cramp duration, cramp EMG area under the curve (AUC), and perceived muscle soreness were measured. **RESULTS:** Of 38 initial volunteers, 29 (76%) were identified as repeat crampers. In these 29 subjects, A lengthened the contraction time before cramp onset (A: 38 ± 5 s, V: 24 ± 4 s; p=0.01) and decreased perceived muscle soreness after cramping (A: 4.3 ± 0.4 arbitrary units, V: 4.7 ± 0.4 units; p=0.04) but did not alter the isometric force necessary to elicit the cramp (A: 13 ± 2 kg, V: 12 ± 2 kg; p=0.51), muscle cramp duration (A: 14 ± 3 s, V: 13 ± 2 s; p=0.87), or EMG AUC during cramp (A: 55 ± 10% EMG_{max}•s, V: 80 ± 20% EMG_{max}•s; p=0.22) compared to V. **CONCLUSION:** Activation of oral and mucosal TRPV1 and TRPA1 receptors increased the isometric muscle contraction time prior to cramp onset and decreased self-reported muscle soreness after the cramp. Consumption of naturally occurring TRP channel agonists positively impacts self-induced muscle cramping.

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Unilateral Fatigue Differences between Novice and Experienced Resistance Trainers

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Neuromuscular fatigue (NF) can be identified as a failure to maintain proper muscle force essential to completing the task at hand. The effects resulting from NF differ between bilateral and unilateral tasks and limb dominance probably plays a role in unilateral NF. **PURPOSE:** The purpose of this study was to analyze the unilateral NF differences between dominant and non-dominant limbs of novice and experienced exercisers. **METHODS:** Ten college age men (age = 21.70 ± 1.70 years) were separated into two groups: novice (N=5), less than 6 months of experience, and experienced (N=5), 18 months or more resistance training experience. Muscle activity of the clavicular head (CH) and sternal head (SH) of the pectoralis major as well as the rectus femoris (RF) and vastus lateralis (VL) were examined through surface electromyography (sEMG). Subjects were tested for one repetition max (1RM), fatigued at 60% of 1RM using a dynamic fatiguing protocol, then retested at 1RM value. **RESULTS:** No significant differences ($P \leq 0.05$) were observed across the two conditions likely due to the small sample sizes in each group. However, our data show there may be differences in muscle activity between groups. In the dominant leg RF, experienced individuals displayed an increase of peak μV (102.73 ± 239.18 μV) while novice individuals displayed a decrease (222.57 ± 282.31 μV). Additionally, novice individuals displayed a decrease of average μV (91.32 ± 97. 15 μV) in the SH of the ND limb whereas, experienced individuals displayed an increase (10.30 ± 109.06 μV). **CONCLUSIONS:** Experienced resistance trainers dominant limbs appear to display different neuromuscular activation patterns than novice trainers. With resistance training, fatigue effects may be handled differently within the muscle. These results suggest that different muscle activation patterns may develop over time with training compensating for fatigue.

Effect of Sitting Time on Measures of Subclinical Atherosclerosis in Older Adults

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Increased sitting time has been associated with increased risk of cardiovascular disease and cardiovascular mortality. In young adults, sitting time was found to correlate with arterial stiffness and wave reflection, two subclinical markers of early atherosclerotic progression. **PURPOSE:** To determine if sitting time is associated with markers of subclinical atherosclerosis in older adults. **METHODS:** 99 adults between the ages of 60 and 85 yrs (mean: 68±6 yrs; 46.5% female) completed the International Physical Activity Questionnaire to assess physical activity behavior, including sitting time. Markers of subclinical atherosclerosis included common carotid intima-media thickness (IMT), carotid β stiffness, and Young's elastic modulus (ε) as measures of carotid stiffness, carotid-femoral pulse wave velocity (c-fPWV) as a measure of aortic stiffness, and aortic augmentation index (AIx) as a measure of global wave reflections. IMT, β stiffness, and ε were assessed on the left common carotid artery using ultrasound, while c-fPWV and AIx were assessed on the right side via applanation tonometry. Pearson correlations were performed to determine the strength of the relationship between sitting time and subclinical atherosclerotic measures. **RESULTS:** Older adults sat for an average of 6.3±2.8 $hrs \cdot d^{-1}$ and sitting time was not different between the sexes (6.0±2.5 vs. 6.6±3.0 $hrs \cdot d^{-1}$, $p = 0.279$, for women and men, respectively). Sitting time was not significantly correlated with IMT ($r = -0.089$, $p = 0.193$) β stiffness ($r = -0.047$, $p = 0.324$), ε ($r = -0.013$, $p = 0.449$), c-fPWV ($r = 0.038$, $p = 0.356$), or AIx ($r = -0.003$, $p = 0.488$). When exploring associations by sex, there were no associations between sitting time and any measure of arterial stiffness or wave reflection ($p \geq 0.073$). **CONCLUSIONS:** Sitting time is not associated with measures of subclinical atherosclerosis in older adults. These data suggest sitting time may not further impact the structure of the aged artery. Future studies using objective measures of sedentary behavior are needed to further explore the relationship between sitting time and subclinical atherosclerotic risk.

Supported by Dairy Research Institute/Dairy Management Inc.

The Effect of a Backpack Hip Strap on Energy Expenditure While Walking

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Previous studies have demonstrated that energy cost increases as the weight of the load increases, but few investigations have been conducted that focus on backpack carriage specifically. **PURPOSE:** To examine the effect of backpack hip strap use on walking energy expenditure while carrying a loaded backpack. **METHODS:** A crossover design was used in which 15 young, healthy male subjects walked at a self-selected pace for two 10-minute loaded backpack trials either with a hip strap (strapped) or without a hip strap (non-strapped). Oxygen consumption (VO_2), rating of perceived exertion (RPE), respiratory exchange ratio (RER), and heart rate (HR) were monitored throughout each 10-minute trial. Change scores from the 4^{th} to 10^{th} minute were calculated for each variable. A t-test was used to evaluate the difference between trials for each variable. **RESULTS:** The change in VO_2 (-0.62±0.40 vs. 0.33±0.23,

p=0.04) and RPE (1±0.25 vs. 2±0.21, p<0.01) from the 4th to the 10th minute were different for the strapped versus non-strapped condition, respectively. There was no difference in the change in RER (0.04±0.01 vs. 0.03±0.01, p>0.05) or HR (3.53±0.93 vs. 4.07±1.39, p>0.05) for the strapped versus unstrapped condition, respectively. **CONCLUSIONS:** These results suggest wearing a hip strap reduces the energy expenditure and perceived exertion in as little as 10 minutes of walking. The reduced energy expenditure found with using a hip strap may have a significant impact on an individual's ability to hike or march for extended periods of time.

Blood Pressure Responses to Emergency Calls in Volunteer Firefighters and Emergency Medical Technicians

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High levels of stress can lead to a higher resting blood pressure (BP) eventually leading to hypertension and increased risks for cardiovascular disease. There is an association between work stress, an increased heart rate, and systolic BP. Emergency medical technicians (EMT), first responders, and firefighters (FF) have some of the most stressful jobs due to the demands of the occupation. Studies have demonstrated that EMTs, paramedics, and FF experience increased BP as well as higher heart rate during a work day. Importantly, sudden cardiac events are the number one cause of in-line duty death of volunteer FF, so understanding how these risk factors are affected is important. **PURPOSE**: The purpose of this study was to measure the BP response to emergency calls and examine relationships between the response and cardiovascular health. **METHODS**: Using an ambulatory BP cuff, BP was monitored for 12-hours during a typical work or volunteer shift to observe BP response with emergency dispatch calls. A 10-hour fasted study was also completed measuring plasma glucose levels, cholesterol levels, and core BP through the radial artery. **RESULTS**: Thus far we have collected 23 pieces of 12-hour BP data and 6 patients received an emergency call during their session. The average 12-hour BP of these emergency service providers was 118.2±8.0 mmHg systolic and 74.0±8.7 mmHg diastolic BP. With pager activation systolic BP surged an average of 20.7±14.9 mmHg and diastolic BP surged 10.0 ±6.7 mmHg. Examining this surge compared to the 12-hour average BP, we found systolic BP increased 22.9±11.7 mmHg and diastolic BP increased 13.6±6.2 mmHg; with an average time to return to baseline BP of 1.1 hours for systolic BP and 1.6 for diastolic BP. **CONCLUSION**: Data collection is ongoing, but we found that both systolic and diastolic BP surge with pager activation. Also, it appears that this BP surge has a potential relationship with years of experiences and with type of emergency call. This observation is suggesting specific emergency calls create more of a stress reaction in some responders over others.

The Effects of a Six-Week HIIT Program on CVD Risk Factors in Sedentary Individuals

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Regular physical activity is linked to improved cardiovascular (CV) health. High intensity interval training (HIIT) is a type of CV exercise that involves interchanging intervals of high intensity exercise (usually 80-100% of maximum heart rate) with lower intensity recovery periods. **PURPOSE:** The purpose of this study was to assess the effect of a six-week HIIT program on modifiable cardiovascular disease (CVD) risk factors. **METHODS:** Total

cholesterol (TC), high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, fasting plasma glucose (FPG), blood pressure (BP), resting heart rate (RHR), and body fat percentage (BF %) were assessed before, halfway through, and after the six-week program in nine sedentary young adults. Subjects performed three sessions per week for six weeks at a work-to-rest (W:R) ratio of 1:4, where they were required to sprint and walk. **RESULTS:** There was a significant increase in FPG from the pre-program to the post-program assessment (P=0.03). There was also a significant decrease in diastolic BP (DBP) (P=0.03) and RHR (P=0.04) from the pre-program to post-program assessment. **CONCLUSIONS:** These data suggest that HIIT is effective in significantly reducing DBP and RHR. However, a six-week, 18 session HIIT program at a 1:4 W:R ratio may not be effective for reducing the risk for CVD through idealizing blood lipids, SBP, body composition, or anthropometry measurements in this population. This study contributes to the necessity to find an optimal HIIT program length, training session duration, and W:R ratio to help establish the most advantageous training program to reduce the risk of CVD.

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Comparison of Lower Extremity Muscle Activity in Sliding Lunges versus Standard Lunges

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Lunges are a functional exercise used in lower body neuromuscular training programs. Lunges are typically performed on the floor stepping forward, sideways, or backwards, but can be performed on a slide board or with foot sliders. Sliding allows partial weight bearing and may improve stability. Differences in neuromuscular challenges, specifically hip and knee muscle activity, between sliding and standard lunges are unknown. **PURPOSE:** To compare hip and knee muscle activity between sliding and standard reverse lunges (RL) and side lunges (SL). **METHODS:** Sixteen healthy active subjects performed 3 types of RLs and SLs: slide board (SB), foot sliders (FS), and standard lunges (ST). After skin preparation, surface electrodes were placed over the muscle bellies of the gluteus maximus (GMX), ipsi- and contra-lateral gluteus medii (iGM, cGM), vastus lateralis (VL), and vastus medialis (VM). Muscle activity of the weight bearing leg was measured at 1000 Hz with a wireless EMG system. Lunges were performed at a standardized tempo (44 bpm) and subject specific standardized length. Maximum voluntary isometric contractions (MVIC) were used to normalize peak EMG (pEMG) and average EMG (aEMG) to percent MVIC for 4 lunges of each subject all conditions. One-way repeated measures ANOVAs (α=0.05) were used to determine differences between the 3 lunge types for SL and RL. **RESULTS:** RL cGM aEMG was greater for ST (22 ± 21%) versus FS (16 ± 17%), p = .012. RL VM aEMG was lower for SB (30 ± 12%) versus FS (34 ± 14%), p =.016. SL VL aEMG was greater for ST (230 ± 150%) versus SB (198 ± 121%), p = .049. SL GMX aEMG was greater for ST (192 ± 137%) versus SB (159 ± 123%) and FS (162 ± 103%), p = .001 and .035. SL VM aEMG was greater for ST (135 ± 14%) versus SB (26 ± 11%) and FS (25 ± 9%), p = .009 and .004. SL iGM pEMG was greater for ST (79 ± 44%) versus SB (52 ± 32%) and FS (50 ± 37%), p = .019 and .003. SL cGM pEMG was greater for ST (79 ± 41%) versus SB (59 ± 34%), p =.027. SL VM pEMG was greater for ST (92 ± 46%) versus SB (63 ± 28%) and FS (60 ± 18%), p =.031 and .01. **CONCLUSION:** Hip and knee muscle activity is similar for RL with minor differences in cGM and VM based on lunge type. Standard SL had

consistently greater peak and average muscle activity compared to sliding lunges. Sliding SL may require different neural control which could be important in rehabilitation settings.

Psychometric Validation of Physical Activity from the Youth Health Behavior Survey

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Background: The Youth Health Behavior Survey (YHBS) is a 26-item survey with items in the domains of physical activity (PA), nutrition, and access to preventative health services. Although the YHBS was developed from previously validated tools, the validity of the YHBS itself has not been previously validated. **Purpose**: To validate baseline PA from the YHBS between a sub-sample of fourth grade students attending schools partnered with the Healthy Futures Initiative, a three-year multi-level, school-based intervention addressing childhood obesity. **Methods**: The YHBS was completed by 220 students at baseline among four schools (Schools A, B, C, D). Validity was assessed between schools with Pearson product-moment correlation coefficients. Because Questions 2 and 4 violated the basic assumption of normality, a Spearman's rho correlation coefficient was used. Alpha levels were set at $p<0.05$. **Results**: A total of five questions were assessed for validation (Table 1). A significant positive relationship was found between the responses of Schools A and C for Question 2, $r_s=0.36$, $p=0.05$. A significant negative relationship was also found between the responses of Schools B and D for Question 4, $r_s=-0.287$, $p=0.035$. No other relationships were found between the responses of any school for Questions 1, 3, or 5 ($p>0.05$). **Conclusion**: Because we found significant relationships between Schools A and C for Question 2, and Schools B and D for Question 4, from the PA sub-section of the YHBS, use of these questions is validated for the study population. The development of more age-appropriate language for Questions 1, 3, and 5 of the YHBS may better evaluate the self-reported PA among fourth grade students in the Greater Philadelphia region.

Table 1: Five Physical Activity (PA) Questions Validated from the Youth Health Behavior Survey

Question 1	During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?
Question 2	On an average school day, how many hours did you watch TV?
Question 3	On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work?
Question 4	In an average week when you are in school, on how many days do you go to physical education classes?
Question 5	During the past 12 months, on how many sports teams did you play?" between the responses of any of the schools

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Examination of self-efficacy to perform exercise before and after a high altitude hike

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Travel to high altitude poses many challenges for low land natives, including an increased risk of acute mountain sickness, which may influence self-efficacy for exercise and participation in recreation above 3,000 meters. **PURPOSE:** To compare levels of self-efficacy for exercise in young adults before and after completing a high altitude hike in the Andes mountain range. **METHODS:** Undergraduate students who enrolled in a study abroad to Peru volunteered for the study. Prior to traveling, students completed the Exercise Self-Efficacy Scale at sea level (SEA). The survey was repeated at 3,040 meters, before (PRE) and after (PST) embarking on a two-day, high altitude hike on the Inca trail. The 12-item scale assessed confidence in performing vigorous exercise at high altitude for increasing periods of time. Scores ranged from 0 (Not at all confident) to 100 (Highly confident). **RESULTS**: Fifteen students (age 21 ± 1.6 years; M:7, F:8) completed the hike and all three surveys. There was a statistically significant difference in exercise self-efficacy across each survey, as determined by repeated measures ANOVA ($F(2,28)=5.82$, $p<0.008$). Pairwise comparisons with a Bonferroni correction revealed a lower exercise self-efficacy score at PRE (20.7 ± 14.3 AU) compared to SEA (33.7 ± 20.4 AU)($p=0.006$) and PST (34.4 ± 22.9 AU)($p=0.004$). There was no difference between SEA and PST exercise self-efficacy scores ($p=0.904$). **CONCLUSION:** Ascent to 3,000 meters resulted in a reduced self-efficacy to perform vigorous exercise at high altitude. Self-efficacy returned to sea level values after successfully completing a high altitude hike. These data demonstrate the importance of performance accomplishments in improving self-efficacy, which may result in increased participation in recreational activities at high altitude.

Side-to-Side Knee Strength Imbalances and Increased Odds of Reporting Injury in Military Special Forces Operators

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Lower extremity strength differences are common in athletic populations. Previous studies have indicated <10% differences to be “normal” and >20% as “probably abnormal”. Increased injury risk in athletes with side-to-side strength differences has been shown, but few studies exist on military injury risk based on strength imbalance. **PURPOSE**: To compare isokinetic knee strength in Air Force Special Operations Command (AFSOC) Operators who reported/denied a previous lower extremity injury (LI) or knee injury (KI) and to examine potential increased odds of reporting previous injury based on the magnitude of side-to-side differences (StoSD) in knee strength. **METHODS**: 150 AFSOC Operators self-reported injury history and completed isokinetic strength testing on knee musculature. Injury history was obtained by a clinician. Injury counts were classified into groups: reported/not reported LI and/or reported/not reported KI, then analyzed using appropriate independent samples tests. Peak torque from 5 knee extension/ flexion repetitions were averaged and normalized to body weight. StoSD were calculated as the absolute value of the difference between limbs and dividing it by average peak torque of the

dominant limb. For odds ratio comparison, subjects were placed into cohorts: <10%, 10-20%, and >20% strength difference. **RESULTS**: Operators who reported a previous LI and those who reported a KI demonstrated larger StoSD (LI: p=0.029, KI: p=0.011) in knee extension strength (LI: 10.9±10.5%, KI: 13.5±12.9%) compared to those who didn't report an injury (LI: 8.0±5.4%, KI: 8.1±5.9%). Operators with >20% StoSD in knee extension strength had increased odds of reporting an LI (OR=3.3, 95% confidence interval (CI) (0.891,12.218); p=0.026) and a KI (OR=1.9, 95% CI (0.985-3.476); p=0.014) compared to those in the <10% cohort. Operators with >20% StoSD in knee extension strength also had increased odds of reporting a KI (OR=1.8, 95% CI (0.958, 3.527); p=0.025) compared to the 10-20% cohort. **CONCLUSIONS**: AFSOC Operators with a previous KI demonstrated significant StoSD in knee extension strength and those with >20% differences had increased odds (1.8-3.3) of reporting a previous LI or KI. Targeted rehabilitation for those with previous lower extremity injuries may improve StoSD in strength and limit potential re-injury risk.

Adipose Tissue Differs and Correlates to Carbohydrate Metabolism and Proinflammatory Adipokines by Level of Spinal Cord Injury

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Level of injury (LOI) and the contribution of visceral (VAT) and subcutaneous (SAT) adipose tissue (AT) to cardiometabolic dysfunction following spinal cord injury (SCI) remains an area of ongoing investigation. Current research recognizes AT as an endocrine organ releasing proinflammatory adipokines that can alter carbohydrate metabolism. **PURPOSE:** The aim of this investigation was to examine differences in AT volume and characterize the relationship of AT with carbohydrate metabolism and proinflammatory adipokines by LOI. **METHODS**: Forty-three chronic motor complete SCI individuals were included (M/F 36/7, age 42.7±10.5, BMI 26.0±6.0) following completion of informed consent in this IRB approved study. Participants were excluded if unable to undergo magnetic resonance imaging (MRI), had pressure ulcers>grade 2, uncontrolled spasticity/autonomic dysreflexia, or thyroid/renal disease. Participants were classified according to their LOI as either tetraplegic (C5-C8; n=11) or paraplegic (T2-L1; n=32) and underwent an intravenous glucose tolerance test to calculate glucose effectiveness (S_g), insulin sensitivity (S_i), and laboratory assessments, including serum levels of fasting plasminogen activator inhibitor-1 (PAI1), high sensitivity c-reactive protein (CRP), interluekin-6, tumor necrosis factor alpha (TNFα), and thrombin activatable fibrinolysis inhibitor. VAT and SAT were quantified using noncontrast MRI and separated by depot**.** Assays and images were analyzed according to previously published methods. *Mann-Whitney U and* Spearman correlations were used to evaluate the data. $\alpha<0.05$. **RESULTS:** VAT was greater in tetraplegia vs. paraplegia (2974±1524 vs. 2022±1247 cm^3, respectively; p=0.042). In tetraplegia, SAT correlated with S_g (ρ=-0.54, p<0.05), while VAT correlated with TNFα (ρ=0.65, p<0.05). In paraplegia, VAT correlated with S_i (ρ=-0.47, p<0.001), while both VAT and SAT correlated with PAI1 (ρ=0.47, p<0.001 & ρ=0.44, p<0.05, respectively). **CONCLUSION:** The current results show that LOI influences the distribution of AT as well as the relationship between AT depots and both carbohydrate metabolism and proinflammatory adipokines. These findings may help

explain the observed differences in body composition and metabolic profiles between tetraplegia and paraplegia.

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Effects of Texting and Walking on Gait Pattern and Attention to Detail in College-Aged Students

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PURPOSE: To examine the effects of texting while walking on gait parameters and attention to detail. **METHODS:** Twenty-four college-aged students (M±SD: age = 21.2 ± 1.6 years, mass = 77.2 ± 21.4 kg, height = 173.9 ± 8.4 cm, BMI = 23.0 ± 8.3 kg/m^2) volunteered to participate in the study. Using a course that was based on university crosswalks and sidewalks, students were asked to walk at a self-selected pace while completing three different conditions: (1) control (CON), (2) single-sourced texting (SST), and (3) multi-sourced texting (MST). The order was randomized and counter-balanced. Signs along the course were changed following each condition to gauge attention to detail and a gait mat was used to record selected gait parameters. Data were analyzed using repeated measures ANOVA. **RESULTS:** Statistically significant difference were yielded for gait speed ($p < .05$), stance time ($p = .05$), and step length ($p < .01$). A trend was also seen for cadence ($p = .08$, Table 1). Error rates for text message responses were found to be nearly double in the MST trials (17.6% error) when compared to the SST trials (8.5% error). There was no significant difference reported in step width or terminal double support time. Only 2 of the 24 subjects (8.3%) noticed changes to course. **CONCLUSION:** Overall, gait patterns and attention to detail were negatively influenced by texting while walking. Subjects spent more time in stance, took less steps that were shorter when texting.

Table 1: Mean comparison of gait variables during three texting and walking trials

Variable	Multi-source (MST)	Single-source (SST)	Control (CON)
Stance Time (s)	0.72 ± 0.10	0.71 ± 0.06	0.68 ± 0.06*
Step Length (cm)	64.44 ± 7.70	65.35 ± 7.15	70.77 ± 7.62#
Gait speed (m/s)	1.29 ± 0.26^	1.37 ± 0.25^	1.59 ± 0.25*
Cadence (steps/min)	112.59 ± 34.15	105.34 ± 7.63	124.87 ± 35.97
Step Width (cm)	10.60 ± 4.67	10.67 ± 3.60	10.60 ± 3.69
Terminal Double Support Time (s)	0.27 ± 0.32	0.16 ± 0.02	0.29 ± 0.37

*CON was different from both texting conditions; #CON was different from one texting condition; ^MST and SST were different from each other

Effects of Hot or Cold Hydrotherapy on Subsequent Power Output Following a Wingate Protocol

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Previous research has highlighted the significance of hydrotherapy recovery methods in respect to increasing an athlete's ability to return to their normal pre-testing state, following maximal exertion exercise. However, the majority of implemented hydrotherapy recovery modalities occurred in a chronic manner. **PURPOSE:** To determine the optimal acute hydrotherapy recovery protocol, with the least amount of variance, between preliminary and subsequent jumps after subjects experienced anaerobic exhaustion. **METHODS:** Fifteen college-aged students between the ages of 18-21 (20.73 ± 1.65 years old) participated in this study. Every 6 days, the subjects' vertical jump was assessed using force plates to establish baseline numbers, following a pre-determined dynamic warm-up. After subjects completed a Wingate leg cycle ergometry test, they completed either one of the two (i.e. hot = thermotherapy, cold = cryotherapy) hydrotherapy recovery protocols, or a passive recovery (i.e. control) for 10 minutes. The control and hydrotherapy protocols were administered in a counter-balanced order. Identical warm-up procedures were completed preceding each subsequent set of jumps. **RESULTS:** No significant difference occurred between thermotherapy (Trial 1: 949.03 ±190.3 N, Trial 2: 892.7 ± 187.8 N) and cryotherapy (Trial 1: 951.5 ± 194.6 N, Trial 2: 864.9 ± 189.04 N). Also, cryotherapy was not significantly different than the passive protocol (Trial 1: 962.11 ± 200.4 N, Trial 2: 906.15 ± 199.2 N). Finally, no significant differences occurred between thermotherapy and a passive recovery protocol. **CONCLUSIONS:** It can be suggested that none of the trial groups (i.e. thermotherapy, cryotherapy, and passive recovery) were more effective on acute recovery than the other. Also, neither of the hydrotherapy methods had a greater affect on acute recovery following an anaerobically fatiguing event as measured by the power output as determined from a vertical jump test. Future research should be conducted for use within a specific athletic population (e.g. high school, collegiate, professional). Other studies include administering contrasting water temperatures in addition to longer recovery times for impact on acute recovery.

The Effects of Beetroot Juice Supplementation on Cycling Time-Trial Performance in Normoxia and Moderate Hypoxia

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Recent research has shown that Beetroot Juice (BR) ingestion assists in Nitric Oxide (NO) production and may increase exercise efficiency, decrease muscular fatigue, increase

mitochondrial respiration, increase calcium handling, elevate glucose uptake, and aid vasodilatation. Also, given evidence for the detrimental effects of environmental hypoxia on exercise due to decreases in partial pressure of arterial oxygen (P_aO_2), as well as hypoxia-induced reductions in NO, increases in NO production via dietary nitrate supplementation may serve to enhance performance in hypoxia. **PURPOSE:** To investigate the effects of 3 day supplementation of beetroot juice on oxygen consumption (VO_2), arterial oxygen saturation (SpO_2), and average workload (W) during 15 minute time trial (TT) in both normoxic and simulated hypoxic (F_IO_2 = 15.3%) conditions in active males, aged 18-24. **METHODS:** Ten recreationally active healthy males participated in the study. Subjects were assigned in a double-blind randomized, crossover design consuming 140 mL of beetroot juice (2 shots) containing ~8.4mmol of nitrate (NO_3-) and nitrate depleted placebo (PL) for 2 days prior to testing and 2.5 hours prior to testing in both normoxic and hypoxic conditions. A 72 hour washout was utilized during the crossover. Prior to testing all subjects completed a maximal effort protocol to determine Maximal Power Output (W_{max}).During testing, subjects completed a 5 minute warmup, a 15 minute steady state normoxic preload at 50% W_{max}, and finished with a 15 minute cycling time trial (TT) at 70% W_{max}, in either normoxia or simulated hypoxia (F_IO_2=15.3% O_2). **RESULTS:** No significant difference was found for BR vs PL group by condition in mean workload (164.5±20.7 vs. 166.5±18.7 watts in normoxia and 162.6±13.9 vs. 161.0±22.1 watts in hypoxia, p=.769). **CONCLUSION:** The present research found no significant differences in average workloads during a 15 minute cycling TT performed in either normoxia or moderate simulated hypoxia after chronic supplementation of beetroot juice (140 mL X 3 days) vs. placebo. A 3-day chronic dosing protocol of 8.4 mmol NO_3- per day in the form of BR may not be beneficial to athletes competing in cycling time trials of ~15 minutes in duration at either sea level, or following acute altitude exposure at ~2500m.

Neuromuscular and Metabolic Activity During Concentric and Eccentric Squat Exercise

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PURPOSE: This study examined neuromuscular and metabolic activity during concentric (CON) and eccentric (ECC) squat exercise. Specifically, we wanted to determine if the ratio of neuromuscular activation between ECC and CON is similar in comparison to the ECC/CON ratio for energy consumption. **METHODS:** 7 men (age 20.5 ± 0.5) performed two squat protocols on different weeks using CON or ECC muscle actions. Expired air was collected and analyzed for CO2 production and O2 consumption using a metabolic cart and a two-way non-rebreathing facemask. Electromyography (EMG) of the vastus lateralis and biceps femoris muscles were recorded using an 8 channel biopotential amplifier and surface electrodes. Data were analyzed using a two-way repeated measures ANOVA, with Fisher's Least Significant Difference (LSD) post hoc analyses wherever appropriate. We hypothesized that the ratio of ECC/CON for muscle activation of the quadriceps and hamstrings (mV) would be similar to the ratio of ECC/CON for energy expenditure (kcal/min). **RESULTS:** The ECC/CON ratios for energy expenditure during sets 1-4 (75.2±9.4, 67.0±6.8, 68.0±7.9, and 68.4±8.4, respectively)

were significantly greater ($p \leq 0.05$) compared to the ECC/CON ratios for quadriceps and hamstring EMG (56.9±13.0, 49.1±15.3, 53.7±15.9, and 52.9±16.0, respectively), as well as the ECC/CON ratios for EMG from the quadriceps only (42.1±5.8, 38.6±13.8, 48.1±18.6, and 52.8±23.8, respectively), with the exception of Set 3, which was not significantly different. **CONCLUSION:** When squats are performed with 2 sec CON or ECC muscle actions and 50% of 1-RM, the ECC/CON ratio for EMG for each set was on average 53.2±1.4%, while the ECC/CON ratio for energy expenditure was 69.7± 1.1%. These data suggest that neuromuscular activation responses may not change in parallel with energy expenditure responses with different muscle actions.

Self Reported Lifetime Physical Activity in a Sample of Rural Cancer Survivors:A Pilot Study.

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The evidence of the benefits of exercise for those diagnosed with Cancer has grown significantly. These findings include prevention as a measure against cancer occurrence or reoccurrence has been growing significantly. As part of a larger ongoing study examining the characteristics of the rural cancer population in west central Pennsylvania, this study investigated the association between lifetime physical activity and cancer. **Purpose:** To describe the levels of self-reported lifetime leisure time physical activity levels in a sample of rural cancer survivors. **Methods**: A sample of 39 rural cancer survivors were initially included in the study. Participants recruited from newspaper postings, emails or posters were mailed questionnaires. Thirty-three (33) questionnaires were returned and 27 had usable data. Physical activity data was collected using a modified version of the Historical Leisure Activity Questionnaire. Data was separated using the following age groups: 13-17, 18-22, 23-34, 35-50, 51-65, and 66-80. Total MET Hours were calculated and were compared to a bench mark of physical activity according to ACSM recommendations of 2.5 hours of moderate intensity activity per week. The comparator of a 5 MET activity was used in the calculation of the benchmark MET Hours value. This study was approved by the Saint Francis University Institutional Review Board. **Results**: Twenty-seven (27) predominantly white, non-Hispanic participants, with a mean age of 60 years (27 to 77 years) completed all outcome measures. The mean age of Cancer diagnosis was 51 years, (9 to 70 years). Breast Cancer (n=11) was the predominate Cancer reported. Significant differences ($p<0.05$) from actual to predicted MET levels were found for each age group, except for the 13-17 group. The 13-17 group was the only group that exceeded the ACSM recommendation. The following groups demonstrated significantly lower MET level than predicted: 18-22 ($p<.017$), 23-34, ($p<.016$), 35-50 ($p< .000$), 51-65 ($p< .001$), and 66-80 ($p< .043$). **Conclusion**: This pilot data supports the evidence that reduced physical activity is associated with a cancer diagnosis, and suggests that lifetime physical activity levels may play a role in the incidence of Cancer in a rural population. Support was provided by the Office of Student Research.

The effects of normobaric hypoxia on CIVD and MBT following a bout of submaximal exercise

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Cold-induced vasodilation (CIVD) is a mechanism that protects the peripheries from cold-related injury. **PURPOSE:** The purpose of the current study was to investigate the effects of normobaric hypoxia on the thermoregulatory and CIVD response before and following submaximal exercise. **METHODS:** 10 apparently healthy men (23±3 years) volunteered for this study. The two experimental trials (13% O2 and 21% O2) were counterbalanced and blinded from the participant. Following a 60-min. acclimation the experimental trials consisted of two 15-min. exposures to 5ºC water of the non-dominant hand. The exposures were separated by a 30-min. bout of submaximal exercise producing the equivalent of 400 watts (W) of metabolic heat. Mean body temperature (MBT) and oxygen saturation (SaO2) were collected during the final 5 min. of each stage. CIVD was measured pre- and post-exercise during each of the cold-water exposures on the nailbed of the middle finger on the non-dominant hand. **RESULTS:** Onset time of CIVD was found to be significantly earlier in the 21% O2 condition compared to the 13% O2 condition ($p=0.043$). The cold exposure following exercise led to significantly earlier peak times of CIVD ($p=0.03$) in the 13% O2 condition. Amplitude was found to be significantly greater in the 21% O2 condition ($p=0.024$). In the 13% condition, the SaO2 reduction observed during exercise was significantly correlated to CIVD amplitude following exercise ($r=0.656$, $p=0.039$). In the 21% O2 condition, MBT following acclimation significantly correlated to the onset of CIVD following exercise ($r=-0.697$, $p=0.025$). Baseline MBT was also found to be significantly correlated to the amplitude of CIVD during the first and second cold-water exposures ($r=0.761$, $p=0.011$; $r=0.660$, $p=0.038$, respectively) in the 21% O2 condition. **CONCLUSION:** While at rest, normobaric hypoxia and a cold stress test appear to have minimal effect on MBT and the CIVD response. The amplitude of CIVD following exercise appears to be influenced by a reduction in SaO2 in normobaric hypoxia, while in normoxia, amplitude of CIVD is influenced more by baseline MBT.

Vascular Health Improves with a 4-Week Functional Exercise Program in Volunteer Firefighters

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Cardiovascular disease is the leading cause of death in the United States, and, in addition, over 50% of line-of-duty death in volunteer firefighters are a result of a cardiac incident. Exercise has been shown to improve cardiovascular health, yet volunteer agencies are not required to fitness test or have a fitness program for firefighters. Furthermore, there is a paucity of research that examines vascular health of volunteer firefighters. **PURPOSE:** To determine if a 4-week self-report functional exercise intervention improves vascular health measures in volunteer firefighters. **METHODS:** Twenty-six seemingly healthy volunteer firefighters completed the 4-week functional exercise program. Blood pressure (BP), blood glucose and cholesterol levels, body fat, carotid artery intima media thickness (IMT), and brachial artery flow-mediated dilation (FMD) were measured after an overnight fast, pre- and post- intervention. For the intervention,

participants completed 3 cycles of a 6-station exercise circuit, 3 times per week. The circuit included functional exercises such as weighted carries, stair climbs, balance exercises, and core strength exercises. **RESULTS:** Participants' average age was 37.96 ±13.5 yrs, and body weight was 194.9 ±35.9 lbs. Adherence to the four-week exercise program was 97.8%. We found significant improvements in cardiovascular and vascular health measures; systolic BP (126.5 ±10.49 to 121.1 ±10.9 mmHg), diastolic BP (76.8 ±5.5 to 73.9 ±6.3 mmHg), triglyceride levels (115.0 ±59.8 to 95.3 ±54.8 mg/dL), percent FMD (7.2 ±3.2 to 9.6 ±3.9 %), FMD/shear (0.5 ±0.2 to 0.6 ±0.2), core systolic BP (112.5 ±11.8 to 107.9 ±10.79 mmHg) and diastolic BP (76.3 ±8.7 to 73.5 ±6.2 mmHg), body fat percent (33.6 ±7.7 to 32.1 ±8.0%), and an increase in VO_{2peak} (35.5 ±4.3 to 36.8 ±4.6 mL/kg-min). **CONCLUSION:** Our results suggest that 4 weeks of functional fitness exercises may improve vascular health and fitness in the volunteer firefighter population.

The Effect of Mental Preparation in Muscular Movements

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The phrase 'warm-up' often is used in conjunction with a physical activity like a sport or workout, and refers to physical preparation. The benefits of being physically prepared have been well documented, whereas the importance of mental preparation in movement is less understood. **PURPOSE:** To determine if mental preparation, psyching (PSY) will contribute to higher muscular performance (knee extension) compared to distracted conditions, mental arithmetic (MA) and reading comprehension (RC). **METHODS:** 23 participants (11 females, 12 males), between 19-30 years of age, were required to have a minimum of one year weight training experience. The Biodex Quick Set Isokinetic Dynamometer measured force production. The study consisted of two visits. Visit one consisted of informed consent, a background questionnaire and Biodex practice trials. Participants engaged in a dynamic warm-up with nine practice trials for familiarization. Visit two included the same warm-up and exposure to three different conditions (PSY, RC, and MA). Conditions consisted of three trials (total of nine) with a rest interval between each trial. During each trial, a 20-second task period was provided (PSY, RC, MA). For each trial, participants determined their rate of perceived exertion by using the Borg RPE scale. Participants also rated their rate of focus after each trial based on a scale of 0-100, with 0 being the least and 100 the most focused. **RESULTS:** Force production averages within each participant for PSY (156.64 N*m) were higher compared to RC (143.32 N*m) and MA (145.52 N*m). A significant difference existed between PSY and RC (0.001), PSY and MA (0.012) and no significant difference for the distractions (RC and MA). Participants rated their perceived exertion (RPE) with higher ratings for the PSY (16.50) condition in comparison to RC (15.45) and MA (15.02). There was also a significant difference between PSY and RC (0.044), between PSY and MA (0.005) and no significant difference between the distractions (RC and

MA). Averages demonstrated a higher focus on RC (83.53) and MA (84.86) compared to PSY (81.67). **CONCLUSION:** PSY appeared to produce higher force averages and a higher perceived exertion in comparison to RC and MA. The study suggests promising results in psyching preparation as a method to increase muscular performance and enhancement.

Effect of dietary nitrate supplementation on step test performance at sea level and altitude

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Nitrate-rich beetroot juice improves exercise performance in untrained and moderately trained individuals at sea level through increased production of nitric oxide (NO). Beetroot supplementation may be more effective during exercise in a hypoxic environment, where NO production is reduced, due to low O2 tensions and muscle pH. However, results from studies that have examined the effects of nitrate supplementation on exercise performance at altitude have been equivocal. **PURPOSE:** To examine the effect of beetroot-juice ingestion on step test performance at sea level and altitude. **METHODS:** Undergraduate students enrolled in a 10-day study abroad to Peru that included a two-day hike on the Inca trail. Prior to traveling, all students performed a Queens College step test at sea level. Students stepped at a predetermined cadence for 3 minutes, after which recovery heart rate was recorded and entered into a standardized regression equation to estimate VO_{2max}. The test was repeated at sea level, 90 minutes after ingesting a 70 mL shot of beetroot juice (6.45 mmol nitrate concentration). The step test was completed twice more at an altitude of 3500 meters; both with and without beetroot juice ingestion. All tests were separated by at least 24 hours. **RESULTS**: Twelve students (age 21 ± 1.7 years; M:6, F:6) completed all aspects of the study. The estimated VO_{2max} at sea level without and following nitrate supplementation was 45.2 ± 9.3 $ml \bullet kg^{-1} \bullet min^{-1}$ and 46.8 ± 9.1 $ml \bullet kg^{-1} \bullet min^{-1}$, respectively. The estimated VO_{2max} at 3500 meters increased from 45.2 ± 9.8 $ml \bullet kg^{-1} \bullet min^{-1}$ to 47.7 ± 12.3 $ml \bullet kg^{-1} \bullet min^{-1}$ following nitrate ingestion. However, one-way repeated measures ANOVA revealed no differences in mean estimated VO_{2max} across conditions, $F(3,33)= 1.31$, $p=0.29$). **CONCLUSION:** We found no apparent effect of altitude or nitrate supplementation on step test performance in a group of college students. The duration of the exercise bout, as well as the dosage and timing of nitrate supplementation may explain our inability to observe an ergogenic effect.

The Utility of Aortic Doppler Ultrasound Measurements in the Parasternal Long Axis View

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Doppler based cardiac stroke volume measurements require a parallel angle between the flow of blood and the ultrasound probe necessitating apical cardiac views to obtain accurate absolute values. However, apical cardiac views are technically challenging during long serial recordings. Parasternal views are less challenging, but do not provide a parallel angle to the aorta. If a relationship exists between the aortic Doppler measurements from these two cardiac windows then a regression calculation can be established to estimate stroke volume from the parasternal view. **PURPOSE:** To determine if a relationship exists between Doppler measurements made at the aorta in the parasternal long axis and apical three chamber echocardiographic views. **METHODS:** Healthy college age participants underwent Doppler ultrasound measurements at the aorta in the parasternal long axis and apical three chamber view. Linear cross sectional analysis was performed to assess aortic annulus area and Teichholz stroke volume estimates in the parasternal long axis. Only participants with complete data sets are included in this analysis. Bivariate correlations were performed between the parasternal and apical Doppler measurements. Correlations and paired t-tests were performed between parasternal Doppler and Teichholz stroke volume estimates. **RESULTS:** Of the 18 participants studied, only 12 (66.7%; 6 males, 6 females, age 25.5±1.1yrs, height 156±14.2cm, weight 69.8±4.5kg, body fat 20.6±2%) had adequate Doppler strength in parasternal long axis for software automated signal tracing. No relationship was found between the time averaged mean blood flow velocity measurements obtained in the parasternal long axis and apical three chamber views ($r=-0.216$, $p=0.498$). Parasternal long axis Doppler based stroke volume (25.9±4.9mL/beat) measurements were lower than parsternal long axis Teichholz estimated stroke volume (57.8±4.9mL/beat) measurements ($p<0.001$), with no correlation between the two ($r=0.402$, $p=0.190$). **CONCLUSION:** While this data is preliminary, it suggests that aortic Doppler measurements in the parasternal long axis view suffer from low Doppler signal strength, and are inaccurate when compared to more conventional measurements.

Effects of Supplemental Glucose and Bicarbonate for Promoting Recovery During Swim Training

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Swim athletes train at volumes that can lead to overtraining. The use of ergogenic aids, such as carbohydrate (CHO) and sodium bicarbonate (BC), has been proposed as means of promoting recovery during intense daily swim training. **PURPOSE:** To determine the effectiveness of post-exercise CHO and BC supplementation to promote recovery during two weeks of intensified swim training**. METHODS:** Eighteen collegiate swimmers, 12 males and 6 females, participated in a two-week, double blind study (age = 19.32±1.16 yrs., height = 177.3±11.23 cm, and mass = 75.55±13.37 kg). Subjects were divided into three groups, receiving a) CHO (75 g) beverage and placebo (PL) capsules (CHO+PL); b) receiving low dose CHO (10 g CHO) beverage and PL capsules (PL+PL); and c) receiving CHO (75 g) beverage and BC (3.6 g) capsules (CHO+BC). Pre and Post-tests included: 100 yard freestyle performance; two Wingate trials (3-min recovery); grip strength; and positive and negative affect scale (PANAS) evaluation. **RESULTS:** No main group effect was observed for average Wingate power, peak Wingate power, swim performance (Table 1), positive PANAS score, and negative PANAS score ($p = .32$, $p = .48$, $p =$

.98, p = .24, and p = .92 respectively). A main time effect was observed in average power from the pretest Wingate trial 2 to the posttest Wingate trial 2 (p < .01). Significant improvement in average Wingate power and non-significant improvement in swim performance were observed in all groups. However, no main group effects were observed for any variables. **CONCLUSION:** It was determined that CHO and BC administered following daily swim training did not improve recovery during two weeks of intensified swim training.

Table 1. 100-Yard Freestyle Swim Performance Time (sec).

Group	Pretest	Posttest
CHO+PL	59.94 ± 8.34	59.45 ± 7.87
PL+PL	57.36 ± 4.36	57.00 ± 3.96
CHO+BC	57.90 ± 7.79	57.46 ± 7.81

A Randomized Controlled Trial of Riboflavin for Enhancement of Ultramarathon Recovery

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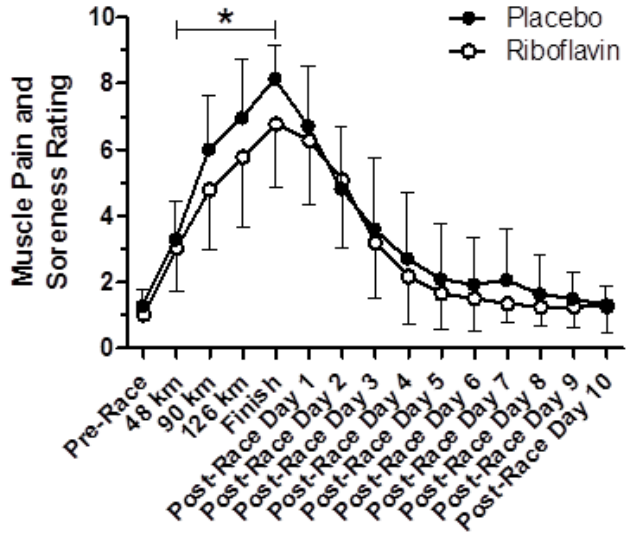
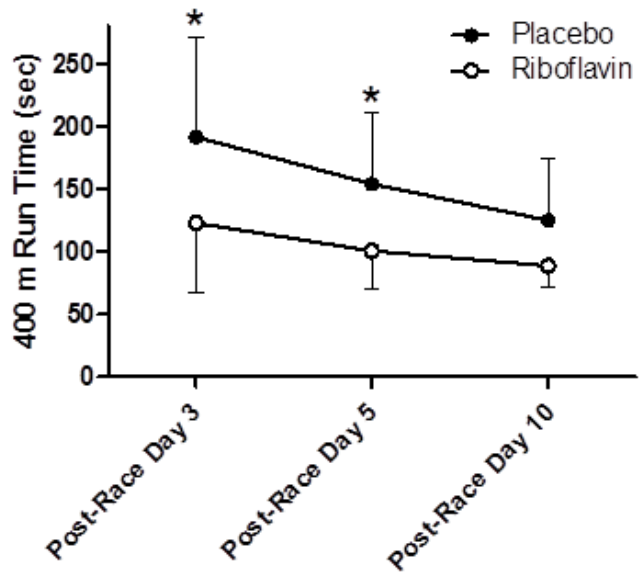
Purpose: This study investigated whether acute ingestion of riboflavin reduces muscle pain and soreness during and after completion of a 161-km ultramarathon, and improves functional recovery after the event. **Methods**: In this randomized, double-blind, placebo-controlled trial, participants of the 2016 161-km Western States Endurance Run were randomized to receive a riboflavin or placebo capsule shortly before the race start and when reaching 90-km. Capsules contained either 100 mg of riboflavin, or 95 mg of maltodextrin and 5 mg of 10% ß-carotene. Subjects provided muscle pain and soreness ratings before, during and immediately after the race and for the 10 subsequent days. Subjects also completed 400 m runs at maximum speed on days 3, 5 and 10 after the race. **Results**: For the 32 (18 in riboflavin group, 14 in placebo group) race finishers completing the study, muscle pain and soreness ratings during and immediately after the race were found to be significantly lower (p=.043) for the riboflavin group. Analysis of the 400 m run times also showed significantly faster (p<.05) times for the riboflavin group than the placebo group at post-race days 3 and 5. Both groups showed that





muscle pain and soreness had returned to pre-race levels by 5 days after the race and that 400 m run times had returned to pre-race performance levels by 10 days after the race.

Conclusion: This work provides preliminary evidence that riboflavin supplementation immediately before and mid-way through prolonged exercise may reduce muscle pain and soreness during and at the completion of the exercise and enhance early functional recovery after the exercise.

This work was funded by the Western States Endurance Run Foundation and the Rossi Family Foundation.

The Effects of Modern Climbing Holds on the Finger Forces

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With the inclusion of Sport Climbing to the 2020 Olympics, understanding how competitive rock climbing affects the body is critical. Much of the biomechanical climbing research of the hand while hanging has involved simulated holds and postures, little research has looked at the effects of competition grade climbing holds. **PURPOSE:** To determine if changing the type of climbing hold affects the forces on individual fingers by looking at maximum normal and average normal forces on each individual finger, as well as the distance between the middle finger (MF) and ring finger (RF) center of force locations. **METHODS:** 19 subjects (9 climbers, 10 upper body trained) completed 2 second isometric hangs on 7 different climbing holds. Hold 1 and 2 (H1, H2) were slopers, 90° and 110°. Hold 3 and 4 (H3, H4) were pinches, one thin and one thick. Hold 5,6,7 (H5, H6, H7) were edges 60°, 75°, and 90°. Attached to each hold was a pressure sensing film that recorded both normal forces and center of force locations between the fingers at 67 Hz. Means and standard deviation were calculated for each of the four fingers (thumb excluded) and 2 two-way and 5 one-way repeated measures ANOVAs were run to compare fingers and climbing holds ($\alpha = 0.05$). **RESULTS:** The MF had the greatest force across all 7 climbing holds, 103.64 N ± 1.58; then the pointer finger (PF), 125.98 N ± 2.15; then the RF, 96.26 N ± 1.30; and the pinky, 62.28 N ± 0.94. H1 had less maximum force then most other holds, with a difference in means (DIM) ranging from 15 - 24 N (p-value 0.000 - 0.038). H5 had a greater average force then H6, H7, and H4 with a DIM ranging from 11-13 N (p-value 0.028 - 0.080). For RF specifically, H5 had greater force than H1 and H7 with a DIM of 11 N and 22 N respectively (p-value 0.00 and 0.04). The COF distance between the MF and RF was less on H7 than H5 and H6 with a DIM of 0.58 cm and 0.68 cm (p-value 0.001 and 0.002). **CONCLUSION:** The findings of the study suggest that overall the climbing hold itself does not largely change the forces on the fingers; however, H5 did have a greater force than most other holds for both average and maximum forces. With the COF differences of the external forces for H7, the internal forces of the fingers may be affected by hold which could have clinical applications; this is an area needing further research.

Supported by Atomik Climbing Holds.

Do Sport Beverages Affect Self-Efficacy and Anaerobic Performance?

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Many sports teams and athletes utilize carbohydrate beverages during or prior to participation in exercise sessions. Whether the perceived benefit of sports beverage supplementation translates into enhanced work capacity under anaerobic exercise stress is of interest. **PURPOSE:** The primary purpose of this study was to examine the effects of carbohydrate beverages and self-efficacy on anaerobic performance. **METHODS:** Eight university students (5 male, 3 female, age: 20.63±0.7 yrs.; height: 176.21±10.39 cm; mass: 69.76±12.84 kg) volunteered to participate in this study. All subjects were considered moderately physically active and completed a health history questionnaire and one orientation testing day. The exercise protocol consisted of 10 x 60 sec cycle ergometry sprints (60 sec recovery) with total distance completed measured. Each test was conducted 10 min after consuming the assigned beverage for the day. Subjects completed the same exercise protocol preceded by each of three beverage (300 ml) conditions (placebo control (CON), 3% CHO (CHO-3), and 6% CHO (CHO-6)) on separate days. Treatment order was counterbalanced and drink administration was double-blinded. Distance, RPE, heart rate and

self-efficacy were measured after each sprint. Self-efficacy was gauged after each interval by collecting responses to this question: "Your average distance was (distance in km) on your orientation day, what do you think your next distance will be?" **RESULTS:** No significant differences (p>0.05) were shown between average distance traveled for the three drink solutions (CHO-6: 0.651±0.11 km; CHO-3: 0.695±0.06 km; CON: 0.656±0.08 km). Likewise, no significant differences were observed with RPE (CHO-6: 12.9±0.84; CHO-3: 13.26±0.62; CON: 13.4±0.84) or with self-efficacy results among the different beverages. **CONCLUSION:** Despite the common perception that sports beverages may be broadly applied to exercise activities, there is no evidence that they enhance self-efficacy or performance involving interval work.

Assessing the Relationship Between Body Composition and 50-km Running Performance

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Interest in ultramarathon participation and research has grown substantially over the past decade, with one of the main focus in research being race performance. Previous studies have focused on body composition in relation to race performance at distances ranging from 5-km to multi-day adventure races. However, no previous studies have assessed body composition and performance measures at the 50-km distance. **PURPOSE:** To investigate the relationship that may exist between body fat percentage (BF%) and body mass index (BMI) with race finishing time and position in ultramarathon runners who competed in a mountainous 50-km race. **METHODS:** Forty-six ultramarathon runners (male = 31, female = 15; BF%: 19.75 ± 5.64; BMI: 23.7 ± 2.58) participated in this study and were given a preliminary screening questionnaire on-site during packet pick-up on the day prior to the 50-km race. The participants' height was calculated using a leveled measuring tape. Weight and body composition measurements were taken using a bioelectrical impedance analysis (BIA) system. Finishing times and positions were collected from the race website four days after the event. Pearson correlations were calculated to determine if a correlation existed between overall race finish time/position and BMI and BF%. **RESULTS:** All forty-six participants completed the 50-km race (22967.37 ± 3001.1 seconds). Significant correlations were noted between race finish time and BF% (r = .548, p = 0.00) and race position and BF% (r = .532, p = 0.00). There were no significant correlations between overall race finish time and BMI (r = 0.036) or race position and BMI (r = 0.004) **CONCLUSION:** BF% measurements may be more accurate in loosely predicting potential overall finish time and position as compared to using BMI calculations. The results suggest that a runner with a lower body fat percentage may finish with a faster time and therefore better order of finish as compared to a runner with a higher body fat percentage. Future studies may focus on the potential change in body composition and its impact on race performance in male and/or female ultramarathon runners.

Expression of Strength and Power Relative to Lean Body Mass Impacts Results of Caffeine Intervention

Geoffrey M Hudson[1], Kyle Sprow[1], Tara Hannings[2], Loretta DiPietro[1], FACSM. [1]The George Washington University, Washington, D.C., [2]La Salle University, Philadelphia, PA

Differences in performance tests for strength or power could be attributed to the amount of lean body mass (LBM). So it may be important to report results of such tests not only relative to weight, but also relative to LBM. Depending on their proposed ergogenic mechanism(s), discerning between absolute and relative strength may be even more important in dietary supplement research. **PURPOSE**: Previously, our lab examined effects of caffeine withdrawal and acute caffeine ingestion, while this current investigation aims to elucidate if the prior results are dependent upon whether strength and power variables are expressed in absolute values or relative to body mass / LBM. **METHODS**: Subjects were strength trained, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg). Subjects abstained from caffeine for 4 days, consumed 5mg·kg^{-1} for 3 days and finally ingested 6mg·kg^{-1} caffeine or placebo one hour before final testing. Groups were assigned in matched pairs. Isokinetic peak torque (PT), total work, average power, and average PT were tested in the subjects' dominant leg at 60°·s^{-1}, 180°·s^{-1}, and 300°·s^{-1}. Endurance was assessed by 30 reps at 180°·s^{-1}. Isometric PT was measured at 30° and 90° flexion of the non-dominant leg. Absolute performance measures were converted to relative measures by dividing by the subject's body mass, LBM, or LBM of the exercising limb. Data were analyzed with independent or paired t-tests and an alpha of 0.05. **RESULTS:** Caffeine yielded many significant increases in strength and power. However, 5 of these measures were statistically significant in absolute terms, but no longer significant when divided by body mass. Isometric PT at 30° yielded significant results for caffeine supplementation in absolute PT ($p=0.042$) and relative units ($p=0.032$), but not when divided by the LBM of the exercising leg ($p=0.059$). **CONCLUSION:** This analysis demonstrates that the significant results of a study looking at the effects of acute caffeine ingestion are overestimated when strength variables are reported in absolute units as opposed to relative. Moreover, strength relative to LBM is important to examine changes independent of subjects' %BF. These relative values would then be more associated with differences in neuromuscular stimulation or fatigue irrespective of muscle size.

Physical Fitness Predictors of a Proposed Combat Readiness Test

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Combat readiness is defined as the ability to accomplish missions on the battlefield, and physical fitness is one of the key element. The U.S. Army recently proposed a new physical fitness test called the Army Combat Readiness Test (ACRT) to replace the three-decade-old Army Physical Fitness Test (APFT). Determining which physical fitness components are essential to performing well in the proposed ACRT can help U.S. Army Soldiers to attain the physical fitness required for carrying out their duties. Currently, there are no studies that have examined the relationship between the proposed ACRT performance and the components of physical fitness. **PURPOSE:** to identify the underlying and modifiable components of physical fitness for the proposed ACRT performance. **METHODS:** Forty-three healthy and physically active male subjects (age: 21.5±2.9yrs; height: 177.9±7.7cm; mass:77.8±11.1kg) participated in one field test session and one laboratory test session. Subjects were assessed with the proposed ACRT in the field test sessions and physical fitness measurements in the laboratory test sessions, which included muscular strength and endurance, postural stability, aerobic capacity, anaerobic capacity, flexibility, body composition, fat-free mass, and agility. Backward stepwise linear regression

analysis was performed to establish a multivariate model to predict time to completion of the proposed ACRT using the physical fitness measurements. **RESULTS:** Muscular endurance, aerobic capacity, body composition, fat-free mass, and agility contributed to a model that predict time to completion of the proposed ACRT ($R^2 = 51.78$, $p < 0.001$). **CONCLUSION:** The proposed ACRT assess a combination of physical fitness components consisting of muscular endurance, aerobic capacity, body composition, fat-free mass, and agility.

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Expression of Strength and Power Relative to Lean Body Mass Impacts Results of Caffeine Intervention

Geoffrey M Hudson[1], Kyle Sprow[1], Tara Hannings[2], Loretta DiPietro[1], FACSM. [1]The George Washington University, Washington, D.C., [2]La Salle University, Philadelphia, PA

Differences in performance tests for strength or power could be attributed to the amount of lean body mass (LBM). So it may be important to report results of such tests not only relative to weight, but also relative to LBM. Depending on their proposed ergogenic mechanism(s), discerning between absolute and relative strength may be even more important in dietary supplement research. **PURPOSE**: Previously, our lab examined effects of caffeine withdrawal and acute caffeine ingestion, while this current investigation aims to elucidate if the prior results are dependent upon whether strength and power variables are expressed in absolute values or relative to body mass / LBM. **METHODS**: Subjects were strength trained, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg). Subjects abstained from caffeine for 4 days, consumed $5mg \cdot kg^{-1}$ for 3 days and finally ingested $6mg \cdot kg^{-1}$ caffeine or placebo one hour before final testing. Groups were assigned in matched pairs. Isokinetic peak torque (PT), total work, average power, and average PT were tested in the subjects' dominant leg at $60° \cdot s^{-1}$, $180° \cdot s^{-1}$, and $300° \cdot s^{-1}$. Endurance was assessed by 30 reps at $180° \cdot s^{-1}$. Isometric PT was measured at 30° and 90° flexion of the non-dominant leg. Absolute performance measures were converted to relative measures by dividing by the subject's body mass, LBM, or LBM of the exercising limb. Data were analyzed with independent or paired t-tests and an alpha of 0.05. **RESULTS:** Caffeine yielded many significant increases in strength and power. However, 5 of these measures were statistically significant in absolute terms, but no longer significant when divided by body mass. Isometric PT at 30° yielded significant results for caffeine supplementation in absolute PT (p=0.042) and relative units (p=0.032), but not when divided by the LBM of the exercising leg (p=0.059). **CONCLUSION:** This analysis demonstrates that the significant results of a study looking at the effects of acute caffeine ingestion are overestimated when strength variables are reported in absolute units as opposed to relative. Moreover, strength relative to LBM is important to examine changes independent of subjects' %BF. These relative values would then be more associated with differences in neuromuscular stimulation or fatigue irrespective of muscle size.

Empirical Evidence for the Relationship Between Cognitive Workload and Attentional Reserve

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In an environment with increasingly complex and challenging situations, there is an ever-growing requirement to manage the demand on one's mental systems in an adaptive manner so as to maximize productivity and performance. The capacity of the cognitive system can be divided into two basic elements: *cognitive workload* (CW), or the processes concerning task-relevant information, and *attentional reserve* (AR), the portion of the capacity that it unused by the task. Theoretically, these two constructs have an inverse relationship, but this has never been explicitly tested. **PURPOSE:** The present experiment focused on using electroencephalography (EEG) and event-related potentials (ERPs) as measures of CW and AR, respectively (Gentili et al., Submitted; Miller, Rietschel, McDonald, & Hatfield, 2011) in an effort to provide empirical data to support or refute this theoretical prediction. It is hypothesized that as EEG measures of CW increase, ERP measures of AR will decrease. **METHODS:** Participants (27 males) performed a flight simulation task under three levels of nominal difficulty (low, medium, high) while EEG spectral measures of cortical activation and ERP data were collected. Canonical correlations were conducted on difference scores between each condition to test the statistical magnitude and significance of the relationship between EEG and ERP measures. **RESULTS:** Results from a canonical correlation (cancorr) analysis revealed the predicted result; collectively, measures of CW (spectral measures of cortical activation) have a strong inverse relationship to measures of AR (ERP components) (Low – Medium: Cancorr Coefficient = -0.783, $p = 0.047$; Low – High: Cancorr Coefficient: -0.791, $p = 0.038$; Medium – High: Cancorr Coefficient = -0.817, $p=0.019$). **CONCLUSION:** These findings support the present hypothesis; as measures believed to represent CW increase, measures believed to represent AR decrease. Future work must be conducted to assess reference values, or "anchor points", for these measures of CW and AR to understand their practical implications (i.e., How high/low can measures of CW/AR be?). Until such information is gathered, it will not be possible to understand the magnitude of the changes observed in physiological measures of CW and AR. Supported by the Lockheed Martin Corporation.

Core Strength as a Predictor of Performance During Three Functional Movement Screens: A Preliminary Analysis

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Current measures of core stability utilized by clinicians and researchers suffer from a number of shortcomings, such as: poor reliability, non-functionality, and incomplete in the assessment of core stability. Three functional movement screens appear, at face-value, to be dependent on the ability to activate and control core musculature. As a whole, these three screens may present a

viable alternative to current measures of core stability. **PURPOSE:** To determine whether core strength, a component of core stability, is a significant predictor of performance on these three screens **METHODS:** 31 subjects (Age = 22 ± 3.1 yrs, Height = 137.5 ± 70.1 cm, Weight = 68.7 ± 10.4 kg) completed a deep squat (DS), trunk stability push-up (TSP), and rotary stability (RS) screen, each being scored on a scale of 1-3. Strength was assessed for trunk flexion/extension, trunk rotation, hip abduction/adduction, knee flexion/extension, and pectoralis major, with the latter two included due to their potential influence during the DS and TSP, respectively. Scores on the three screens were summed to form a composite score (COMP). Two ordinal logistic regression equations were calculated with COMP as the outcome variable. After predictors were eliminated to avoid multicollinearity, the first equation included both core strength variables (trunk rotation, and hip abduction/adduction) and accessory strength variables (knee flexion and pectoralis major) as predictors. To compare the relative amount of variance explained without the accessory strength variables, the second equation only contained core strength variables. **RESULTS:** The first model was insignificant in predicting COMP (p=.053); however, the model fit was good (Pearson's Chi-Square=118.80, p=.385; Nagelkerke's R-Squared=.311). The second model was significant in predicting COMP (p=.017). The model fit was good (Pearson's Chi Square=126.96, p=.249) and the relative amount of variance was similar to the full model (Nagelkerke's R-Squared=.295). **CONCLUSION:** Overall performance on the three core stability screens is predicted by core strength, even when accounting for other strength variables. While more investigation is needed, the DS, TSP, and RS, collectively, appear to be a good assessment of overall core strength.

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DISEASE BURDEN IS ASSOCIATED WITH DIFFERENCES IN DIURNAL PATTERNS OF PHYSICAL ACTIVITY IN OLDER ADULTS

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Physical activity is an important risk factor for disease and functional outcomes with aging. Measurement of objective physical activity by accelerometry has become common in recent years and is often reported as total or average daily physical activity. However, a better understanding of the diurnal patterns of physical activity may elucidate the associations among physical activity, disease, and functional outcomes in older adults. **PURPOSE:** To evaluate the relationship between disease burden and objectively measured physical activity, overall and by time-of-day. **METHODS:** Physical activity (PA) was measured using wrist-worn ActiGraph Link accelerometers continuously over 7 days in 63 older participants (31 women, aged 68±10 yrs) of the Longitudinal Aging Study at Towson (LAST). Data was smoothed into one minute intervals and expressed as the average counts per minute across the three axes. Diurnal patterns of activity were modeled as the average activity counts over six 4-hour time bins. Number of chronic diseases was determined using a health history questionnaire and calculated as the sum of eight different diseases (hypertension, high cholesterol, heart disease, diabetes, arthritis, respiratory disease, gastrointestinal disease, and psychological well-being). Disease burden was categorized as either low (0-2 chronic diseases) or high (3 or more). The association between the mean of the log-transformed activity counts and disease burden was modeled overall and across each time bin using linear regression, adjusting for age, sex, and BMI. **RESULTS**: Total 24-h

PA (counts) was lower in those with high disease burden compared to those with low disease burden ($3.2x10^6 \pm 0.9x10^6$ vs. $3.8x10^6 \pm 1.0x10^6$ counts, $p = 0.01$). When examining diurnal patterns, early morning (4:00am-8:00am), afternoon (noon-4:00pm), and early evening (4:00pm-8:00pm) PA was lower in those with high disease burden compared to individuals with low disease burden ($p<0.05$ for each period). **CONCLUSION:** PA is lower in older adults with high chronic disease burden, particularly in the late afternoon and evening. Interventions aimed at increasing PA in older adults with multiple chronic conditions should consider targeting daily nadirs of activity by promoting PA during the afternoon and evening when their activity is typically lowest.

Assessment of Acute Balance and Agility Following Submaximal Plyometrics and Cycling

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Balance and agility are required in competitive sport and well trained athletes are exceedingly skilled at both. A loss of balance or lack of agility has the potential to hinder performance. **PURPOSE:** To examine the acute effects of two different exercise protocols (plyometrics vs. stationary cycling) on balance and agility in a college-aged sample. **METHODS:** Eleven undergraduate students participated in this study (7 males, 4 females; age = 21.36±0.67 years, height = 171.17±7.98 cm, mass = 72.26±7.09 kg, BMI = 24.72±1.80 kg/m^2, and body fat = 17.24±8.97%). Each subject completed an orientation session and two exercise protocol testing days: (1) 8-min of stationary cycling (CYC) and (2) plyometric (PLY) exercises. The protocols were counterbalanced and completed at least 48 hours apart. On testing days, all subjects completed a 5-min warm-up and cool-down on a cycle ergometer and balance and agility were measured before and after the exercise protocol. Agility was assessed using the T-test and balance was measured statically and dynamically using the standing one leg balance and Y-Balance tests, respectively. The data were analyzed using descriptive statistics and a one-way ANOVA with repeated measures. **RESULTS:** No statistically significant differences ($p > .05$) were yielded between exercise conditions. However, there was a statistically significant improvement on the T-test (Pre: CYC = 10.82±0.94 s, PLY = 11.11±1.27 s; Post: CYC = 10.49±0.94 s, PLY = 10.97±1.29 s) and left leg Y-balance (Pre: CYC = 257.03±26.76 cm, PLY = 251.75±26.17 cm; Post: CYC = 264.01±23.23 cm, PLY = 259.02±19.23 cm) after the exercise protocol, regardless of the type of exercise. **CONCLUSION:** Overall, exercise positively influenced agility performance (2% improvement) and dynamic balance (2.8% improvement), regardless of the mode.

Effects of a 6-week Resistance Training Program on Muscular Strength and Endurance in Older Adults

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It is estimated that nearly one in five U.S. residents will be aged 65 years or older in 2030. Through the aging process, both muscular strength and endurance decline. Decreased muscular

strength may increase the risk of falling and contribute to an overall reduction in functional ability. Functional strength training may increase muscular strength and thus, decrease the risk of falling and fall related injuries. **PURPOSE:** To determine the effects of a 6-week resistance training program in community-dwelling older adults enrolled in an interdisciplinary fall prevention program. **METHODS:** The study design was a one-group pretest-posttest design. Participants included community-dwelling older adults. Pre- and post-intervention assessments were taken before and after the 6-week program. Assessments included 30-second chair stand, handgrip strength and timed up and go. The 20-minute, twice a week, resistance training program consisted of functional upper and lower extremity strength and endurance exercises (i.e. sit to stand, marching, squats, bicep curls). Exercises were progressed by increasing weight, number of sets, and speed. *t* tests were used to determine statistical significance from pre- to post-intervention for each variable. **RESULTS:** 24 participants completed the program (58.3% white, 79.2% female, mean age 76.5 years; SD=7.10). *t* tests revealed no statistical significance pre-intervention to post-intervention in any of the variables measured. Mean grip strength decreased by 1.33kg (SD ± 6.79kg, $t(22)$=.92, p=0.37). Mean up-and-go test time decreased by 0.58 seconds (SD=1.98, $t(17)$=1.25, p=0.22), 30-second chair stand test increased by 0.58 completed rises (SD=2.23, $t(19)$=1.15, p=0.265). **CONCLUSION:** There was no statistical significance observed in any of the variables examined. However, the up and go time decrease and chair stand increase may be clinically relevant in the older adult population that is focused on maintaining independence and activities of daily living. Future studies should increase intervention frequency, duration, and intensity to achieve further improvements in strength and endurance.

*Alter*in*G* Awareness: Attentional Focus Responses to Weighted and Unweighted Walking and Running on a Treadmill

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Attentional focus reflects the degree to which an individual utilizes or attends to internal cues (i.e. association) or to external cues (i.e. dissociation) during exercise. Lower body positive pressure (LBPP) treadmills provide varying levels of weight support while exercising. The degree of unweighting may result an individual shifting their attention internally or externally during exercise depending on the demand. Thus, understanding shifts in attentional focus while using a LBPP treadmill as compared to a normal treadmill (NT) might provide insight in terms of LBPP treadmill utilization and rehabilitation programming. **PURPOSE:** The purpose of this investigation was to examine attentional focus (AFS) during bouts of walking and running on a LBPP treadmill and a normal treadmill. **METHODS:** Nineteen non-obese participants (age: 24.4±7.2 years; BMI: 24.0±2.6 $kg \cdot m^{-2}$) completed randomized counterbalanced bouts of walking and running on both a normal and LBPP treadmill at 40%, 60%, 85%, and 100% (60%, 40%, 15%, and 0% of body weight supported, respectively) for either (a) a 2 min walking stage at 0.89 $m \cdot s^{-1}$ or (b) 4 min stages of running at 2.24, 2.68, and 3.13 $m \cdot s^{-1}$. Participants reported AFS at the end of every stage. **RESULTS:** Repeated measures ANOVA indicated a significant two-way interaction between treadmill condition and speed on AFS, $F(9, 162) = 4.002$, $p < .0005$, partial $\eta^2 = .182$. Simple main effects for treadmill condition revealed significant differences at 2.24 $m \cdot s^{-}$

^{1} (40% vs. 100%, $p < .001$), 2.68 $m \cdot s^{-1}$ (40% vs. 60%, $p < .0005$; 40% vs. 100%, $p < .005$; 60% vs. 85%, $p < .0005$), and 3.13 $m \cdot s^{-1}$ (40% vs. 60%, $p < .01$). Simple main effects for treadmill speed revealed significant linear decreases in AFS at each speed for the 60% and 100% weighted conditions (both *p*s < .0005). AFS was significantly lower at 3.13 $m \cdot s^{-1}$ compared to 0.89 $m \cdot s^{-1}$ in the 40% ($p < .0005$) and 85% ($p < .05$) weighted conditions. **CONCLUSIONS:** Findings suggest that attentional focus shifts from a more dissociative to a more associative awareness as less body weight is supported and speed increases. This shift in focal awareness may reflect greater attention towards physiological strain and mechanical loading with increasing body weight and/or speed. This may have compliance implications for LBPP utilization and rehabilitative programming.

Effects of Submaximal Downhill Running on Cytokine Expression in Young, Endurance Trained Men and Women

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Strenuous exercise has been shown to dramatically alter levels of anti- and proinflammatory cytokines; proteins involved in the regulation of systemic inflammation. **PURPOSE**: To determine if a single bout of submaximal downhill running will elicit a change in the expression of specific circulating cytokines. **METHODS**: Healthy endurance-trained men (n=5) and women (n=3) aged 18-35 were screened for exercise contraindications using a health history questionnaire, blood chemistry, and body composition. A VO_{2max} test and downhill running familiarization were completed to determine experimental running speed at 70% VO_{2max}. After abstaining from exercise, caffeine, alcohol, NSAIDs, and other drugs for 48 hours, subjects ran on a 15% decline for 30 minutes at 70% VO_{2max} and ~70% HRR. Fasting blood samples were obtained immediately before and after the run, as well as after 30 minutes, 60 minutes, and 24 hours of rest. Plasma was immediately separated, aliquoted, and stored at -80^{o}C. ELISA kits specific to each cytokine were used to measure levels in plasma at each time point. Samples were run in duplicate. **RESULTS**: There were no significant changes in IL-15 or Myostatin at any time point. Compared to baseline, IL-1ra showed an increase of 46.9% (p=0.009), 60.9% (p=0.001), and 38.8% pg/ml (p=0.028) at 0 minutes, 60 minutes and 24 hours after exercise, respectively. For IL-10, there was an increase of 19.6% (p=0.01), 28% (p=0.003), and 37.1% pg/ml (p=0.0009) at 30 minutes, 60 minutes, and 24 hours after exercise, as compared to baseline. **CONCLUSION**: In endurance trained individuals, a 30 minute submaximal bout of downhill running caused an increase in the anti-inflammatory cytokines IL-1ra and IL-10 for up to one day, and no significant change in the inflammatory cytokines IL-15 or myostatin. IL-1ra exhibited the greatest increase 60 minutes after exercise, while IL-10 was increased significantly at 30 minutes, 60 minutes, and 24 hours, with the greatest effect being seen the day after

exercise. Further, IL-15 levels were highly variable, and dichotomized subjects into two distinct groups that were not explained by any demographics studied here. This result has not been previously reported and deserves further study.

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Effects of Energy Drink Functional Ingredients on Running Performance

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The claims for the ergogenic effects of the functional ingredients of energy drinks such as caffeine, taurine, and glucose, by manufacturers are ambiguous. It is common for athletes to consume energy drinks prior to competition, yet the efficacy of the functional ingredients contained in these drinks remains to be determined, especially in short duration high intensity endurance events. **PURPOSE:** To evaluate the isolated and combined effects of caffeine, taurine, and glucose on exercise performance time as well as related physiological and perceptual responses. **METHODS:** Sixteen recreational endurance runners (10 men, 6 women, 20.88 ± 1.89 years, 69.79 ± 11.36 kg, 177.88 ± 9.22 cm; daily caffeine intake, 113.44 ± 115.99, weekly running distance of 36.11 ± 7.05 km) participated in a double blind, crossover, repeated measures study. Participants completed a 5-km running time trial on the treadmill for each visit. In the first session the subjects performed the test without drink (control trial). Subjects were randomly assigned to supplement with 500 ml of a commercially available energy drink, caffeine (160 mg), taurine (2g) and glucose (54g) 60 minutes before completing a 5-km time trial; separated by seven days. Time, heart rate, RPE (RPE-Overall; RPE-Chest; RPE-Legs), and affect were recorded at 500-m intervals during the 5-km time trial. Session RPE and session Affect were obtained 5 min following completion of the 5-km time trial. Time to complete the time trial was recorded. Differences between treatments were assessed using repeated measures and analysis of variance. **RESULTS:** Comparisons among the commercial drink, caffeine, taurine, glucose and the control condition did not show statistically significant differences in the results of the performed test (Control: 1415.12 ± 179.71 s; Energy drink: 1403.56 ± 171.41 s; Caffeine: 1400.06 ± 175.29 s; Taurine: 1418.31 ± 198.39 s; Glucose: 1405.31 ± 185.95; $P = .80$). There were no differences in heart rate, RPE, affect, session RPE, session affect, or the split times measured at 500-m intervals between the five 5-km time trials ($P > 0.05$). **CONCLUSION:** Although the effects of isolated and/or combined consumption of caffeine, taurine, and glucose before exercise were in the expected direction, they did not approach significance with a sample size of 16.

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Effects of Pre-workout Supplementation on Trained College Weight Lifter's Muscular Performance and Psychological Factors

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Pre-workout supplementation prior to exercise is prevailing within the sports performance environment. However, the effect of pre-workout supplementation on muscle performance or the mechanism responsible for performance improvement is not clear. **PURPOSE:** To examine

changes in muscle performance and psychological factors associated with pre-workout placebo supplementation. **METHODS:** Twenty one (age 18-25 years) trained weight lifters volunteered to participate in the study. Prior to the study, all subjects' one repetition maximum (RM) for bench press (BP) and leg press (LP) exercises were obtained using National Strength and Conditioning Association 1-RM protocol. Subjects then performed BP and LP exercises at 70% of their 1-RM until failure under two separate conditions, with and without pre-workout placebo supplementation. On "Pre-workout" supplementation day, placebo supplementation was administered 30 minutes prior to the start of the exercise. Number of repetition performed was used as a measure of muscle performance. Hart rate (HR) and rate of perceived exertion (RPE) were measured immediately after exercise. Prior to exercise, subjects were asked on their self-arousal and confidence level on their upcoming performance using questionnaires. Each condition was separated by a minimum of one week. One-way ANOVA with repeated measures was used to compare the difference between conditions. **RESULTS:** The results demonstrate that the pre-workout placebo supplementation produced modest increase in repetitions performed as well as self-arousal and confidence level.

	LEG PRESS		BENCH PRESS	
	CONTROL	PLACEBO	CONTROL	PLACEBO
Repetition	20.91 ± 8.63	25.95 ± 11.65	17.38 ± 2.85	18.00 ± 2.24
HR (bpm)	147.38 ± 34.067	149.38 ± 23.22	136.52 ± 24.74	127.52 ± 33.03
RPE	16.38 ± 2.60	16.52 ± 2.02	15.67 ± 2.92	15.71 ± 2.28
Self-Arousal	3.26 ± 0.92	3.43 ± 0.68	3.24 ± 1.00	3.71 ± 1.10*
Confidence	20.48 ± 24.00	40.00 ± 36.06*	31.19 ± 27.56	45.00 ± 27.93

*Significantly different from control condition ($p<0.05$).

CONCLUSION: The notion of taking a "pre-workout" supplement may provide psychological benefits that produce positive outcomes in muscle performance.

Single-leg Squat: Interrater Reliability and Sex Differences in Medial Knee Displacement in Collegiate Athletes

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The Single Leg Squat (SLS) is a commonly performed clinical screening tool used to identify faulty lower extremity biomechanics, specifically dynamic knee valgus. Despite this use, few studies have investigated its reliability or examined if sex-differences exist in SLS performance in athletic populations. **PURPOSE:** Determine interrater reliability of the SLS and investigate whether occurrence of medial knee displacement (MKD) differed between male and female collegiate athletes. **METHODS:** Fifty injury-free Division I collegiate athletes completed SLS testing as part of their preparticipation exam, including 25 men (age=18.5±1.7y, height=185.4±8.7cm, mass=98.9±20.9kg) and 25 women (age=18.1±0.7y, height=167.9±7.8cm,

mass=65.5±10.5kg). Participants completed 5 consecutive SLSs on each leg while being recorded with a standard video camera from the frontal plane view. Videos were slowed and paused for scoring purposes. Participants were assigned a positive (+) SLS score if the midpoint of the patella moved to the great toe during the SLS in at least 3 of the 5 trials. All trials were scored by 2 members of the research team (GM, RM). Frequency counts were calculated and agreement of the SLS was analyzed with an unweighted kappa statistic. Pearson Chi-square tests were used to evaluate the association between sex and SLS performance. **RESULTS:** The interrater reliability for the right and left-leg SLS scores was 0.762 and 0.634, respectively, which indicated a substantial level of agreement. The overall percent agreement was 85%. More than half (30 of 50; 60%) of all athletes had a (+) SLS test result in at least 1 leg. Although not significant, females were almost twice as likely (χ^2=1.33; *p*=0.248, OR=1.96, 95%CI=0.62-6.19) to have a (+) SLS score in at least 1 leg in comparison to males. A significant association was found between bilateral MKD and sex; females were roughly 4 times as likely (χ^2=5.33; *p*=0.021, OR=4.03, 95%CI=1.20-13.53) to have a (+) SLS score on both legs in comparison to males. **CONCLUSION:** The interrater reliability for the MKD component of the SLS demonstrated a substantial level of agreement. Female collegiate athletes displayed a greater occurrence of MKD than male collegiate athletes. Future work will determine if SLS performance is a predictor of injury in collegiate athletes.

Wearing Personal Protective Equipment and Carrying Tools Effect on Cardiac and Metabolic Stress of Firefighters

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Average firefighter carries approximately 70 lbs of gear when ready to fight a fire. This amount of gear with added heat stress may cause further physiological and metabolic stress on a firefighter's body. **Purpose**: To determine and quantify the amount of physiological stress that is placed on a firefighter while wearing different levels of personal protective equipment (PPE) and carrying a tool. **Methods**: Ten male volunteer and career firefighters (age 20.9±1.8 years, height 175.8±6.6 cm, weight 79.3±9.3 kg) performed a submaximal walk test on a treadmill while wearing three different levels of PPE: 1) street clothes (SC), 2) PPE and self-contained breathing apparatus (SCBA), and 3) PPE with SCBA and carrying a hose bundle (PPET). Each subject performed the exercise test and each condition was separated by minimum of one week. During the exercise test, subjects' rate of perceived exertion (RPE), heart rate (HR), mean arterial pressure (MAP) and VO_2 were measured. One-way analysis of variance was used to compare the differences in physiological measures under three conditions. **Result**s: SCBA condition showed significantly higher RPE, HR, and VO_2 responses when compared to SC ($p<0.05$) while mean arterial pressure (MAP) did not have a significant different. No significant difference was observed between SCBA and PPET conditions.

Conditions	RPE	HR (bpm)	MAP (mmHg)	VO2 ($L \cdot min^{-1}$)
SC	6.4 ± 0.5	91.8 ± 7.2	90.7 ± 5.1	0.7 ± 0.1
SCBA	9.1 ± 1.7*	115.5 ± 9.8*	95.5 ± 5.3	1.1 ± 0.1*
PPET	10.2 ± 2.0	123.5 ± 12.7	99.1 ± 4.5	1.1 ± 0.2

*Significantly different from SC condition ($p<0.05$).

Conclusion: Wearing PPE can significantly increase metabolic and cardiac stress of firefighters, while added weight of a hose bundle to the PPE did not significantly increase physiological stress. These findings could be used to aid future research in designing new, lighter PPE or implementing more comprehensive physical training for the firefighters to maintain in the best physical condition.

Length Change of the Hip External Rotators in Common Stretch Positions

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Stretching of the deep rotator muscles of the hip is commonly employed in patients with lumbosacral, sacroiliac, posterior hip, and buttock pain. There is limited research that demonstrates the effectiveness of common stretching techniques on the short external rotators of the hip. **PURPOSE:** To evaluate length change of the inferior (IP) and superior (SP) piriformis, superior gemellus (SG), obturator internus (OI), and inferior gemellus (IG) during several commonly used stretching positions. **METHODS:** Seventeen hip joints from 9 embalmed cadavers were skeletonized leaving only the short external rotators and joint capsule intact. Polypropylene strings were attached from the origin to insertion sites of each muscle to represent the musculotendinous fibers. The change of length (mm) from the anatomical position to 4 specific stretch positions: 1) 45° internal rotation from neutral flexion/extension, 2) 45° external rotation with 90° hip and knee flexion, 3) 30° adduction from 90° of hip and knee flexion, and 4) 30°of adduction with hip and knee flexion to contact the lateral malleolus with the lateral femoral epicondyle of the contralateral limb (supine piriformis stretch), were recorded. **RESULTS:** There was a significant effect on length change based on the stretch position, $F(15,166) = 14.67$, $p < .0005$; Wilk's $\Lambda = .097$, partial $n^2 = .540$. The greatest length change for the SP (30.7mm), IP (23.7mm), and the SG (20.8mm) occurred when positioned in 30° adduction from 90° of hip and knee flexion followed by 45° internal rotation from neutral (SP: 22.2mm; IP: 20.6mm; SG: 17.4mm) and 45° external rotation with 90° hip and knee flexion (SP: 19.4mm; IP: 10.4mm; SG: 9.4mm). The OI (18.2mm) and IG (15.5mm) had the greatest length change with 45° internal rotation from neutral flexion/extension followed closely by 30° adduction from 90° of hip and knee flexion (OI: 17.1mm; IG: 14.7mm). The supine piriformis stretch caused the least amount of length change ($p < 0.05$). **CONCLUSION:** The three stretch positions that caused the greatest length change were: 1) 30° adduction from 90° of hip and knee flexion, 2) 45° internal rotation from neutral flexion/extension, and 3) 45° external rotation with 90° hip and knee flexion. Clinicians may apply the results of this study to select positions to effectively stretch the short external rotators of the hip.

Comparison of Electromyographic Responses Across Handle Types During Seated Row Exercise

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	Handle Type

	Cylinder	MAG®
Biceps Brachii	66.6 ± 8.9	72.9 ± 2.6*****
Latissimus Dorsi	86.6 ± 13.3	84.2 ± 4.6
Flexor Carpi Radialis	57.9 ± 4.1	67.3 ± 4.3

Handle design and wrist position can affect the muscular performance during resistance exercises. **Purpose:** This study compared the electromyographic (EMG) responses during seated row exercise in the Latissimus Dorsi (LD), Biceps Brachii (BB), and Flexor Carpi Radialis (FCR) using a cylindrical handle versus a wrist flexed gripping (WFG) handle, which puts the wrists in a semi-flexed position during exercise. **Methods:** Ten college-aged males with prior resistance training experience (6.3 ± 1.9 years) performed the exercise protocol on a cable machine. Participants completed a one-repetition maximal lift (1-RM) followed by one set at 85% 1-RM until failure using both handle types in randomized order. Root mean square EMG (EMG_{RMS}) recordings from the BB, LD, and FCR were normalized to the 1-RM values. **Results:** Two-way repeated measures ANOVA was used to analyze differences between handle types. EMG_{RMS} values (%) are presented in the table below:

***** Sign. Diffs. ($p < 0.001$)

The 1-RM lifts were significantly greater ($p < 0.003$) using the WFG handle (115.2± 17.4kg) versus the cylindrical handle (112.5 ± 17.6kg). However, there were no significant differences ($p > 0.43$) between handles for the total number of repetitions completed (cylindrical 11.9 ± 3.67; WFG 11.2 ± 2.4). **Conclusions:** These findings showed significantly higher maximal lifts and greater EMG activity in the BB using the WFG handle. Possible mechanisms for these differences may be related to actin and myosin overlap of the forearm flexors, grip comfort and differences in handle contact surface area.

Comparing Daily Class Schedule and its Influence on Undergraduate Students' Physical Activity Patterns

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Full-time undergraduate students' daily physical activity patterns may be affected due to Penn State University's different class schedules -Monday/Wednesday/Friday (M/W/F) and Tuesday/Thursday (T/Th). A no class period (common hour: 1:00pm-2:30pm) on M/W/F is offered as scheduled breaks in the academic course schedule for student activities at different Penn State University Commonwealth campuses. **PURPOSE:** To objectively determine the differences in daily step count and energy expenditure of Kinesiology students on different days of the week. **METHODS:** Sixty eight (35M/33F, 21.6±2.9 years, average BMI 25.9±5.2 kg/m^2) apparently healthy juniors and seniors were recruited from the Penn State Berks. A wrist-worn activity-tracker was deployed for one week to assess students' free-living physical activity levels. **RESULTS**: M/W/F vs. T/Th (Mean±SD) step count (10387 ± 3560 vs. 9268 ± 2899 steps/day; p=0.015) and activity calories (1056.4±535.2 vs. 963.5±608.3 kcal/day; p=0.097) were measured. Students were most active on Mondays (10691±4531 steps/day) compared to the

rest of the week. **CONCLUSION**: Students achieved the recommended 10,000 steps daily goal on M/W/F and did not meet the step goal on T/Th. This difference in steps could be attributed to the mandatory no class 'common hour' which may allow students to be more physically active than the T/Th schedule. In addition, the shorter class structure on M/W/F (50 min/class) might also provide opportunities for students to be more active than T/Th (75 min/class). These preliminary results may be useful for planning early physical activity interventions on specific days of the week among college students.

Effects of cold-water hand immersion on executive function, mood, and memory in normobaric hypoxia

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PURPOSE: The purpose of the present study was to investigate the effects of cold-water hand immersion on changes in executive function, mood, and memory in normobaric hypoxia. **METHODS:** 10 apparently healthy men (23±3 years) volunteered for this study. The two experimental trials (13% O2 and 21% O2) were counterbalanced and blinded from the participant. Following a 60-min. acclimation the experimental trials consisted of a 15-min. exposure to 5ºC water of the non-dominant hand. Executive function (Stroop), total mood disturbance (TMD), and memory (RMCPT) were recorded during the final 8 min. of each baseline, acclimation, and cold-water hand immersion. **RESULTS:** A main effect of time was displayed for Word-Color Association (WCA) ($p<0.001$), a test of executive function. The WCA improvement following 60-min. acclimation as well as cold-water hand immersion led to significantly greater ability to inhibit conflicting responses during cold-water hand immersion in both conditions, relative to baseline (21% O2: $p<0.001$, $p=0.047$ respectively; 13% O2: $p=0.001$, $p=0.003$ respectively). The percentage of correct responses for the RMCPT led to a significant effect of condition ($p=0.05$), which is further explained by the steady decline in the 13% O2 condition. Furthermore, in the 13% O2 condition TMD was significantly correlated to minimum temperature ($r=0.657$, $p=0.039$) during cold-water exposure, indicating the reduction in temperature may have led to worsening mood. **CONCLUSION:** Executive function was improved over time in normobaric hypoxia and normoxia, while memory steadily declined in the normobaric hypoxic condition, but not the normoxic condition. Cold-water hand immersion did not improve memory, and significantly worsened mood in normobaric hypoxia.

The Effects of Squats and Jump Squats on Mechanical Work and Energy Expenditure

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PURPOSE: To investigate the effects of two non-ballistic squat and two ballistic jump squat protocols performed over multiple sets on the total mechanical work performed and oxygen uptake. **METHODS:** In a counterbalanced cross-over design, 11 resistance-trained men (age: 21.9 ± 1.8 years; height: 1.79 ± 0.05 m; mass: 87.0 ± 7.4 kg) attended four testing sessions

during a three week period where they performed multiple sets of squats and jump squats with a load equivalent to 30% 1-repeititon maximum under one of the following conditions: 1) three sets of four non-ballistic repetitions (30N-B), 2) three sets of four non-ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PN-B), 3) three sets of four ballistic repetitions (30B), 4) three sets of four ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PB). Force plates and a 3-D motion analysis system were used to determine the total mechanical work performed during each session while a portable gas analysis system was used to collect expired gases. **RESULTS:** Total mechanical work performed during each set was significantly greater during 30B compared to 30N-B (mean difference [MD]: 7,792 J, $p<0.001$, effect size [ES]: 1.88) and 30PN-B (MD: 7,749 J, $p<0.001$, ES: 1.89), while that during 30PB was significantly greater than that during both 30N-B (MD: 7,488 J, $p<0.001$, ES: 1.89) and 30PN-B (MD: 7,445 J, $p<0.001$, ES: 1.90). Energy expenditure during each set was significantly greater during the 30B condition compared to the 30N-B (MD: 13,983 J, $p<0.001$, ES: 1.08) and the 30PN-B (MD: 11,326 J, $p=0.001$, ES: 0.92). Energy expenditure during 30PB was also significantly greater than that during 30N-B (MD: 12,615 J, $p=0.001$, ES: 1.04) and 30PN-B (MD: 9,958 J, $p=0.006$, ES: 0.86). Furthermore, energy expenditure during set 1 was significantly greater than that during set 2 (MD: 6,840 J, $p<0.001$, ES: 0.64) and set 3 (MD: 8,070 J, $p<0.001$, ES: 0.75). **CONCLUSION:** Ballistic resistance training exercises may represent a more effective metabolic stimulus compared to traditional resistance training exercises and a pause inserted between the eccentric and concentric phases has little effect.

Effects of Follistatin-like Protein 1 on Myogenic Differentiation and Mitochondrial Respiration in Canine Myoblasts

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Follistatin-like Protein 1 (FSTL1) is a glycoprotein secreted by cardiac and skeletal muscle tissues under stress conditions. An elevated level of plasma FSTL1 has been observed after a single bout of exercise suggesting its potential myokine-like role involved in the crosstalk between muscle and other organs. **PURPOSE:** To investigate autocrine effects of FSTL1 on myotube differentiation, myosin heavy chain expression and mitochondrial respiration in primary canine myoblasts. **METHODS:** All animal procedures were performed in accordance with specific protocols approved by the Institutional Animal Care and Use Committee. Primary myoblasts were isolated from canine gastrocnemius muscle. Myotube differentiation was induced by a low serum condition for 4 days. Immunostainings were performed using MF20 antibody (rod-like tail region of myosin) and DAPI (nuclei); and fusion index was determined by calculating the ratio between total number of nuclei and number of nuclei within myotubes formed. RT-PCR assays were performed using primer sets precisely designed to specifically amplify each fiber type-associated myosin heavy chain isoforms (i.e. MyHC 7, 2, 1, and 4). Oxygen consumption of intact cells was measured using a Clark-type oxygen sensor; and mitochondrial respiration was measured using Seahorse XF96 analyzer. **RESULTS:** During

myotube formation, FSTL1 treatment (300 ng/ml, 4 days) significantly enhanced myogenic potential determined by fusion index (~2-fold increase). There was a significant increase in MyHC 7 expression (~1.5 fold) in myotubes treated with FSTL1 during differentiation compared to non-treated myotubes, whereas no significant differences were observed in other MyHC isoforms. Chronic FSTL1 treatments (250 ng/ml, 64 hours) significantly increased oxygen consumption in both intact myoblasts and myotubes. Acute FSTL1 treatment (up to 500 ng/ml, either a single injection or 1-hour pre-incubation) had no significant effect on mitochondrial respiration. **CONCLUSION:** Our preliminary data suggest that FSTL1 enhances differentiation potential and increases oxidative metabolism in myogenic cells suggesting that FSTL1 may be an important cellular mediator for the benefits of exercise in the context of skeletal muscle adaptation.

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Effects of a Four-Week Intervention of Occupational Stress and Health of University Employees

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Maintaining a physically active lifestyle has been established as not only being a main component in maintaining good health and disease prevention, but also occupational well-being. **PURPOSE:** To determine if a daily 30-40 minute exercise program of eight short exercises, would have an effect on occupational stress and well being of university employees with a sedentary job. **METHODS:** Seventeen employees (height: 166.18±10.93 cm, mass: 75.30±14.18 kg, age: 43.76±11.83 yrs) elected to be in the control (CON) or experimental (EXP) group. Subjects attended a baseline testing session and post intervention testing session in which each individual filled out two forms: short form-36 and an occupational stress test questionnaire. The EXP group was asked to attend an additional information session in which all daily exercises were explained and demonstrated. Body composition analysis and physical fitness tests were also completed at that time. At the end of every week, blood pressure, and resting heart rate were collected on both the EXP and CON groups. The EXP group also turned in a weekly adherence log to track exercise adherence. **RESULTS:** There were no changes in occupational stress or health reported; however, there were limited changes in anthropometric and physical variables. There was a change in body fat percent (CON: Pre 34.54±9.72%, Post 35.50±9.15%; EXP: Pre 32.09±7.38%, Post 31.43±7.75%, p =.05), systolic blood pressure (CON: Pre 127.57±9.81 mmHg, Post 117.86±17.64 mmHg; EXP: Pre 130.80±18.88 mmHg, Post 124.10±16.43 mmHg, p =.05), upper body flexibility (CON: Pre 18.57±4.83 in, Post 16.71±4.28 in; EXP: Pre 21.15±5.84 in, Post 25.40±4.00 in, $p < .01$) and partial curl-up test (CON: Pre 22.70±13.66 reps, Post 34.30±11.32 reps; EXP: Pre 29.00±17.69 reps, Post 33.14±16.54 reps, $p = .02$) over the four week intervention period. No other significant differences were found. **CONCLUSION:** Overall, the exercise protocol did not significantly decrease stress levels or impact self-reported health measures. However, the EXP group demonstrated improvements in upper body flexibility and over the four weeks, both groups showed a decrease in systolic blood pressure and an increase the number of partial curl-ups completed. It is thought a continuation of this exercise

protocol would have a greater impact over a longer duration.

The Effects of the Fight-or-Flight Response on the Performance of Margaria-Kalamen Power Test

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Fight-or-flight is the sympathetic response of the body allowing individuals to act in a situation deemed a threat, by releasing several hormones and neural transmitters. Although many studies have explored the mechanism behind this phenomenon, few have researched the effect of this response on performance. **PURPOSE:** To test the influence of external auditory stimulus on cardiovascular measures, exercise performance, skin conductance and felt arousal. **METHODS:** Twelve subjects (20.4±0.9 years, Height 1.71±0.1 m, Weight 72.1±16.0 kg) performed Margaria-Kalamen (MK) power test under three conditions; 1) control, 2) pre-auditory stimulus (AS), and 3) pre-auditory stimulus with prior notice (AS-P) of the stimulus. AS was introduced by blowing an air-horn prior to exercise. Each condition was separated by a minimum of one week. Blood pressure, heart rate, skin conductance, and psychological felt arousal were measured before and after the introduction of AS as well as after MK test. One way analysis of variance with repeated measures was used to compare differences amongst three conditions. **RESULTS:** AS and AS-P conditions showed increases in MK power output when compared to the control condition. However, these differences were not significant ($p>0.05$). On the other hand, AS and AS-P conditions did have significant impact on the heart rate and felt arousal when compared to control condition ($p<0.05$).

Conditions	MK Test (Watts)	HR (bpm)	SBP (mmHg)	Skin Conductance (AU)	Felt Arousal
Control	984.5 ± 499.1	140.8 ± 16.0	135.9 ± 13.8	N/A	3.17 ± 1.12
AS	1040.1 ± 562.9	124.7 ± 16.8*	130.8 ± 20.2	1.07 ± 0.42	4.08 ± 1.38*
AS-P	1060.5 ± 498.9	125.4 ± 13.7*	124.5 ± 15.3	1.04 ± 0.91	3.83 ± 1.34*

*Significantly different from control condition ($p<0.05$).

CONCLUSION: The application of the external stimulus to drive neurologic mechanisms appeared to have significant impacts on some of the cardiovascular and psychological measures. However, these stimuli did not enhance or hinder exercise performance.

Viewing Television While Walking: Effects on Preference For Exercise, Treadmill Endurance Time and Behavioral Outcomes

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PURPOSE*:* To determine the effects of television viewing while walking on: 1) preference for

exercise and 2) treadmill endurance time. **METHODS***:* Twenty-five insufficiently active adults (mean±SD; age: 46±12 years; body mass index: 31.2±5.3 (kg/m^2) completed the study. Part 1: participants performed three randomized 1/3-mile walking bouts at an intensity equivalent to 70% of their oxygen consumption at ventilatory threshold (VO_2-at-@VT). During these exercise bouts, individuals viewed 1) their favorite television program (FavTV), 2) a standardized nature program (NatTV) or 3) no-TV (NoTV). A behavioral choice paradigm approach was used to assess preference for exercising with each television condition. Part two: participants completed two randomized 60-minute visits where they were asked to walk at 70% of VO_2-at-VT for 10-minutes under FavTV or NoTV conditions. After 10 minutes, participants could choose to continue exercising under the current TV condition or stop exercising and watch television while seated. Participants were allowed to switch between exercise and rest as they desired during the remaining time. **RESULTS***:* Part 1: Preference for exercise was greater during FavTV and NatTV versus NoTV ($p<0.05$), with no differences between FavTV and NatTV ($p=0.132$). Part 2: Despite this difference in preference for exercise, there was no significant difference in treadmill walking time (FavTV vs. NoTV; 50.0±2.6 vs. 44.7±3.2 minutes, respectively; $p=0.102$). **CONCLUSIONS***:* This study provides empirical evidence that inactive individuals prefer walking with television viewing versus with no television. Further research is needed to determine if active television viewing can translate to observable changes in exercise behaviors.

Caffeine and short-term exercise, independently and combined, modestly alter eating behavior

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Caffeine has been shown to improve exercise performance, reduce ratings of perceived exertion, and reduce appetite. There is a shortage of research examining the combined effects of caffeine and short-term exercise on eating behavior. **PURPOSE:** The purpose of this study was to assess the relationship between caffeine and short-term moderate-vigorous intensity aerobic exercise, independently and combined, on the relative reinforcing value of LED and HED foods, food intake, and appetite. **METHODS:** 18-50 y old adults were randomized to consume caffeine or placebo 30 minutes prior to exercise or no exercise for two weeks. Participants consumed a buffet breakfast and had the RRV of LED and HED foods assessed at baseline and again after the intervention. Participants also recorded all foods and beverages consumed after leaving the laboratory on eating assessment and first and last intervention days. At intervention sessions all participants drank 350-mL Gatorade® with a relative (3 mg/kg body weight) dose of caffeine or placebo. Treatment (placebo/caffeine) x condition (no exercise/exercise) intervention sessions (sessions 3-10) varied by caffeine/exercise group. **RESULTS:** Exercise independently increased *ad libitum* intake at breakfast ($p = 0.040$) and rate of consumption (kcalories/min) (45 vs 75 kcal/min; $p = 0.021$) at food reinforcement assessment compared to no exercise. Caffeine independently increased responding for LED food (2.5 vs 3 portions; $p = 0.021$) post two weeks compared to placebo. Chronic exposure to caffeine had an ergolytic effect on exercise among overweight/obese ($p = 0.026$). **CONCLUSION:** These results suggest signals from exercise and caffeine on eating behavior may compete with each other or the effects are too weak or too

transient to be consistently replicated. More research is needed to identify and describe any possible short-term caffeine and exercise interactions on food choice, food intake, and the implications for exercise responses.
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Exercise or Reduced-Calorie Diet Attenuates Overnutrition-Induced GLUT4 Carbonylations in Adipose Tissue.

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Obesity, caused in part by overnutrition and lack of physical activity, has been well-established to be a risk factor for insulin resistance. One mechanism for insulin resistance is decreased or dysfunctional glucose transporter type 4 (GLUT4), which plays a central role in skeletal muscle glucose uptake. Recently, we showed as little as 3 to 14 days of overnutrition results in oxidative damage to GLUT4 via carbonylations and subsequent insulin resistance in adipose tissue of both mice and humans. However, it is unknown if these carbonylations of GLUT4 in adipose tissue are permanent or potentially reversible. **PURPOSE:** To determine if physical activity or a reduced-calorie diet can reduce GLUT4 carbonylations following overnutrition in mice. **METHODS:** Mice (n=4) were fed an overnutrition (60% high fat diet) for 14 days and then then switched to a 30% reduced calorie diet for 3 days or given access to a voluntary running wheel for 7 days. To determine if adipose GLUT4 carbonylations could be reversed the 'control' group consisted of time matched mice kept on the high fat diet with no intervention. At the end of each experimental condition mice were sacrificed and white adipose tissue (WAT) was collected. GLUT4 carbonylations were measured in WAT using a validated mass spectroscopy-based multiple reaction monitoring (MRM) method via a Quantum Ultra TSQ. All experimental procedures were approved by Temple University's IACUC. **RESULTS:** Following 14 days of overnutrition reducing caloric intake by 30% for 3 days reduced WAT GLUT4 carbonylations ~58% compared to time matched mice maintained on the overnutrition diet. Further, wheel-running exercise for 7 days following overnutrition reduced WAT GLUT4 carbonylations ~81%. **CONCLUSION:** Overnutrition induced GLUT4 carbonylations in mouse WAT are not permanent and can be reversed by exercise or a reduced-calorie diet.
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Vascular Health and Fitness Levels in Metabolically Healthy and Unhealthy Obesity

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Obesity is related to cardiovascular disease (CVD), impaired vascular health, and other chronic disease. Within the obese population, those that are metabolically healthy (MHO) are

hypothesized to have lower CVD risk as compared to the metabolically unhealthy (MUHO), because of their lower levels of vascular inflammation. However, research is limited examining whether vascular health differs between MHO and MUHO. **PURPOSE:** We compared vascular measures and fitness levels between adults with MHO or MUHO. **METHODS:** On separate days, 64 (36 MHO 31.3 ± 13.8yrs old, 28 MUHO 32.6 ± 13.6yrs old) adults recruited from the Philadelphia suburban area came to the lab for testing. After an overnight 12-hour fast, participants underwent carotid artery intima thickness (IMT) ultrasound, brachial artery flow mediated dilation (FMD), fasted glucose/cholesterol testing, body composition (bioelectrical impedance), and blood pressure (BP) measurement. During another visit, participants completed VO_{2peak} treadmill testing and had subsequent BP measurements taken. In accordance with previous literature metabolic risk factors were defined as: BP ≥ 130/85 mmHg or on antihypertensives; fasting glucose ≥ 100 mg/dL or on antidiabetic medications; BMI ≥ 30 Kg/m^2 or BF ≥ 25%; triglycerides ≥ 150 mg/dL; and HDL ≤ 40 mg/dL. Participants with less than two risk factors were considered MHO and those with two or more risk factors were considered MUHO. **RESULTS:** We found that in the adults classified as MUHO weight was higher (235.4 ± 41.0 vs 189.4 ± 36.7 lbs.), fat mass was higher (85.5 ± 26.3 vs 60.8 ± 19.6 lbs.), and BP was higher (SBP:134.8 ± 8.3 vs 123.2 ± 8.8 mmHg; DBP: 80.4 ± 5.9 vs 75.6 ± 6.7 mmHg). In addition, fasted plasma glucose levels were higher (96.4 ± 9.8 vs 86.8 ± 6.9 mg/dL) and triglyceride levels were higher (160.8 ± 69.6 vs 84.9 ± 28.3 mg/dL) in MUHO compared to MHO. We found no differences between groups for vascular health measures or fitness levels. **CONCLUSION:** Although adults with MUHO have impaired cardiovascular health compared to MHO, the population studied may be too young to discern vascular health differences. Further studies should investigate inflammation and other vascular measures, in addition to FMD and IMT, to discern possible differences in CVD risk between MUHO and MHO in adults.

Comparison of Lung Volumes and Estimated VO_{2max} in College-aged Wind Musicians Versus Aerobic Athletes.

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It is well known that aerobic athletes and musicians have higher dynamic lung functions than the general population. There is a gap in the current literature comparing the lung volumes of college-aged aerobic athletes to the lung volumes of college-aged wind musicians. **PURPOSE:** To compare the lung volumes (SVC, FVC, FEV_1, MVV) and VO_{2MAX} between college-aged Division II athletes and physically inactive wind musicians. **METHODS:** Subjects (n=21) were recruited based upon age and medical criteria. Athletes (n=11) were defined as individuals who accumulated at least or more than 150 minutes of moderate intensity aerobic activity per week and participated on an aerobic based athletic team. Wind musicians (n=10) were defined as individuals who played a wind instrument at the collegiate level who did not meet aerobic exercise guidelines. Three respiratory tests (SVC, FEV_1, MVV) were performed to assess lung volume using a spirometer. VO_{2MAX} was also estimated using an 8-minute treadmill walk test that elicited a heart rate between 50% and 85% of their maximal heart rate. Collected results were

analyzed using a two-tailed independent t-test and Pearson correlations. **RESULTS:** There was a significant difference in VO_{2MAX} ($p=0.013$) between groups with the athletes (42.1 ± 7.2) having higher values than musicians (30.44 ± 11.9). There were no significant differences in the other lung volumes between groups. However, there were strong positive correlations between FVC and SVC ($r=0.927$), as well as, MVV and SVC ($r=0.911$) with musicians. There were also strong correlations between FEV_1 and FVC ($r=0.980$), FEV_1 and SVC ($r=0.946$), and FVC and SVC ($r=0.937$). **CONCLUSION:** The VO_{2MAX} results were greater in athletes when compared to wind instrument musicians. Interestingly, physically inactive musicians had similar lung functions as athletes. This difference could be attributed to athletes training their cardiorespiratory system and not solely their respiratory system.

Angiotensin-II Induces Atrophic Signaling in Muscle Cells.

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Numerous chronic pathological conditions are associated with elevated circulating levels of angiotensin II (Ang II). A substantial amount of previous research has focused on the effects of elevated Ang II on the heart and vasculature. However, skeletal muscle atrophy also occurs during chronic conditions in which Ang II is elevated in circulation including cardiovascular disease, renal disease, and certain cancers. While some of the mechanisms responsible for muscle atrophy during these are well known, such as elevated glucocorticoids, it is feasible that Ang II directly results in skeletal muscle atrophy. Further, previous evidence from our lab and others indicates that microRNAs play a central role in the regulation of muscle atrophy. Specifically, miR-23a directly targets and inhibits MuRF1 and Atrogin-1 mRNA, and during certain chronic conditions miR-23a is reduced resulting in increased muscle atrophy via increased expression of these key atrophy genes. Therefore it is feasible that Ang II could directly induce atrophy in muscle cells potentially through a miR-23a mediated mechanism. **PURPOSE:** To test whether Ang II directly activates atrophic signaling in skeletal muscle cells. **METHODS:** Cells from an immortal cell line derived from the skeletal muscle of mice (C2C12 cells) were cultured, differentiated into full myotubes, and treated with 500 nM of Ang II for 24 hrs. Following treatment, total RNA – including microRNA – was isolated, and cDNA synthesis and subsequent qPCR were performed. **RESULTS**: Ang II treatment of muscle cells resulted in a 25% decrease in miR-23a. Since miR-23a directly targets and inhibits MuRF1 and Atrogin-1 in muscle, we then measured MuRF1 and Atrogin-1 mRNA levels. Accordingly, Ang II treatment resulted in an 18% increase in MuRF1 mRNA expression and a 16% increase in Atrogin-1 mRNA expression. **CONCLUSION:** Collectively this data indicates that Ang II induces activation of key muscle atrophy related genes in skeletal muscle cells which may be occurring due to a reduction in miR-23a.

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Greater Ankle Strength and Anaerobic Capacity in Female Marines Who Completed Military Occupational Specialties School.

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Female Marines can now serve in all military occupational specialties (MOS). A cohort of female Marines participated in ground combat MOS schools as part of the Ground Combat Element Integrated Task Force (GCE ITF), which studied the integration of women into combat arms. It is important to identify characteristics of female Marines who successfully graduated from ground combat MOS schools. **PURPOSE:** To explore physical and physiological differences between female Marines who did or did not successfully complete MOS school. **METHODS:** Female GCE ITF Marines (N=62, 22±3yrs, 163±6cm, 63±7kg) underwent the following assessments prior to ground combat MOS school: anthropometric, strength (average peak torque) with an isokinetic dynamometer (knee, shoulder, trunk) or hand-held dynamometer (ankle), maximal oxygen uptake (VO_2)/ lactate threshold (LT) during an incremental ramped protocol to exhaustion, and anaerobic power (AP)/capacity (AC) during a 30-second cycling protocol. Subjects were classified as graduated (N=45) or did not graduate MOS school, due to failed fitness testing or injury (N=16). Statistical significance was set *a priori* at alpha of 0.05. Between group differences were assessed with an independent t-test or Mann Whitney U test, as appropriate. **RESULTS:** Despite no significant anthropometric differences between groups, significant differences were found in right/left ankle evertor strength, right ankle invertor strength, AC, VO_2 max and VO_2 at LT (all $p<0.05$ - Table 1). **CONCLUSION:** Higher ankle strength and anaerobic capacity were observed in female ground combat MOS school graduates. These results may help female Marines optimize physical readiness for ground combat.

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Self-Selected Intensity of Four Different Modes of Aerobic Exercise in Sedentary Adults

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The prescription of self-selected intensity (SSI) exercise has shown promise as a method to increase physical activity and cardiorespiratory fitness. SSI allows control over the exercise stimulus, promotes positive affect, and is often an intensity known to induce health-fitness benefits. **PURPOSE:** To compare SSI between Treadmill, Elliptical, Upright Cycle, and Recumbent Cycle exercise in sedentary adults (<90 min of aerobic activity per week). **METHODS:** Eight subjects (6 w, 2 m; 33 ± 10 yr, VO_2max: 36 ± 7 $ml \cdot kg^{-1} \cdot min^{-1}$) completed five submaximal exercise trials on separate days. The first four, one trial per mode completed in random order, were 30-min each: 5 min warm-up, 20 min SSI, 5-min cool-down. Oxygen consumption (VO_2; ParvoMedics) and heart rate (HR; Polar) were monitored continuously. Ratings of perceived exertion (RPE; OMNI Scale) and affective responses (AR; Feeling Scale) were collected every 5 min. The fifth trial was a submaximal graded treadmill test to predict VO_2max. The mean values from the 20-min SSI were compared between modes using repeated-measures ANOVA. Pairwise comparisons were performed using Bonferroni corrections for significant ANOVAs. **RESULTS:** ANOVAs were significant for VO_2 ($F_{3,21}$=12.81, p<.05),

%VO_2Reserve ($F_{3,21}$=6.41, p<.05) and Kcal ($F_{3,21}$=7.43, p<.05). For each, Treadmill was significantly greater than Recumbent Cycle.

	Treadmill	Elliptical	Upright Cycle	Recumbent Cycle
VO_2 (ml·kg^{-1}·min^{-1})	21.9 ± 6.0	21.1 ± 5.7	17.6 ± 5.4	16.5 ± 3.2*
%VO_2Reserve	58 ± 18	55 ± 13	43 ± 11	41 ± 10*
HR (b·min^{-1})	149 ± 19	158 ± 17	148 ± 16	137 ± 16
HR (%APMHR)	80 ± 9	85 ± 7	80 ± 9	74 ± 9
RPE (Omni Scale)	5.7 ± 1.8	6.2 ± 1.7	6.1 ± 1.4	5.9 ± 1.2
AR (Feeling Scale)	2.2 ± 1.8	1.1 ± 2.4	1.9 ± 2.6	2.3 ± 1.9
Kcal (Total Accumulated)	206 ± 50	209 ± 49	171 ± 61	162 ± 43*
Data exhibit mean ± SD. *indicates significant difference from Treadmill (p<.05).				

CONCLUSION: The mean SSI during all four modes of exercise is in line with the ACSM position stand for developing and maintaining cardiorespiratory fitness, which states that subjects with a mean VO_2max <40 ml·kg^{-1}·min^{-1} can improve cardiorespiratory fitness with intensity prescriptions as low as 30% VO_2Reserve.

Acute Effects of Exercise on Cognition in Young Adults: Strength vs. Endurance Protocols

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Exercise has ample benefits for health in general but its potential effects on cognitive functioning (i.e., cognitive control, attentional processes) are only recently examined (McMorris & Hale, 2015). **PURPOSE:** to test the acute effects of a strength and aerobic protocol on executive functioning capacity within a young adult sample. **METHODS:** Subjects (N=60) were randomly assigned to strength or aerobic task conditions. Subjects in the strength condition squeezed a handgrip dynamometer at 30% of maximum voluntary contraction. Subjects in the aerobic condition performed a stepping task to the cadence of a metronome. In each condition, rate of perceived exertion (RPE) and heart rate (HR) were measured at 30-s intervals. Three alternate forms of the Trail Making Test (TMT) were administered to assess executive functioning scores. Subjects completed the TMT at rest, at RPE = 6 (moderate intensity), and at RPE = 9 (vigorous intensity). **RESULTS:** Analysis revealed a significant main effect for RPE condition. Relative to moderate and high exertion, under rest subjects took longer to complete TMT-A ($p < .001$). Following RPE = 6 and RPE = 9, subjects in the aerobic condition completed TMT-A significantly faster ($p < .001$) than subjects in the strength condition. A similar pattern was observed for TMT-B although this was not significant. **CONCLUSION:** Relative to strength-endurance (handgrip) task, aerobic (stepping) task seemed to further facilitate executive functioning skills. Implications and recommendations for the use of exercise to optimize cognitive functioning will be discussed. Directions for future research will be outlined.

Regular Physical Activity in Older Adults: Implications for Cognitive Gains

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Worldwide dementia incidence is estimated to be around 47.5 million cases (WHO, 2016). To this date, no conclusive treatment or prevention intervention is available for those suffering from dementia or at increased risk for it (Wortmann, 2012). Physical inactivity is a major risk factor for the development of dementia (Bares, Whitmer & Yaffe, 2007). Physical activity has a positive effect on cognitive performance amongst older adults (Etnier & Chang, 2009; Kramer, 2006) but the dose-response relationship remains unclear. **PURPOSE**: To further examine the relationship between physical activity participation and cognitive decline and to determine a dose-response relationship between physical activity and cognitive gains. **METHODS:** Using a cross-sectional design, 35 older adults (M_{age} = 70.6 years) were tested. Subjects wore physical activity monitors and responded to a series of cognitive batteries (Stroop Task, Trail Making Test). **RESULTS:** Correlational analysis revealed a significant relationship between physical activity participation and cognitive performance scores. Independent t-tests revealed that older adults participating in > 150 minutes of moderate to vigorous physical activity each week scored higher on cognitive batteries compared to less active peers ($P < .05$). **CONCLUSION:** Regular moderate to vigorous physical activity participation may help prevent cognitive decline in older adults. Strategies to promote desirable doses of physical activity for preventing cognitive decline in older adults will be outlined. Recommendations for future research will be advanced.

THE CORRELATION OF TRACK & FIELD DISTANCE RACING TO JUMPING PREFORMANCE

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Eliciting changes in distance runners becomes more of a challenge as aerobic training persists. Recently, studies suggest that resistance training may be a viable option in improving running efficiency in distance runners. Resistance training has demonstrated increases in jump performance and sprint performance but there is a lack of evidence in events of longer distance. **PURPOSE:** The purpose of this study was to evaluate the relationship between jump performance and competitive race times in collegiate middle and long distance runners. **METHODS:** Eleven male NCAA Division II Track & Field distance runners participated (age = 20.2 ± 1.3years, height = 176.0 ± 5.6cm, and mass = 65.7 ± 7.0kg) in this study. Subjects completed a three jump test (measuring distance), countermovement jump (CMJ), and depth jump (DJ) from 20cm, 30cm, and 40cm drop heights. Jump height (JH), relative power (RP), work ratio (WR), and reactive strength index (RSI) were all calculated. In addition, race times in the 800m, 1,500m, 3,000m, 5,000m, and 10,000 were used for correlation analysis. **RESULTS:** Strong to moderate relationships between jumping tests and race times were found. R-values are as followed, with respect to the CMJ, 20cm DJ, 30cm DJ, and 40cm DJ, 800m & JH are -0.976, -0.151, -0.562, -0.708; 800m & RP are -0.660, -0.596, -0.552, -0.613; 1,500m & JH are; -0.947, -0.838, -0.962, -0.819; 1,500m & RP are -0.576, -0.616, -0.609, -0.638; 3,000m & WR are 0.170, -0.600, -0.843, -0.791; 3,000m & RSI are -0.032, -0.526, -0.633, -0.632; 5,000m & WR are -0.790, -0.816, -0.696, -0.802; 5,000m & RSI are -0.354, -0.827, -0.675, -0.674; 10,000m & WR are -0.859, -0.936, -0.755, -0.729; 10,000m & RSI are -0.793, -0.908, -0.980, -0.929.

CONCLUSION: Competitive middle distance runners demonstrate greater JH and RP, while more competitive distance runner's demonstrate greater WR and RSI.
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Validation of Fitbit Blaze Activity Monitor during Treadmill Walking and Running

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Fitbit activity monitors are growing in popularity and have become an integral part of one's lifestyle. However, before placing trust in these devices, their validity and reliability must be determined. **Purpose:** To compare step counts obtained by Fitbit Blaze with the observed step counts obtained by video recordings during treadmill walking and running in order to evaluate the accuracy of the device in determining steps taken at different speeds. **Methods:** Thirty-Four apparently healthy participants (22M/12F; age range:19-55years, mean BMI: 26.8 kg/m^2) completed a 4-stage treadmill exercise protocol, consisting of walking at slow (1.9mph), moderate (3.0mph), and brisk (4.0mph) paces, and jogging (5.2mph); 6min duration/stage with a Fitbit Blaze worn on their left wrist. Observed steps were assessed by manual counting of a video recording in one-minute epochs. **Results:** Fitbit Blaze vs. observed video (Mean±SD) step count (2965 ± 162 vs. 2958 ± 141 steps; $p=0.706$) was not statistically significant. Estimated step counts from the wrist based Fitbit Blaze strongly correlated with observed step counts ($r=0.797$; $p<0.01$). The difference between Fitbit-estimated step counts and observed step counts ranged from -305 steps to 209 steps, with a standard deviation of 120 steps. While sometimes the Fitbit Blaze underestimated or overestimated the step counts, overall the mean step counts across all participants resulted in a difference of 6.44 steps or 0.22% error, thus indicating its general accuracy across a larger population **Conclusion:** The Fitbit Blaze is a fairly accurate and reliable device for measuring step counts at various speeds of walking and running among healthy adults. Such simple, cost effective monitors could be used in large scale to assess physical activity patterns in different populations.

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Influence of a high fat, low carbohydrate diet on energy expenditure and recovery time in cyclists

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Endurance athletes are continuously looking for an edge against their competitors. Performance may be enhanced by dietary manipulation, by lowering heart rate (HR), or rate of perceived exertion (RPE). **PURPOSE:** The purpose of this study was to determine the effects a high fat diet (HFD) has on respiratory exchange ratio (RER), RPE, HR compared to a standard diet (SD) in male triathletes/cyclists. **METHODS:** Subjects were randomized into 2 groups: high fat diet (HFD) and standard diet (SD). The HFD macronutrient breakdown was as follows; 65%/20%/15% respectively for fat/protein/carbohydrate, while the SD comprised of 15%/20%/55%. The study required two visits to William Paterson University's exercise science laboratory. Upon the initial visit, a peak power output (PPO) graded exercise test was conducted.

The participant's then followed their 7 day dietary protocol and returned on the 8th day. During this visit, each participant was to cycle for 20 minutes at 50%, 70%, and 80% of their respective PPO. During each 20 minute bout, RER, RPE, and HR were recorded every minute. Average RER (AVGRER) was calculated as the last 5 RER measures during the 20 minute power output test (50, 70 and 80%). **RESULTS:** 6 male trained cyclists have been recruited for this study (mean age: 47±5 years; weight: 80.8±15.4 kg; height: 69.4±7.4 in). As this is preliminary data, to date, only 4 completed the study protocol. No statistical differences were found between the high fat and standard fat diets in RER pre and post-diet, AVGRER at 50% (0.84±0.06 vs. 0.97±0.04, respectively), 70% (0.88±0.06 vs. 0.99, respectively) and 80% (0.96 vs. 1.06, respectively). One subject completed the 70% trial in the SD group, and 1 subject completed the 80% trial in the HFD and SD group, respectively. Of the 4 subjects who have completed the study, there were no differences in recovery time from 50-70% trials (HFD: 509±553 sec vs. SD: 378±236 sec) and 70-80% trials (HFD:641±366 sec vs. SD:667±95 sec). **Conclusion:** While there were no statistical significant differences between groups, AVGRER at the across each intensity level were clearly lower in the HFD group. Lastly, at the 50% PPO protocol, the difference approached .10 (.118). It is possible that with a larger sample size a significant difference will be revealed in RER.
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Comparison of step test performance between Peruvian and American college students

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Cardiovascular disease accounts for 22% of total deaths in Peru. Increased aerobic fitness confers cardioprotection, yet fitness norms for citizens of Peru do not exist. **PURPOSE:** To compare step test performance of a group of Peruvian university students with the step test performance of a group of American students. **METHODS:** Undergraduate students who were currently enrolled in a Peruvian or American university participated in this study. Following the measurement of height and weight, all students performed a Queens College step test. Each student stepped at a predetermined cadence for 3 minutes, after which recovery heart rate was recorded and entered into a standardized regression equation to estimate VO_{2max}. None of the students reported playing competitive athletics. **RESULTS**: Eleven Peruvian (P) students (age 22 ± 2.1 years; M:5, F:6) and 17 American (US) students (age 21 ± 1.6 years; M:7, F:10) completed all aspects of the study. No difference in BMI was observed between the groups (P: 23.7 ± 2.9 vs. US: 23.2 ± 2.6; p = 0.63). The mean estimated VO_{2max} for Peruvian women (35.8 ± 3.8 $ml \bullet kg^{-1} \bullet min^{-1}$) was lower than the mean for American women (40.4 ± 3.8 $ml \bullet kg^{-1} \bullet min^{-1}$)(p=0.03). Similarly, Peruvian men had a lower estimated VO_{2max} (44.5 ± 4.8 $ml \bullet kg^{-1} \bullet min^{-1}$) compared to American men (54.0 ± 7.6 $ml \bullet kg^{-1} \bullet min^{-1}$)(p=0.03). Six American students were classified as having either "Excellent" or "Superior" fitness per ACSM guidelines, whereas no Peruvian students were in these categories. **CONCLUSION:** The estimated aerobic fitness levels of Peruvian university students were lower than their American counterparts. Such information may assist with the development of strategies that promote physical activity and

reduce physical inactivity in order to reduce the burden of cardiovascular disease among Peruvian citizens.

The Effects of an Acute Bout of Resistance Training on College-Aged Male 24hr RMR

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It has been demonstrated that increasing caloric expenditure through exercise participation is one mechanism by which to modify caloric balance in favor of weight loss. While chronic resistance training (RT) has been demonstrated to elevate resting metabolic rate (RMR) due to increased lean mass, there has been less research on the acute effects of a single bout of resistance training on RMR. Thus the effects of acute RT on 24 h RMR may provide insight to another mechanism by which RT may positively affect energy expenditure. **PURPOSE:** To determine the effects of an acute bout of resistance training on the 24 h RMR of college-aged males. **METHODS:** Ten healthy men aged 18-24 yr performed 8 exercises: single leg dumbbell step-ups, bent over dumbbell row, single leg lunge, barbell bench press, back squat, barbell shoulder press, biceps curls and triceps extensions (2 sets, 10 repetitions, 2 min recovery, 70% 1RM & 8RM) following ACSM Guidelines for RT. Subjects reported for testing following a 12 h fast and engaged in 7, 30 min RMR measurements over the next 24 h (2 pre-exercise, 5 post exercise). Diet was controlled during the entire 24 h period. Subjects completed both an experimental (RT) and control (no exercise) day separated by 1 week. **RESULTS:** RMR (kcal) data was analyzed using a 1 way ANOVA with repeated measures on 2 factors (group and time). Statistical analysis revealed that there was no significant main effect for group (*2179.58± 44.82 kcal vs. 2143.16 ± 44.82 kcal*; $F = .330$, $p = .567$) or group x time interaction ($F = .592$, $p = .736$, Table 1). There was a significant main effect for time ($F = 5.126$, $p < .001$). **CONCLUSION**: We conclude that an acute bout of RT, following ACSM guidelines, did not significantly impact RMR in RT males 24 h post-exercise.

Table 1.

Mean 24-hour RMR Values by Group

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

Note. Values are means ± standard error.

Peripheral Chemosensitivity during Head Out Water Immersion

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Carbon dioxide (CO_2) retention is a potentially dangerous issue in divers who use a self-contained underwater breathing apparatus. The peripheral chemoreceptors contribute to ventilatory control and the rise in ventilation (V_E) during hypercapnia. However, it is unknown if head out water immersion (HOWI) blunts peripheral chemosensitivity (PCS). **PURPOSE:** We tested the hypothesis that PCS is blunted during two hours of HOWI. **METHODS:** We assessed PCS to hypoxia (PCS_{O2}) and hypercapnia (PCS_{CO2}) in 3 participants (age: 25 ± 4 y, BMI: 28 ± 3 kg/m^2) before, during, and after thermoneutral (35 ± 0° C) HOWI. V_E, arterial oxygen saturation (%SaO_2), and the partial pressure of end tidal CO_2 ($PETCO_2$) were recorded continuously. We determined PCS_{O2} by having participants inhale 2-6 breaths of 100% N_2, followed by 3 min of room air breathing, 4 separate times. We determined PCS_{CO2} by having participants inhale 1 breath of 13% CO_2, 21% O_2, and 66% N_2, followed by 3 min of room air breathing, 4 separate times. The mean of the 3 highest consecutive V_E values, the lowest %SaO_2, and the peak $PETCO_2$ were determined within 2 min following each hypoxic or hypercapnic administration. The PCS_{O2} and PCS_{CO2} data are reported as the slope of the linear regression line of V_E vs. %SaO_2 or $PETCO_2$, respectively. Measurements were taken at baseline, at 10, 60, and 120 min of HOWI, and post HOWI. **RESULTS:** V_E was not different during the trial (baseline: 12.9 ± 1.1 L/min; at 10 min: 12.6 ± 2.0 L/min, 60 min: 12.2 ± 2.0 L/min, and 120 min: 11.9 ± 1.5 L/min; post: 11.9 ± 0.8 L/min; $p = 0.39$). $PETCO_2$ was statistically indistinguishable during the trial (baseline: 45.9 ± 0.8 mmHg; at 10 min: 47.8 ± 0.9 mmHg, 60 min: 48.3 ± 0.9 mmHg, and 120 min: 48.0 ± 1.3 mmHg; post: 43.2 ± 2.4 mmHg; $p = 0.10$). PCS_{O2} was lower at 10 min of HOWI (0.25 ± 0.10 L/min/%SaO_2, $p = 0.09$) and post HOWI (0.32 ± 0.16 L/min/%SaO_2, $p = 0.04$) vs. baseline (0.41 ± 0.17 L/min/%SaO_2). The PCS_{CO2} tended to be lower ($p = 0.09$) at 10 min of HOWI (0.07 ± 0.03 L/min/mmHg) vs. 120 min of HOWI (0.08 ± 0.03 L/min/mmHg). **CONCLUSION:** These preliminary data indicate that PCS_{O2} and PCS_{CO2} are altered during HOWI while breathing room air. The transient decrease in PCS might contribute to CO_2 retention in divers using a self-contained underwater breathing apparatus.

The Effect of Sport Specific, Governed, and Non-Controllable Focal Point on Female Vertical Jump Performance

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Few studies have assessed factors that directly impact vertical jump performance in females. Prior studies investigated varying warm-up protocols as a means to enhance jump performance without seeking to manipulate the target (i.e. sport specific focal point, non-controllable, or governed focal point) that the female subjects focused on to complete the jumps. A previous focal point vertical jump study utilizing male subjects suggested that vertical jump performance increased when using a sport specific focal point. However, this has not been assessed using a female population to the best of the researchers' knowledge. **PURPOSE:** To determine if a sport specific focal point contributes to an increase in jumping performance compared to non-controllable (i.e. no set focal point), and a governed (i.e. set focal point) in averagely fit females.

METHODS: Thirty averagely fit female participants had descriptive data collected (i.e. age, HT, WT, BF). Participants completed an 8 min warmup, which avoided static movements, and then received a 4 min passive recovery. After completing four familiarization jumps in a counter movement manner participants completed four jumps per each jump trial with thirty seconds of rest between jumps and 2 min of passive rest between each trial. The jump series protocol consisted of three separate counterbalanced trials which included a sport specific (FPS), governed (FP), or non-controllable focal point (FPN). FPN, FP, FPS were compared using ANOVA with significance determined at an alpha level of 0.05. **RESULTS:** FPS (51.56 cm $\pm$ 8.69 cm) was significantly different ($p = .0005$) versus FP (50.67 cm $\pm$ 8.70 cm) and FPN (50.50 $\pm$ 8.83 cm). Also, there was no significant difference ($p = .245$) between FPN and FP. **CONCLUSION:** It appears that using a sport specific focal point may elicit a higher jump in averagely fit females as compared to the jumps when females utilized a non-controlled focal point or a governed focal point. Further research is necessary in order to evaluate the use of a sport specific focal point on vertical jump performance with females who participate in jumping sports (i.e. basketball, volleyball) at the high school, collegiate, and professional level.

Effect of an Acute Bout of Resistance Exercise on Math and Attention Skills

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Purpose: The purpose of this study was to investigate the effectiveness of resistance exercises on math and attention skills. **Methods**: Healthy volunteers (22 men and 24 women) with an average age of 23 ± 5 yr were tested on three separate occasions in the McDaniel College Human Performance Lab. On the first day, they gave informed consent and completed a PAR-Q. Each participant's 15-repetition maximum (RM) was found on four different weight machines (chest press, leg press, leg extension, and seated row). On days two and three, which occurred $\geq$ 7 days apart, the participant would either sit quietly for 20 minutes (Control) or complete a warm-up and two sets of 15-RM on each of the four exercises (Lifting). The order of testing was counter-balanced. HR was measured on both testing days and RPE was measured on the lifting day. Immediately following the 20 minutes of rest or exercise, a d2 Test of Attention to assess concentration performance (CP), total number of items processed (TN), and total number of items processed minus error score (TN-E) and an arithmetic and algebra (Math) exam were administered. Paired t-tests with Bonferroni corrections and Wilcoxon signed rank tests were used to assess statistical significance ($p < 0.05$). **Results**: All data are reported as mean ± SD. On the lifting day RPE averaged 16 ± 2 and participants completed more than 99% of the planned repetitions. The d2 results for the CP (171 ± 34 vs. 161 ± 25), TN (436 ± 78 vs. 412 ± 61), and TN-E (424 ± 77 vs. 401 ± 58) values on the lifting day were all significantly greater ($p < 0.017$) than the control day. The average math exam score on the lifting day of 68 ± 18% was not significantly different ($p > 0.05$) than the score of 73 ± 15% on the control day. **Conclusion:** A single session of resistance exercises improved attention and processing speed. However, the resistance exercises had no impact on mathematical ability.

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Sensitivity Analysis of Biomechanical Models for NASA's Digital Astronaut Project

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Musculoskeletal deconditioning is a side effect of human inhabitance in a microgravity environment and a major obstacle to long-term space travel. The Digital Astronaut Project (DAP) aims to evaluate exercise countermeasure devices intended for future exploration missions on their ability to provide sufficient loading stimuli and maintenance of astronaut fitness. Using open-source biomechanics software, DAP members have created computer models of exercises conducted on a prototype resistance device envisioned to fly on the Orion Multi-purpose Crew Vehicle. **PURPOSE:** As part of the verification and validation process for the DAP models, sensitivity analyses were performed as a means to understand the effects that uncertainty in model input parameters, which accrue during the model scaling process, can have on joint moment outputs of interest. **METHODS:** A split squat exercise model with a long-bar loading configuration was chosen for analysis. The inertial body segment parameters of mass and center of mass (COM) were the primary inputs under examination. Mass parameters were perturbed by 5.0 kg for the torso and 3.0 kg for femurs while center of mass for all bodies was perturbed by 0.03 m in the x, y, and z planes. Monte Carlo simulations for each perturbation were generated with the help of a probabilistic plugin appended to the software's application program interface using custom code. Pearson's R correlation coefficients were then used to quantify the relationship between inputs and inverse dynamics outputs. **RESULTS:** Lumbar extension moment was found to be highly sensitive to perturbations in the torso inertial parameters ($r_{COM(x)}$=1, $r_{COM(y)}$=1 ,$r_{COM(z)}$= -1 , r_{mass} =1) whereas hip adduction ($r_{COM(x)}$=1 , $r_{COM(y)}$=1 ,$r_{COM(z)}$=1 , r_{mass} = -1) and hip flexion moments ($r_{COM(x)}$=1 , $r_{COM(y)}$= -1 ,$r_{COM(z)}$= -1 , r_{mass} =1) were highly sensitive to perturbations in the respective femurs. Pelvis perturbations did not affect any outputs of interest ($r \leq 0.01$). **CONLUSION:** The highly sensitive, highly linear correlations observed indicate that failure to accurately account for subject-specific variation in inertial parameters will directly impact DAP moments of interest. From these data it is apparent that the torso and femur require greater focus in future model development and scaling.

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Effect of Minimalist Footwear on Landing Kinematics of the Knee in Physically Active Adults

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A current fitness trend is the use of minimalist footwear (MF), which is defined as footwear providing minimal interference with the natural movement of the foot. Research has shown the effect MF has on running stride kinematics, but there has been little research investigating the effect of MF on landing kinematics. Research indicates that increased knee valgus angles during landing may be related to knee injury. If a difference in landing kinematics between MF and non-minimalist (NM) users can be seen, future research can be carried out investigating its effects. **PURPOSE:** To examine the role of MF on knee kinematics during a jump landing task. **METHODS:** Healthy physically active individuals (n = 50) who regularly participate in high

intensity interval training participated in the study. The MF group (27.8 ± 5.5 yrs, 168.5 ± 11.0 cm, 73.1 ± 13.8 kg) consisted of 15 females and 10 males who are habitual users of MF. The NM group (22.9 ± 4.9 yrs, 170.0 ± 9.9 cm, 67.7 ± 12.1 kg) consisted of 14 females and 11 males with no history of MF use. Subjects performed a jump landing task, which required subjects to jump off two feet from 40% of their height onto a force plate, landing on their dominant foot. Upon landing, subjects maintained balance for five seconds. A camera-based motion analysis system using reflective markers was implemented to assess joint angles during the task. Average knee angle kinematics across five trials were used for analysis. Independent samples t-tests were used to compare average kinematics between the groups for hypothesis testing at $p < 0.05$. Mann-Whitney U was used for data that was not normally distributed. **RESULTS:** Knee valgus/varus angle at initial contact was significantly more neutral ($p = 0.019$) in the MF group (-0.60° ± 4.26°) compared to NM (2.89° ± 4.25°). Peak varus angles were also significantly closer to neutral ($p = 0.046$) for the MF group (5.70° ± 9.73°) compared to NM (12.33° ± 11.63°). Peak valgus angles, however, were significantly higher ($p = 0.043$) in MF (-7.50° ± 8.34°) than NM (-3.37° ± 7.27°). **CONCLUSION:** Kinematic data suggests significantly more neutral knee angles at initial contact and smaller peak varus angles with MF, which could be considered protective. However, the greater peak valgus angles might indicate greater knee excursion in MF.

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Fasting Blood Lipid Levels in College Students Differ Throughout The Week

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The National Heart, Lung and Blood institute recently released updated lipid screening guidelines for children and adolescents. They recommend testing adolescents between the ages of 17 and 21. Early recognition of dyslipidemia is important for preventing arteriosclerosis and cardiovascular disease. **PURPOSE:** To determine if there are differences in blood lipids and glucose levels by day of the week. **METHODS**: Following an 8-hour fast, blood glucose and lipid levels were measured on 2559 college students via fingerstick. Data were imported into SPSS 23 for analysis. Lipid and glucose measures obtained on different days of the week were compared using one-way analysis of variance with Tukey's post-hoc test where appropriate. **RESULTS:** Significant differences were seen in triglycerides (TRI) ($F=12.6$; $p=0.000$), high-density lipoprotein cholesterol (HDL-C) ($F=5.5$; $p=0.000$) and low-density lipoprotein cholesterol (LDL-C) ($F=3.3$; $p=0.011$). In TRI, values obtained on Monday and Tuesday were significantly higher than those obtained on Wednesday, Thursday and Friday. LDL-C values obtained on Monday were significantly lower than those obtained on Thursday and Friday; conversely, HDL-C values were significantly higher on Monday than they were on Thursday or Friday. There was no difference in glucose levels or total cholesterol throughout the week. **CONCLUSION**: In college students, TRI levels decrease as the week progresses from Monday to Friday. Cholesterol levels, on the other hand, worsen throughout the week as HDL-C levels drop and LDL-C levels rise. These changes could have implications for cardiovascular disease development. The implications of weekend lifestyle choices related to diet and alcohol consumption in this population will be discussed.

Ability of Fitness Trackers to Accurately Measure Caloric Expenditure of College-Aged Students during Submaximal Exercise

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Since the early 2000s, fitness trackers have grown in popularity; especially among those looking to become more active. **PURPOSE:** To determine the accuracy of caloric expenditure as measured by fitness tracker 1 (FT1) and fitness tracker 2 (FT2) when compared to indirect calorimetry (IC) using expired gas analysis. A secondary objective was to determine differences in caloric expenditure between an athletic and non-athletic sample. **METHODS:** Nineteen (10 athletes and 9 non-athletes) college-aged subjects participated in the study and completed three exercise protocols. The protocols were: (1) orientation to testing, (2) walking one mile at 3.0 mph, 0% grade and (3) walking one mile at 3.0 mph, 3% grade. During testing sessions, all subjects wore both fitness tracker devices on the left hip and noseclip and mouthpiece apparatus to obtain and analyze expired gases. Data were analyzed using 2x3 ANOVAs with repeated measures. **RESULTS:** When comparing caloric expenditure on a flat surface to a graded surface, there was a statistically significant interaction ($F = 9.10$, $p < .01$) and main effect for the devices ($p < .01$). There were statistically significant differences in caloric expenditure output between FT1 and FT2 ($p < .01$), as well as FT2 and IC ($p < .01$). However, there was not a difference shown between FT1 and IC. There were no significant interactions or main effects when comparing the caloric expenditure of athletes and non-athletes after walking on a flat surface ($p > .05$) or graded surface ($p > .05$, Table 1). **CONCLUSION:** FT2 overestimated caloric expenditure when compared to FT1 and IC. However, there was not a difference in caloric expenditures between the athletic and non-athletic population samples.

Table 1: Comparison (M±SD) of caloric expenditure (kcal) as measured by fitness trackers and indirect calorimetry by group and grade condition. Total distance = 1 mile.

Treadmill Walking at 3 mph on Flat Surface			
Group	Fitness Tracker 1	Fitness Tracker 2	Indirect Calorimetry
Athletic (n = 10)	96.20±20.20	116.40±18.57	93.50±18.08
Non-Athletic (n = 9)	98.00±10.68	114.44±13.35	92.11±17.78
Total (N = 19)	97.05±15.99	115.47±15.89	92.84±17.45
Treadmill Walking at 3 mph on 3% Graded Surface			
Group	Fitness Tracker 1	Fitness Tracker 2	Indirect Calorimetry
Athletic (n = 10)	104.10±16.24	113.30±15.47	111.30±25.19
Non-Athletic (n = 9)	102.67±19.22	114.89±16.18	108.78±21.29
Total (N = 19)	103.42±17.22	114.05±15.39	110.11±22.82

Run Economy of Trained Endurance Athletes on a Lower Body Positive Pressure Treadmill

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The use of Lower Body Positive Pressure (LBPP) treadmills has become an option in the rehabilitation and training for endurance athletes. Run Economy (RE) is important information for endurance athletes to recognize their efficiency of running. There is a lack of research on RE and LBPP notably with endurance-trained runners. It is also unclear if changes in VO_2 and RE would be proportional to the decrease in body weight on LBPP. **PURPOSE**: To measure VO_2 and RE during steady state running on a normal treadmill (100% body weight), and with LBPP (85% of body weight). **METHODS**: Fifteen trained endurance athletes, 7 males and 8 females, (AGE 21.7± 2.9 yrs, WEIGHT 61.9 ± 8.5 kg), who have participated in collegiate cross-country and can run a 7-min. per mile pace for 5 km, completed two sessions of exercise where they ran on (i) normal treadmill, and (ii) a LBPP treadmill and 15% of their body weight was supported (85% of normal body weight). During each session they ran at three steady state speeds (2.9, 3.4, and 3.8 $m \cdot s^{-1}$) for four minutes each. Oxygen consumption and CO_2 production was collected using open flow indirect calorimetry during the last minute of each steady state stage. **RESULTS**: Volunteers' average (±SD) RE on normal treadmill at each speed was 183.7 ± 14.6, 181.0 ± 12.5, and 174.5± 13.4 ml $O_2 \cdot kg^{-1} \cdot km^{-1}$, respectively. Average (±SD) RE on LBPP treadmill at each speed was 181.6 ± 21.6, 172.0 ± 21.3, and 169.1 ± 19.7 ml $O_2 \cdot kg^{-1} \cdot km^{-1}$, respectively. Repeated measures ANOVA indicated no main effect of treadmill condition and RE; $F(1, 14) = 1.289$, $p = .275$, partial $\eta^2 = .084$. Running Economy was significantly impacted by treadmill speed $F(1,14) = 29.104$, $p < .0001$, partial $\eta^2 = .675$. There was no significant interaction between treadmill condition and speed on VO_2, $F(1, 14) = 0.265$, $p = .614$, partial $\eta^2 = .019$. **CONCLUSION**: Endurance runners were more economical with a greater running speed independent of treadmill condition. There was no significant effect of treadmill condition (normal vs. LBPP) on RE at any speed, although absolute VO_2 was ~10% less with LBPP. Runners may be able to use a LBPP treadmill for training or rehabilitation at 15% less body without a change in RE. Future research will investigate the effects of a greater reduction in body weight on RE in endurance trained runners.

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Experimental Intermittent Ischemia Augments Exercise-Induced Inflammatory Cytokine Production

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Acute exercise-induced transient increases in inflammatory cytokines are linked to the beneficial vascular effects of exercise, but the underlying mechanisms that promote appearance are contingent on numerous factors (e.g. muscle mass recruited, exercise intensity/duration, etc.). Evidence suggests that a lack of oxygen and/or blood flow to working muscle modifies cytokine appearance. However, little is known about the inflammatory response to intermittent ischemia in working muscle. **PURPOSE:** Determine the extent to which local inflammation is involved in

the response to ischemic exercise by reproducing the peripheral arterial disease (PAD)-associated phenomenon of intermittent claudication without the presence of potential confounding comorbidities frequently exhibited by patients with PAD. **METHODS:** 14 healthy males performed unilateral isometric forearm contractions for 30 minutes with and without experimental ischemia. Blood was drawn at baseline, 5 and 10 minutes into exercise, at the end of exercise, and 30, 60, and 120 minutes after exercise. **RESULTS:** Oxygen saturation levels, as measured by near-infrared spectroscopy, were reduced by 10% and 41% during non-ischemic and ischemic exercise, respectively ($P < 0.001$). Non-ischemic exercise did not affect cytokine values during exercise (all $P > 0.05$). Ischemic exercise enhanced concentrations of basic fibroblast growth factor, interleukin (IL)-6, IL-10, tumor necrosis factor-alpha, and vascular endothelial growth factor at the end of exercise by 148%, 197%, 129%, 154%, and 164% ($P < 0.05$), respectively, but IL-8 was not influenced by ischemic exercise ($P > 0.05$). **CONCLUSION:** In conclusion, the present study demonstrates that ischemic, small muscle endurance exercise elicits local inflammatory cytokine production, compared to non-ischemic exercise. The effect of ischemic exercise with PAD-associated comorbidities may impact the inflammatory response during and after exercise.

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Relationships Between Mobility Tests and Maximum Bicycling Cadence during Speed Training in Older Adults

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Bellumori et al (2016) showed that speed-based exercise could improve neuromuscular function and mobility in older adults. Throughout training, the pedaling cadence of fast intervals (revolutions per min. RPM) progressively increased. **PURPOSE:** Secondary analysis was performed to determine if correlations exist between maximum RPM (RPM-max) and mobility tests and surveys of quality-of-life and movement confidence in older adults. **METHODS:** 14 older adults exercised on stationary recumbent bicycles twice per week in a six week program. High speed and low resistance emphasized neural activation while reducing musculoskeletal and cardiovascular strain. 30-min. sessions included five min. of warm-up and cool-down at preferred pedaling cadence. In the middle 20 min., subjects executed 20, 20-s fast intervals. RPM-max values were obtained for the first and last training sessions. Timed up and go test (TUG), 6-meter walk test, with instructions to go fast and safe (walk), 4-square step test (4SST), 9-hole peg test (peg), Activities-specific Balance Confidence (ABC) Scale, 36-item Short Form Survey (SF36), and right and left hand isometric handgrip strength test were administered pre and post training. Grip strength was normalized to body mass (L/RGripN). Pearson's correlations describe the relationships among variables. **RESULTS:** At the program's onset, RPM-max was significantly ($p<.05$) correlated with TUG ($r = -.585$), walk ($r = -.796$), 4SST ($r =$

-.916, n=7), ABC (r =.723, n=13), SF36 (r =.550), LGripN (r = .541), and RGripN (r = .596). At the program's end, RPM-max was significantly correlated with TUG (r = -.849), walk (r = -.894), 4SST (r = -.791, n=7), LGripN (r = .690) and RGripN (r = .652). TUG, walk, 4SST, and L/RGripN were significantly correlated with RPM-max both before and after the program. **CONCLUSION:** Maximum RPM has a strong relationship with timed tests of mobility and moderate correlations with strength and perceived quality of life and balance confidence. While the association between fast pedaling and overall mobility is logical, these data support the use of RPM-max as an informative parameter related to mobility status and the overall robustness of the older adult.

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Evaluating the Relationship Between Vertical Jump Performance and FMS in Young Adult Males

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Functional Movement Screening (FMS) is an assessment test used to determine an athlete's risk of injury based on the scores of seven tests that utilize commonly used movement patterns during exercise. Each test is scored based on whether or not biomechanical deficiencies are present when performing each test. Prior research has predominantly evaluated the relationship between FMS and susceptibility to injury. Yet there appears to be limited research with FMS and anaerobic performance. Specifically, the relationship between FMS and vertical jump performance has not yet been addressed. **PURPOSE:** To determine the correlation between Functional Movement Screening scores and maximum vertical jump height in young adult males. **METHODS:** Thirty averagely fit males (Age= 23.13 $\pm$ 3.02 yrs, HT= 178.74 $\pm$ 8.00 cm, WT= 82.14 $\pm$ 13.46 kg, BF%= 14.32 $\pm$ 4.60) voluntarily participated in this study. Each subject performed FMS and were scored according to the grading criteria provided by the developers of FMS. Then a dynamic warm-up utilizing a cycle ergometer for 8 min was performed followed by a 4-min passive recovery period. Next, subjects performed four maximum effort vertical jumps, which served as their vertical jump familiarization trials. All jumps were separated by 30 seconds except the last jump of the familiarization trial and the first jump of the performance trials which were separated by 4 min of passive recovery. The highest of the four performance jump trials, excluding the first jump, was utilized for data analysis. Pearson Correlations were utilized to assess the relationship maximum vertical jump height and total FMS score, squat FMS score, and inline lunge FMS score. **RESULTS:** There was a slight positive correlation when comparing maximum vertical jump (69.51 $\pm$ 9.68 cm) to total FMS score (r=.264) and FMS squat score (r=.170), but there was a moderate positive relationship with FMS inline lunge score (r=.421), which was significantly higher (p= .01) than both FMS total and FMS squat scores. **CONCLUSION:** The results of the current study seem to suggest that total FMS score is not a significant predictor for maximum vertical jump height. However, future studies should seek to

determine the potential impact that improvements in the FMS inline lunge, squat, and total score may have on vertical jump performance.

The Effects of Multiple Sets of Squats and Jump Squats on Mechanical Variables

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PURPOSE: To investigate the effects of two non-ballistic squat and two ballistic jump squat protocols performed over multiple sets on mechanical variables. **METHODS:** In a counterbalanced cross-over design, 11 resistance-trained men (age: 21.9 ± 1.8 years; height: 1.79 ± 0.05 m; mass: 87.0 ± 7.4 kg) attended four testing sessions during a three week period where they performed multiple sets of squats and jump squats with a load equivalent to 30% 1-repeititon maximum under one of the following conditions: 1) three sets of four non-ballistic repetitions (30N-B), 2) three sets of four non-ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PN-B), 3) three sets of four ballistic repetitions (30B), 4) three sets of four ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PB). Force plates and a 3-D motion analysis system were used to determine the mean vertical velocity, mean vertical force, and mean power output during each repetition. **RESULTS:** Significantly greater vertical velocity (mean difference [MD]: 0.25 – 0.21 m/s, $p<0.001$, effect size [ES]: 1.70 – 1.74) and vertical force (MD: 526 N, $p<0.001$, ES: 1.61) were attained during 30B compared to 30N-B and 30PN-B. Vertical velocity during 30PB was significantly greater than that attained during both 30N-B and 30PN-B (MD: 0.21 – 0.23 m/s, $p<0.001$, ES: 1.89 – 1.76), and vertical force during 30PB was also significantly greater than that during 30N-B (MD: 478 N, $p<0.001$, ES: 1.63) and 30PN-B (MD: 478 N, $p<0.001$, ES: 1.62). Mean power output was significantly greater during 30B compared to both 30N-B (MD: 843 W, $p<0.0001$, ES: 1.66) and 30PN-B (MD: 869 W, $p<0.001$, ES: 1.67). Mean power output during 30PB was also significantly greater than that during 30N-B (MD: 711 W, $p<0.001$, ES: 1.73) and 30PN-B (MD: 737 W, $p<0.001$, ES: 1.72). The increase in power output across the three sets in the 30B condition was significantly greater than the small changes in power output observed during the 30N-B and 30PN-B conditions ($p<0.001$) and significantly different from the decrease observed during the 30PB condition between sets 2 and 3 ($p=0.015$). **CONCLUSION:** Ballistic exercises are likely to be effective in the development of power output and their use across multiple sets may induce post-activation potentiation.

Caffeine Withdrawal and Acute Consumption Effects on Reaction Time and Muscular Strength, Power, and Endurance

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Studies on the benefits of caffeine to anaerobic exercise have varied designs and equivocal results. Previous work in our lab has demonstrated positive effects of caffeine using laboratory-based tests. **PURPOSE**: To study the effects of caffeine withdrawal and caffeine supplementation on field tests of power output, muscular strength, endurance, and reaction time. **METHODS**: Physically active, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg; average caffeine: 258±128mg) participated in a placebo-controlled intervention. All subjects abstained from caffeine for 4 days prior to withdrawal testing (T1),

supplemented with 5mg·kg of caffeine for 3 days and on the final testing day (T2) consumed 6mg·kg of caffeine or placebo (insoluble fiber) one hour before testing. Power was assessed using peak vertical jump height, while muscular strength and endurance were assessed using a handgrip dynamometer. Subjects performed three handgrip trials to determine their maximal voluntary contraction (MVC). They then performed an isometric hold to volitional failure at 40% of their respective MVC. Reaction time was measured using a commercial application for a tablet computer. Data are presented as means ± standard deviation and were analyzed with SPSS 22.0 using either independent or paired t-tests with an alpha of 0.05. **RESULTS:** Following four days of caffeine withdrawal, peak vertical jump height decreased from 17.49±3.70in to 17.00±3.58in ($p<0.001$). There was a trend for an increase in power output (calculated from vertical jump) in caffeine: 3583.6±893.0W vs placebo: 3120±691W ($p=0.065$). Following caffeine withdrawal, there was also a trend for reaction time to slow by 0.01415±0.05414 sec ($p=0.083$). There was no significant difference in handgrip strength or muscular endurance following caffeine withdrawal or acute supplementation. **CONCLUSION:** This study demonstrates that caffeine withdrawal may be detrimental to performance and supplementation provides limited benefit using these chosen field tests. However, our previous findings using an isokinetic dynamometer to assess muscular strength and power provide more consistent results indicating that caffeine withdrawal can hinder muscular strength and power and that supplementation may provide an acute ergogenic effect.

Photo-Plethysmography Heart Rate and Activity Measures during Exercise

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Heart rate (HR) monitors enable users to accurately gauge their HR during exercise. Many HR monitors use a chest strap to detect the heart's electrical signal (ES); yet new wrist-worn devices rely on optical blood flow sensing technology known as photo-plethysmography (PPG) to measure HR and use an accelerometer to track exercise that are synched to a personal website. The accuracy of PPG for measuring HR during exercise is unclear and the extent that PPG devices accurately quantify exercise time is unknown. **Purpose:** To examine the measurement congruence between PPG and ES HR monitors during 30 minutes of treadmill exercise. A second purpose was to compare minutes of exercise between PPG website and observed exercise time. **Methods:** Subjects were 21 male (n=9) and female (n=12) adults between 18-35 years of age who concurrently wore both monitors during seated rest, warm-up, treadmill exercise, and cool-down (5, 5, 30, 5-10 minutes, respectively). HR was recorded each minute and PPG website accounts were accessed to obtain minutes of recorded exercise. Pearson correlations examined HR associations between PPG and ES. Paired t-test was used to assess differences in HR between PPG and ES. Mean absolute percent error (MAPE) was calculated for PPG. Bland-Altman plots and a 95% equivalence test was used to explain overall agreement between PPG and ES. Differences between PPG website and observed exercise minutes were examined with Paired t-test. **Results:** Mean exercise HR was strongly correlated between PPG and ES ($r=.961$, $p<.05$). PPG significantly underestimated mean exercise HR compared to ES (154.61±14.36; 158.15±14.12 bpm, $p<.05$). MAPE was 2.23% for PPG and the 95% equivalence test showed PPG HRs fell within a ± 5% equivalence zone of the mean ES HR (150.24 – 166.06 bpm).

Compared to observed exercise time, PPG website recorded significantly greater exercise time (34.93± 3.61; 29.52 ±2.18 min, p<.05). **Conclusion:** PPG significantly underestimated ES HRs during exercise, yet equivalency tests revealed PPG HRs were comparable to ES. The low MAPE value and use of a more restrictive equivalency zone support the utility of PPG for measuring HR during exercise. The finding that PPG overestimated minutes of exercise may be due to HR response during warm-up, exercise, and cool-down, though additional research is warranted.

Ambulatory Blood Pressure and Habitual Physical Activity in Chronic Kidney Disease

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CVD is the leading cause of death in Chronic Kidney Disease (CKD) and hypertension is an important risk factor for adverse cardiovascular outcomes in CKD patients. Despite pharmaceutical advancements in hypertension, high blood pressure (BP) persists in CKD patients. Physical activity levels are reduced in CKD patients and could contribute to elevated BP however the association between ambulatory BP and physical activity in CKD is unknown. **PURPOSE:** To assess indices of ambulatory BP and determine whether habitual physical activity contributes to 24-hour BP indices in stage 3-4 CKD patients. **METHODS:** 24 hour ambulatory BP and habitual physical activity were assessed in 18 treated stage 3-5 CKD patients (Mean ± SD; Age 60±10 yrs; eGFR 45±13 ml/min/1.73m^2) and 13 healthy controls (Age 56±6 yrs; eGFR >90 ml/min/1.73m^2). Subjects were given an ambulatory BP monitor to wear for 24 hours. Blood pressure was taken every 20 minutes when the subject was awake and every 30 minutes when the subject was asleep. Outcome measures included overall, wake, and sleep BP, morning surge BP, dipping and reading-to-reading average real variability (ARV). Patients were also given an accelerometer to wear at the hip continuously for 7 days. An average of the 7 day period was calculated to represent the average daily activity levels. **RESULTS:** Overall (132±16 *vs.* 116±9 mmHg, p<0.01), wake (135±15 *vs.*121±9 mmHg, p<0.01), and sleep (127±19 *vs.* 104±10 mmHg, p<0.01) systolic pressures were higher in CKD patients as were overall (55±13 *vs.* 43±6 mmHg, p<0.01), wake (55±13 *vs.* 44±6 mmHg, p<0.01) and sleep (55±16 vs. 40±6 mmHg, p<0.01) pulse pressures. Systolic dipping was lower in CKD patients (6±8 *vs.* 14±6 %, p<0.01). ARV was higher in CKD patients (9±2 vs. 8±1 mmHg, p=0.02). Vector magnitude (417312±260806 vs. 577860±112021 AU, p=0.04), daily step counts (5339±3076 *vs.* 8869±2265 AU, p<0.01) and time spent in moderate activity (30±28 *vs.* 56±29 min, p=0.01) were significantly lower in CKD patients. In CKD patients, time spent in sedentary activity was moderately correlated with ARV (r=0.56; p=0.01). **CONCLUSION:** Stage 3-5 CKD patients report high blood pressures, low dipping and increased BP variability despite hypertensive treatment. Physical inactivity contributes to blood pressure variability in CKD patients.

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Habitual Users of Minimalist Footwear Display Better Dynamic Postural Stability During a Jump Landing Task

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Previous studies have shown that minimalist footwear (MF) is correlated to a reduction in loading forces and increased balance in subjects who previously were not exposed to MF. Limited research has been conducted to examine the long-term effects of MF on risk factors of ankle injury, such as worse dynamic postural stability. To help determine if MF use is beneficial, dynamic postural stability was observed in habitual users of MF compared to users of traditional athletic footwear. By utilizing the dynamic postural stability index (DPSI), lower scores in habitual users of MF can show potential for MF to lower the risk of injury. **PURPOSE:** To examine the effects of habitual MF use on dynamic postural stability. **METHODS:** Healthy, physically-active individuals (n = 50) who participate in regular high intensity interval training, participated in this study. The MF group (27.8 ± 5.5 yrs, 168.5 ± 11.0 cm, 73.1 ± 13.8 kg) consisted of 10 males and 15 females who regularly trained in MF. The non-minimalist (NM) group (22.9 ± 4.9 yrs, 170.0 ± 9.9 cm, 67.7 ± 12.1 kg) consisted of 11 males and 14 females who had no previous exposure to MF during training. Subjects jumped forward with both feet over a 30-centimeter hurdle and landed on their dominant foot on a force plate. Jump distance was set at 40% of their height with the hurdle placed at 20% height. A total of five trials were collected and averaged for the jumping task. The primary outcome variable (DPSI) and its component scores (APSI, MLSI, VSI) were calculated based on the ground reaction forces collected for the first three seconds following initial contact with a force plate recording at 1200 Hz. Higher DPSI measures indicate worse dynamic postural stability. Independent sample t-tests were used to compare average stability between the groups for hypothesis testing at $p < 0.05$. Mann-Whitney U was used for data that was not normally distributed. **RESULTS:** DPSI and VSI were significantly lower in the MF group ($p \leq 0.014$). The APSI and MLSI component scores were not significantly different between groups. **CONCLUSION:** The better dynamic postural stability in MF indicates a potential benefit to habitual use of MF as a training device. The lower DPSI might be attributed to an increase in proprioception, which is afforded by the footwear.

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Comparison of Metabolic Rate Between Concentric and Eccentric Muscle Actions

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PURPOSE: Previous studies have reported the energy cost of eccentric exercise to be approximately 1/7 to 1/4 that of concentric exercise, but no study has directly compared concentric-only versus eccentric-only resistance exercise. Therefore, we compared energy expenditure between squats performed with concentric versus eccentric muscle actions. **METHODS:** 7 apparently healthy, college-aged men (20.5±0.53 yrs) with a body mass index (BMI) < 26 performed three exercise protocols once per week designed to compare energy

expenditure between different muscle actions; concentric (CON), eccentric (ECC), and a trial incorporating both concentric and eccentric muscle actions (BOTH). Subject's 1-RM was determined using a plate-loaded squat machine. Each energy expenditure protocol was randomly assigned in a counterbalanced order and required subjects to perform 4 sets of 10 repetitions with 50% of 1-RM. Repetition speed (2 sec), ROM, and rest intervals were identical across all protocols. Expired air was collected continuously before (15 min), during (~12 min), and after (30 min) each exercise protocol, using a Parvo TrueOne 2400 Metabolic cart. Data were analyzed using a two-way repeated measures ANOVA, with Tukey honest significant difference (HSD) post hoc analyses wherever appropriate. **RESULTS:** Rates of energy expenditure (kcal/min) during sets 1-4 of CON (4.47±0.44, 4.65±0.57, 4.60±0.65, and 4.50±0.58, respectively) and BOTH (4.43±0.66, 3.60±0.46, 4.26±0.59, and 3.67±0.43, respectively) were significantly greater ($p \leq 0.05$) compared to ECC squats (3.34±0.33, 3.10±0.34, 3.10±0.35, and 3.05±0.27, respectively), with the exception of Set 2 for BOTH versus ECC, which was not significantly different. There were no significant differences in energy expenditure between CON, ECC and BOTH during identical warm-up sets. **CONCLUSION:** When squats are performed with 2 sec CON or ECC muscle actions and 50% of 1-RM, the energy cost of eccentric exercise was 2/3 to 3/4 that of concentric exercise. While our findings show a greater energy cost from eccentric squats relative to concentric, it may be that slower muscle actions (i.e., 2 sec per muscle action) enhance the overall contribution to energy expenditure from eccentric muscle actions due to increased time under tension during resistance exercise.

Effects of Exercise and Exogenous Glucose on Short-Term Memory Recall in Young Adults

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Characterizing the effects of exercise on cognitive function is an important area of investigation. Extensive research has been conducted to examine the effects of exercise on short-term memory. To date the results have been mixed regarding the effects of an acute bout of exercise on memory. In addition, hyperglycemia has been shown to affect cognition in memory-based tasks. **PURPOSE:** The purpose of this study was to determine the independent effects of light exercise (LEC), heavy exercise (HEC), and exogenous glucose (GLU) on performance during a computer based memory recall test. **METHODS:** 15 subjects (male n = 9, female n = 6; age 20.80±1.26 yr; height 164.6±39.9 cm; mass 72.9±12.1 kg) participated in the study. Subjects viewed 75 images (3 sec/image) prior to the assigned intervention and then were tested on recall (observed or not-observed previously) of the images post-intervention when 25 of the 75 images were replaced with new images. Reaction time of response was also assessed. **RESULTS:** Mean HR was significantly increased during LEC and HEC, 117±14.4 bpm and 161±16.5 bpm, respectively ($p \leq .05$) vs. CON (68.0±9.4 bpm) and GLU (67.8±7.7 bpm). Blood glucose was significantly increased during the GLU condition ($p < .001$) and blood lactate significantly increased during HEC ($p < .001$) vs. all conditions, respectively. Despite these physiologic

alterations, no main treatment effects were observed for reaction time (RT), or accuracy. However, RT was significantly faster for correct responses (1005.10±22.0 ms) compared to incorrect responses (1328.2±46.5 ms) across all treatments ($p < .001$). **CONCLUSION:** Based on the study results, different physiologic stressors resulting from acute exercise or hyperglycemia elicited no positive or adverse effects on short-term memory performance. Future research may evaluate applying the intervention during or prior to the initial stimulus period rather than after.

Reliability of Identifying EMG Onset of Complex Human Movement Electromyography Signals

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Electromyography (EMG) is a popular method for measuring muscle activity in human movement with magnitude and timing two commonly reported variables. While different algorithms to determine EMG onset exist, the gold standard of comparison remains visual observation. This process, however, is subjective and is complicated by the complexity of the underlying neuromuscular signal and noise from the electrode-skin interface, electronics, and electromagnetic interference. To obtain valid measures of EMG onset and to ascertain the validity of different algorithms for determining EMG onset, it is important to establish the reliability of visual observation for determining EMG onset. **PURPOSE:** To determine the agreement between and within raters for EMG onset visual analysis. **METHODS:** Muscle activity on 10 healthy active subjects was collected from the gastrocnemius, biceps femoris, and vastus lateralis using surface electrodes placed over the muscle bellies following skin preparation with sandpaper and alcohol. Subjects completed 4 minutes of exercise on a treadmill, cycle ergometer and stair climber at a low to moderate intensity. EMG were collected with a wireless EMG system (4000 Hz) for 5 to 6 complete movement cycles (6 to 10 seconds depending on cadence) at time points 1:30 and 3:30. The raw EMG data were visually analyzed with custom software. Three researchers manually identified muscle onsets twice for the 180 EMG trials (3 muscles, 3 exercise modes, 10 subjects, 2 time points) with the trials presented in random order. To determine rater agreement, intraclass correlation coefficients (ICC) were calculated for the number of muscle onsets identified per trial. **RESULTS:** Within-rater $ICC_{(2,1)} = 0.85$ and between-rater $ICC_{(2,1)} = 0.89$. However, there were only 132 instances, out of 180, where two researchers agreed with both themselves and another researcher (i.e. two different researchers selected the same number of onsets twice). **CONCLUSION:** Despite moderate to high intraclass correlation coefficients, caution should be taken when determining EMG onset using visual observation since less than 75% of trials had consensus agreement between and within raters.

Blood Pressure Cuff Selection: Does One Size Fit All?

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Blood pressure (BP) is one of the most commonly measured vital signs. Historically, tremendous focus has been dedicated to increasing the reliability of BP measurement by standardizing protocols and reducing error to the smallest possible increment. Errors in BP measurement may result in misdiagnosis, cardiovascular complications during exercise, and improper prescription of antihypertensives. 'Miscuffing' is a common and significant source of error in BP measurement. The '80% rule' (i.e. cuff ≥80% of an individual's arm circumference) is the gold standard method for BP cuff size selection as recommended by the American Heart Association. Interestingly, BP cuff manufacturers routinely print their own cuff size recommendation, based on an arm circumference range, on their products and this method often differs in the suggested cuff size from the '80% rule'. **PURPOSE:** The current study examined the occurrence of 'miscuffing' and the outcome of BP measurement using the '80% rule' cuff selection method versus the manufacturer's recommendations. **METHODS:** Forty-four individuals had their upper arm circumference measured, and appropriate cuff(s) selected using the two sizing methods. An automated oscillametric device was used to measure BP in duplicate with a 1-minute interval in between measurements, and 2-minute interval between cuffs if necessary. If different cuffs were selected, the order of measurement was randomized. A dependent t-test was used to ascertain potential BP measurement differences between sizing methods. **RESULTS:** 'Miscuffing' as the result of method discrepancies between the '80% rule' and the manufacturer's recommendation, occurred in over two-thirds (70%, n=31) of the sample. In these individuals, there was a significant difference in systolic BP between recommended cuffs (7.9 mmHg; $p<0.05$). Approximately 1 in 3 individuals, with two cuffs recommended (35%, n=11), had a smaller cuff suggested by the manufacturer, and were misclassified with a significantly elevated systolic BP (average increase 12.5 mmHg; $p<0.05$). **CONCLUSION:** BP cuff-selection methods are not universal and contribute to reliability concerns. 'Miscuffing' was a common observation when utilizing the manufacturer's method for cuff selection and resulted in BP measurement error and misclassification.

BLOOD PRESSURE RESPONSE TO EXERCISE DURING SHORT-TERM WATER RESTRICTION

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Short-term water restriction (WR) elicits mild dehydration, but it is not known if mild dehydration alters resting or exercise blood pressure (BP). **PURPOSE:** To test the hypothesis that mild dehydration increases BP at rest and during isometric handgrip exercise at 40% of maximal voluntary contraction (HG) and post-exercise ischemia (PEI). **METHODS:** Six healthy participants were recruited to undergo testing (3M/3W, age: 23±3 yrs; BMI: 23±3 kg/m^2; BP 111±11/66±6 mmHg). Beat-by-beat BP was measured continuously with finger photoplethysmography throughout HG exercise and PEI. In randomized order, participants completed a normal hydration (NH) and WR visit, one month apart. Daily water intake for the NH condition was 23 mL H_2O/kg/day for 3 days prior to testing on day 4. Water intake for the

WR condition was similar with a period of no water for 16 hours prior to data collection. **RESULTS:** Plasma volume, estimated by changes in hemoglobin and hematocrit, declined 8.4±0.8% during WR. Urine osmolality (347±16 vs. 525±16 mOsm/kg H_2O, $p < 0.05$), 24-hour urine specific gravity (1.009±0.0004 vs. 1.014±0.0004, $p < 0.05$) and thirst rating on a 0-10 scale (0.8±0.1 vs. 4.7±0.4, $p < 0.01$) were higher for the WR condition, suggesting mild dehydration. While there was a trend for mean BP to be elevated at baseline (77±1 vs. 80±1 mmHg), during HG (91±2 vs. 93±2 mmHg), and PEI (88±2 vs. 92±2 mmHg) during WR (ANOVA p=0.10), the change in mean BP during HG (Δ14±2 vs. 13±2 mmHg, $p > 0.05$) and PEI (Δ11±1 vs. 12±1 mmHg, $p > 0.05$) were not different between conditions. Systolic and diastolic BP responses were also not different between conditions ($p > 0.05$). Heart rate change from baseline to HG and PEI were not different between conditions ($p > 0.05$). **CONCLUSION:** These preliminary findings suggest that mild dehydration does not increase BP during HG or PEI in young healthy adults.

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RELATIONSHIP BETWEEN CHRONIC INFLAMMATION AND OBJECTIVELY MEASURED PHYSICAL ACTIVITY IN OLDER ADULTS

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It is well established that physical activity decreases with age, and that lower levels of physical activity contribute to increased risk of functional decline with aging. Aging has also been linked to an increased pro-inflammatory state; however, the association between objectively measured physical activity and inflammatory burden in older adults is not well defined. **PURPOSE:** To evaluate the association between objectively measured physical activity and inflammation in well-functioning older adults. **METHODS:** Physical activity (PA) was measured using wrist-worn ActiGraph Link accelerometers continuously over 7 days in 60 older participants (28 women, aged 69±10 yrs) of the Longitudinal Aging Study at Towson (LAST). Accelerometer data was downloaded in 60-second epochs and expressed as the log-transformed average counts per day across the three axes. Blood samples were collected after an overnight fast, processed, and stored at -80°C until analysis. Plasma interleukin-6 (IL-6) and tumor necrosis factor alpha (TNFa) concentrations were measured by bead-based multiplex assay, and C-reactive protein (CRP) was measured by enzyme-linked immunosorbent assay. Tertiles of each inflammatory factor were created and the association between the mean of the log-transformed activity counts and inflammatory tertiles was modeled using linear regression models, adjusting for age sex, and BMI. **RESULTS**: In separate models, IL-6 was negatively associated with total daily PA, independent of age ($\beta = -0.11$, $p = 0.01$); however TNFa ($\beta = -0.03$, $p = 0.49$) and CRP ($\beta = -0.06$, $p = 0.18$) were not related to total daily PA. **CONCLUSION:** The independent, negative association between IL-6 and total daily PA highlights potential underlying pathways contributing to the age-related decline in PA, and subsequent physical function.

Time-Dependent Effects of Acute Cycling Exercise on Long-Term Emotional Memory and Salivary α-Amylase

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Psychological research has strongly documented the memory-enhancing effects of emotional arousal. Current opinion implicates the central release of stress hormones, specifically norepinephrine, as the neurobiological basis for this enhancement. Experimental induction of arousal has been shown to enhance long-term memory in a time-dependent manner. While extensive research has provided evidence for the memory benefits of exercise training, the effects of acute exercise on long-term memory are not as well understood. Furthermore, acute exercise of a sufficient intensity and duration stimulates central norepinephrine release. This presents an opportunity to investigate the role of acute exercise-induced arousal in the modulation of long-term memory. **PURPOSE:** The purpose of this study was to determine the time-dependent relationship between acute exercise-induced arousal and long-term emotional memory. **METHODS:** Forty healthy young adults (22±4 yrs) were randomly assigned to an exercise-before, exercise-after, or rest group. Participants in the exercise groups completed a high-intensity session of cycling exercise before or after viewing pleasant, neutral, and unpleasant images. Exercise intensity was prescribed using Borg's Ratings of Perceived Exertion (RPE) scale, and participants were instructed to exercise at an intensity of 15 ("Very Hard"). Salivary α-amylase (sAA), a noninvasive biomarker of central norepinephrine, was measured as an indicator of arousal. A recognition memory test was administered after a 48-hour delay. Memory data were submitted to a 3×3×2 (Group × Valence × List) mixed ANOVA. The sAA data (n = 33) were submitted to a 3×4 (Group × Time) mixed ANOVA. **RESULTS:** No effect of Group or Valence on recognition memory was revealed, however; high-intensity cycling increased sAA in both exercise groups, indicated by a significant Group × Time interaction, $F(6,90) = 6.995$, $p = .001$, $\eta^2 = 0.318$, and confirmed with paired *t*-tests ($p < 0.05$). **CONCLUSION:** This is the first study to our knowledge that demonstrates an increase in sAA resulting from an RPE-prescribed bout of exercise. Further investigation is needed to draw conclusions about the memory-enhancing potential of acute aerobic exercise.

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Minimalist Footwear Reduces Muscle Activity in the Lower Leg During a Jump Landing Task

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Previous research has shown minimalist footwear (MF) to have a positive effect on ankle injury risk factors such as balance, strength, and kinematics. Little research has been reported on the effect of MF on muscle activity. Preliminary investigations in novice users of MF has shown lower muscle activity during a jump landing (JL) task, which may indicate faster reactions and less overall muscle activity in response to a perturbation. It is unknown if similar effects can be detected as a result of long-term MF use. **PURPOSE:** To examine the effects of MF use on muscle activity patterns in lower leg musculature. **METHODS:** Two groups of healthy, physically-active individuals (n = 50) who participate in regular high intensity interval training,

participated in this study. The MF group (27.8 ± 5.5 yrs, 168.5 ± 11.0 cm, 73.1 ± 13.8 kg) consisted of 10 males and 15 females who regularly train in MF. The non-minimalist (NM) group (22.9 ± 4.9 yrs, 170.0 ± 9.9 cm, 67.7 ± 12.1 kg) consisted of 11 males and 14 females with no previous exposure to MF during training. Analysis of the tibialis anterior (TA), peroneus longus (PL), peroneus brevis (PB), and the medial gastrocnemius (MG) was conducted during JL with surface electromyography (EMG) on the dominant leg. EMG data was normalized using a 5-second MVIC for each muscle prior to JL. Subjects jumped with both feet over a 30-centimeter hurdle from a distance of 40% of their height and landed with only their dominant leg on a force plate. The primary outcome variable was normalized EMG activity of the four muscles, during the five seconds post-initial contact with the force plate. Independent sample t-tests were used to compare average EMG activity between the groups for hypothesis testing at $p < 0.05$. Mann-Whitney U was used for data that was not normally distributed. **RESULTS:** EMG activity was significantly lower for PL ($p = 0.031$) and PB ($p = 0.012$) in the MF group. No significant differences were seen for TA or MG. **CONCLUSION:** Lower EMG activity in MF shows that muscle activity during a JL varies across footwear and could be an indicator that long-term MF use results in quicker stability. Intervention studies should be conducted to better determine whether the results were caused by habitual training in MF or rather an effect of the footwear during JL.

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"Expert" Advice On Dietary Supplements

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The incidence of dietary supplement use is high amid the US population. Seventy-eight percent of American adults have used at least one dietary supplement within the past 12 months. Supplements are regulated as food, not drugs, and their safety and effectiveness are often unknown. **Purpose:** This study aimed to evaluate the safety and effectiveness of advice provided by pharmacists and retailers. A secondary purpose was to evaluate whether either recognized symptoms associated with serious cardiovascular concerns and if appropriate follow-up advice was given. **Methods:** Two college-aged women of normal BMI visited 51 pharmacies and 22 retailers with a standardized script that included a desire to lose weight, a lack of energy, and the presentation of multiple, potential cardiovascular disease symptoms. Immediately upon departure, all data from the advice given were recorded. Data were then uploaded into a spreadsheet for analysis. **Results:** Descriptive analyses revealed that 44.2% of pharmacists and 100% of retailers recommended supplements, and only 35.6% of all advice suggested the creation of a negative energy balance. A total of 50 different supplements, with multiple repeats, were recommended. Cardiovascular symptoms were directly addressed by 4.1% of pharmacists and 0% of retailers. Further, 25.5% of pharmacists and 0% of retailers made a referral to a physician. Eleven percent of the time, symptom interpretation by pharmacists and retailers led to misdiagnoses of asthma (n=4), dehydration (n=1), electrolyte imbalance (n=1), allergies (n=1), or vitamin deficiencies (n=1), while, 75.3% of the time, symptoms were ignored entirely. **Conclusions:** Given the high percentage of dietary supplement usage in the United States and the lack of appropriate advice, consumers must use extreme caution when interpreting information from pharmacists and retailers. Supported by two Slippery Rock University grants:

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Atrophy of Muscle Cells Results in a Selective Packaging of Proteins into Exosomes

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Skeletal muscle atrophy occurs in a variety of conditions and can result in decreased quality of life and mortality. Previous work from our lab established that certain microRNAs in muscle cells play a role in the progression of muscle atrophy and the intracellular level of these microRNAs are altered during atrophy, at least in part, due to incorporation into small vesicles (termed exosomes) released into the extracellular environment. Currently, little information exists about muscle released exosomes. Potentially these vesicles could be taken up by other tissues and identify a mechanism by which muscle signals other tissues during chronic conditions in which atrophy is occurring. However, to know what signaling pathways these exosomes may potentially be involved in, it is important to know what potential signaling molecules are present in exosomes released from muscle cells during atrophy. **Purpose:** To identify if exosomes released from muscle cells during atrophy contain different internal cargo proteins than exosomes from healthy muscle cells. **Methods:** C2C12 cells were treated with dexamethasone (DEX; 1μM) for 6 hours in serum free media, media was collected, and exosomes were isolated from the media. LC-MS proteomic analysis was performed on proteins isolated from exosomes, and analyzed using Ingenuity Pathway Analysis software. Nanoparticle tracking analysis (Nanosight) was performed on a separate set of exomes measure vesicle size and number. **Results**: Compared to control cells, the exosomes released during DEX-induced muscle atrophy contained 135 proteins increased greater than two-fold and 159 proteins decreased greater than two. Nanoparticle tracking analysis revealed no change in the number of exosomes released during atrophy ($6.77x10^8$ vs 7.06×10^8 vesicles/mL). However, while there was no change in the total number of exosomes the size profiles of the exosomes released during atrophy was different. **Conclusion:** Skeletal muscle atrophy results in both a selective packaging of proteins into exosomes and unique size profile of exosomes released from muscles, but does not alter the total number of exosomes released. These novel findings could have broad implications for the development of biomarkers in skeletal muscle atrophy.

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Effects of a 4-Week Fitness Intervention on Vascular Health and Fitness in Firefighters vs Non-Firefighters

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Research shows that one of the independent risk factors for cardiovascular disease is increased sedentary time. Physical fitness is inversely related to mortality, and decreasing sedentary time and increasing exercise time can improve cardiovascular risk. Very few studies have previously found that 4-weeks of exercise can improve cardiovascular health and fitness levels. Firefighters are an ideal population considering most of them are sedentary. Approximately 70% of firefighters are volunteers, and health and fitness screenings are often not required. Also, over 50% of the firefighter line-of-duty deaths are cardiac related. **PURPOSE:** The purpose of this study is to compare the effects of a 4-week functional fitness exercise intervention on vascular and fitness levels between volunteer firefighters and non-firefighters. **METHODS:** We had 41 adults participate in the study; 27 volunteer firefighters and 14 non-firefighters. We measured blood pressure (systolic, SBP; diastolic, DBP), flow-mediated dilation (FMD), carotid artery intima media thickness (IMT), body mass index (BMI), fat mass (FM), total high-density lipoproteins (HDL), triglycerides (TRG), as well as fitness variables including VO_2 peak, 2-minute stair climb, right-and left-leg balance, plank, 12-step sprint, and wall sit. **RESULTS:** We found improvements in cardiovascular health and fitness after only 4-weeks of exercise. Firefighters showed improvements in SBP (pre-128.1±1.8 mmHg; post-121.7±1.9 mmHg), DBP (pre-77.8±1.1 mmHg; post-74.5±1.2 mmHg), BMI (pre-30.9±1.0; post-30.9±1.0), FM (pre-68.6±4.8; post-65.8±4.8), HDL (pre-39.0±2.3mg/dL; post-40.3±2.2 mg/dL), TRG (pre-118.2±11.8; post-97.3±11.1), and wall sit time (pre-102.0±12.9 sec; post-118.8±10.3 sec). We found no differences between groups with the intervention in vascular health variables. Firefighters also had more improvements than non-firefighters in most fitness measures. **CONCLUSION:** Preliminary data suggests that 4 weeks of exercise improves cardiovascular health and fitness measures. In addition, it was seen that although firefighters start out the intervention in worse vascular and fitness conditions, they actually improved more after the 4 weeks of exercise.

Perceived Intensity Level During Treadmill Exercise

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The American College of Sports Medicine (ACSM) classifies different exercise intensities through ranges of heart rate, oxygen consumption, and the metabolic needs of the activity. Currently, there are no studies examining if individuals perceive the exercise intensity level as it is defined by these physiological ranges. **PURPOSE:** The purpose of this study was to determine if individuals perceive aerobic exercise intensities as they are defined by the ACSM. **METHODS:** Data are Mean ± SD. 11 total subjects (males, n=4; females, n=7) with age (24.2 ± 7.1 years), BMI (25.8 ± 4.0 $kg \cdot m^{-2}$), percent body fat (28.3 ± 9.9 %) and VO_2max (40.7 ± 8.5 $mL \cdot kg^{-1} \cdot min^{-1}$) participated in this study. Subjects completed a graded exercise test on a treadmill to maximal exertion while rating the intensity at the end of each stage of the test. Subjects used a Perceived Intensity Level (PIL) Scale to rate the intensity. The scale included: 1-Very Light, 2-Light, 3-Moderate, 4-Vigorous, 5-Near Maximal, and 6-Maximal. Subjects were not given the definition of each intensity level as defined by the ACSM, but were given standard

instructions on how to use the scale during the test. Actual Intensity Level (AIL) was determined using $\%VO_2R$ attained at the end of each stage. The PIL rated at the end of each stage was compared against the AIL. **RESULTS:** A contingency table assessed agreement between PIL and AIL. Cohen's Kappa (K) showed the strength of the agreement between PIL and AIL was substantial (K = 0.645). **CONCLUSION:** Current physical activity recommendations state that adults should participate in moderate and vigorous intensity activities for several health-related benefits. These results suggest individuals may be able to appropriately self-regulate aerobic exercise intensity without knowing specific intensity definitions.

Exercise Reduces High-Fat Diet Induced Colon Inflammation but Does Not Influence MUC2 Expression

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Obesity is a potent risk factor for colorectal cancer (CRC) development and exercise has shown to significantly reduce the risk thereof. Further, alterations in the colon mucus barrier are closely involved in the pathology of chronic gut inflammatory disease. **PURPOSE:** We aimed to determine whether exercise can attenuate high-fat diet (HFD) induced colon inflammation and whether the primary component of the colon mucus barrier, MUC2, was affected by inflammatory status. **METHODS:** 49 (n=6/group) 6-week old C57BL/6NTac male and female mice were weighed and randomly assigned to one of 4 groups: (1) lean-sedentary (LS, 10% fat diet, Research Diets); (2) obese-sedentary (OS, 45% fat, Research Diets); (3) lean-exercise (LX); and (4) obese-exercise (OX) for 12 weeks. Mice had *ad libitum* access to food and water. Exercised mice had free access to a running wheel in their cages. Food intake was monitored every other day and body weights once per week. After 12 weeks, animals were sacrificed and distal colon tissues were fixed for histological analysis and immunohistochemistry for cyclooxygenase-2 (COX-2), a marker of inflammation, and MUC2. All tissues sections were blindly scored by a board certified pathologist[3]. Slide staining was reported using a dual number system (#X#). The first number was the intensity of the stain and the second number was the amount of stain present in the specimen. Intensity was graded on 1–3 and the amount indicated as follows- 1-<10%; 2-11-40%; 3-41-60%; and 4->60%. Total score was obtained by multiplying the two numbers. **RESULTS:** OS animals showed the greatest expression of COX-2. Conversely, OX animals had a significantly reduced expression compared to OS. LX animals showed the greatest reduction in COX-2 expression compared to all groups. All MUC2 expression was centralized in the goblet cells of the colon mucosa with varying differences between the epithelium and crypts in stain present. Exercise nor did inflammation appear to affect the intensity of MUC2 staining. **CONCLUSIONS:** Exercise attenuates HFD induced colon inflammation in both male and female mice. MUC2 expression does not appear to be influenced by inflammatory status or exercise suggesting that post-translational modifications of mucins are more indicative of health status.

Statement of Disclosure: The authors have nothing to disclose.

The Validity of Apple Watch For Energy Expenditure Estimation In Physical Activity

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As the technology advance, both consumers and researchers become more interested in using wearable fitness devices to monitor and measure physical activity (PA). Apple Watch® (Apple Inc, Cupertino CA) is designed to track individual's PA and has a built-in exercise application, Workout App which tracks user's energy expenditure and exercise time. Even though Apple Watch claims to be a useful wearable fitness technology, the validity of its PA measures is unknown. **PURPOSE:** The purpose of the study was to investigate the validity and reliability of the energy expenditure estimation of Apple Watch among college students. **METHODS:** A total of 30 college students (17 males and 13 females) from a state public university in Pennsylvania participated into the study. All participants completed two sets of three 10-minute treadmill walking and running trials while wearing three apple watches and being connected to indirect calorimetry. The two sets of bouts were arranged on two separate days with a randomization and >48-hour rest in between. The three walking trials were at speeds of 54, 80, and 107 m•min^{-1} while the running trials were at speeds of 134, 161, 188 m•min^{-1}. Resting Metabolic Rate was collected by the indirect calorimetry along with a familiarization trial prior to the execution of the exercise protocol. Energy expenditure comparisons was made using Two-way ANOVA with repeated measures. Reliability was analyzed by Introclass Correlation. **RESULTS:** There was no significant device x speed interactions ($F(15, 696) = 1.113$, $p > 0.05$) between the indirect calorimetry (criterion) and watches. Bonferroni post hoc analysis revealed no significant differences between the criterion energy expenditure estimates and Apple Watch (B) ($p = 0.117$). The reliability analysis: A moderate to high agreement among the three apple watches examined in this research. The Inter-Class Correlation (ICC) scores were 0.49 (95%CI) at 2mph, 0.66 (95%CI)) at 3mph, 0.72(95%CI)) at 4mph & 5mph, 0.71(95%CI)) at 6mph & 7mph. **CONCLUSION:** Apple watches demonstrated a moderate to high level of validity and reliability on measuring physical activity. **Supported by a University Leveraging Grant #** 2015021.

The Inter-Rater Reliability of A-mode Ultrasound for Determining Percent Body Fat Among College-Aged Males

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Few studies to date have examined the validity and reliability of A-mode Ultrasound (US). While the results have been promising, the inter-rater reliability of both experienced and inexperienced assessors has not been previously investigated. **PURPOSE:** The purpose of this study was to examine inter-rater reliability between four assessors using both US and skinfold methods (SF) to determine percent body fat (%BF) among college-aged males. **METHODS:** Sixteen college-aged adult males between 18-24 years old (20.8 ± 1.6 yrs) participated in this study. All subjects reported for a single testing session in a hydrated state (Usg 1.014 ± 0.006). Both US and SF measurements were taken at the chest (CH), abdomen (AB), and thigh (TH).

The 3-site Jackson & Pollock method was used to determine body density and %BF for both US and SF. Four assessments were completed by four different assessors, two experienced (A1 and A2) and two inexperienced individuals (A3 and A4). **RESULTS:** There was no significant difference in %BF determined by any of the 4 assessors when using US (A1=12.8±4.7%; A2=13.8±5.4%; A3=13.2±5.4%; A4=13.4±5.4%; p=0.120) or SF (A1=10.3±5.0%; A2=11.2±6.3%; A3=10.5±4.7%; A4=10.2±4.9%; p=0.094) methods. The intra-class correlation coefficients (ICC) for %BF measurements determined by US and SF were identical at 0.986. When considering the measurements for CH, AB, and TH for each instrument, the ICC's were 0.967, 0.935, and 0.991 for US, respectively and 0.966, 0.957, and 0.930 for SF, respectively. **CONCLUSION:** The results of this study demonstrate acceptable inter-rater reliability for the assessment of percent body fat using US when administered by both experienced and inexperienced assessors. The reliability for US was equivalent to that demonstrated by SF.

Development of a Computational Tool for Optimal Resting Metabolic Rate Calculation

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Resting Metabolic Rate (RMR) is a measure of body metabolism during a time period of strict and steady resting conditions. The traditional way of calculation of RMR from indirect calorimetry normally involves the manual selection of a proper data region for the oxygen consumption (VO_2) and carbon dioxide production (VCO_2) from the raw data file and the task is labor intensive and time consuming. **PURPOSE:** To develop a computational tool that can automatically determine the optimal data region to efficiently calculate the RMR. **METHODS:** 69 subjects' RMR data were collected in the Neuromuscular Research Laboratory (NMRL) at the University of Pittsburgh. To develop the algorithm for optimal region selection and RMR calculation, several properties of the data, including the length of time interval of the selected region for calculation and the standard deviation of data within the selected region and remaining region, were investigated by summary statistics. The RMR results obtained by the algorithm were compared with each original manual based result for validation purpose. Finally a software, which incorporates the algorithm with Graphic User Interface (GUI) and a database, was developed using Python PyQt framework and SQLite technology. **RESULT:** The mean length of the manually selected region was 9 min 28 sec or 568 seconds which was set to be the length of the time interval for the data region used in the algorithm. The standard deviation of data in the selected region were lower than the standard deviation of ones in the remaining regions (VO_2: 35.1 ± 16.0 vs 54.1 ± 22.8 $p<0.0$, VCO_2: 26.5 ± 12.9 vs 40.8 ± 19.4 $p<0.0$). The mean percent error of RMR between computational tool based and manual based calculation was 3.34%. **CONCLUSION:** The results show that the algorithm is able to identify the optimal data region with the least variation and the results were close to the manual based calculation. The software we developed provides an efficient way for RMR calculation. It also includes a data storage function, which will be useful in future data analysis.

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Title: Leg pain in a high school soccer player

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History: An otherwise healthy 15-year-old female soccer player presented to the Bone and Joint Institute with the complaint of bilateral anterolateral leg pain during exercise that has increased in intensity over the past year. Pain and parasthesias developed within minutes and remained for long periods of time, sometimes hours, post-exercise. The patient stated that the pain has become increasingly worse even with walking or climbing steps at school and was consistently worse in the right leg. She has been limited in recreational exercise and has stopped playing high school soccer due to increased discomfort. Activity modification and stretching failed to relieve pain.

Physical Exam: She had no obvious deformity of the lower extremities. There was no leg length descrepency or tenderness to palpation of bones. There was no tenderness along any of the four leg compartments, however she exhibited woody compartments and had a palpable fascial defect in the right anterior leg but not the left. She had full passive and active range of motion without pain bilaterally. Manual muscle testing showed 5/5 strength in all muscle groups. She had no signs of knee or ankle instability. Forward bend test was within normal limits. She exhibited strong bilateral pedal pulses both during and after exercise.

Differential Diagnosis: 1. Medial tibial stress syndrome 2. Chronic exertional compartment syndrome 3. Stress fracture 4. Popliteal artery entrapment syndrome 5. Slipped capital femoral epiphysis

Tests and Results: Bilateral x-rays of ankles and feet revealed no evidence for fracture or dislocation. Anterior compartment pressure in the right leg was measured to be 29 mmHg at rest and 99 mmHg after 10 minutes of jogging.

Final/Working Diagnosis: Chronic exertional compartment syndrome.

Treatment and Outcomes: Single incision complete anterior compartment fasciotomy. Status post fasciotomy, intracompartmental pressure was measured at 6 mmHg. Follow up appointments were at 5 days, 4 weeks, 3 months, and 1 year. The patient was weight bearing as tolerated and used crutches immediately post-operation. She began a graded running rehabilitation program at 8 weeks. At 1 year post-operation our patient was noticeably better with greatly improved exercise capacity. She has returned to recreational running and playing high school soccer.

Hip Injury in a Dancer

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HISTORY: A 46-year old female dancer sustained a hip injury while dancing. While on vacation, she was dancing on a wet surface when she slipped, and did a split. She felt a pop and severe pain in her left hip. Soon after, she was transported to the local ED by ambulance and found to have a posterior left hip dislocation, which was reduced in the ED. She was placed in a knee immobilizer, and was discharged with crutches. At her follow up in our clinic 10 days later, she complained of diffuse left hip and groin pain, made worse by any kind of movement or bearing weight through the limb. Additionally, she complained of numbness in the left lateral calf and dorsal foot.

PHYSICAL EXAMINATION: Examination revealed diffuse tenderness of the left, gluteal musculature, and hip flexor musculature. Left hip range of motion proved limited in all planes due to pain and apprehension. Pain worsened with passive internal and external rotation of the hip. While strength was limited in the left hip and knee due to pain, ankle dorsiflexion and plantar flexion strength was full. Sensation to light touch was decreased in her left lateral calf.

DIFFERENTIAL DIAGNOSIS: 1. Posterior hip dislocation without fracture 2. Posterior hip dislocation with associated fracture 3. Posterior hip dislocation with associated sciatic nerve injury

TESTS AND RESULTS: X-rays hips and pelvis (day of injury): Posterior left hip dislocation, no fracture. Pincer type impingement with acetabular and femoral cystic changes

CT pelvis then ordered to evaluate for any fractures not seen on x ray

CT pelvis without contrast: No fracture in the region of the hip joint. Presumed moderate sized hematoma in fat between the left quadratus femoris and gluteus maximus muscles, extending into adjacent muscles, completely obscuring the extra-foraminal sciatic nerve

FINAL/WORKING DIAGNOSIS: Left posterior hip dislocation with no associated fracture. Neuropraxic injury to the left sciatic nerve likely due to hematoma.

TREATMENT AND OUTCOMES: The patient was referred to ortho and was seen one week later 1. Advanced from TTWB to protective weight bearing 2. Advised to advance to WBAT 3. Maintain posterior hip precautions 4. Anticipate continued improvement in lateral calf numbness as hematoma resorbed 5. Repeat x rays in 6 months to evaluate for femoral head avascular necrosis

Foot Pain – Runner

Rathna R. Nuti, Drexel University Sports Medicine, Philadelphia, PA
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History: A 39-year-old runner with past history of right plantar fascia pain presented with on-going right heel pain that started 3 months ago. He had increased his running regimen to lose weight. Pain was sharp and stabbing in nature that was worse with walking/running on heel strike and localized to right posterior lateral calcaneus. Occasionally, pain radiates down the lateral side of the foot. Naproxen, stretching, and frozen ice rolling provided little relief. He had changed sneakers and been using gel heel cup inserts.

Physical Exam: Pain was reproducible on palpation over the lateral calcaneus 1-1.5 cm from end of the posterolateral aspect. Positive tinel's sign. Normal sensation, reflexes, and strength of his ankles and feet. Full active range of motion of ankles and feet with no effusion and pedal pulses that are 2+.

DDx: 1. Right calcaneal stress fracture 2. Right plantar fasciitis 3. Sural neuropathy 4. Heel fat pad disorder

Test and Results: Right calcaneal radiographs: - normal. 12 MHz linear array US of the right plantar fascia: - no thickening of plantar fascia – small cystic changes in the calcaneal bone at Achilles attachment (1 mm). MRI R foot: - normal structures present.

Final/Working Diagnosis: Sural Nerve Impingement

Treatment/Outcomes: 1. Ultrasound guided sural peri-neural injection with improvement seen immediately after injection and full resolution after the second injection. 2. Use of Tuli heel cup shoe inserts. 3. Return to running protocol 4. Patient stated he had returned to full function with no pain.

Shoulder Injury — Baseball

Paul Han, United Health Services, Binghamton, NY
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HISTORY: A 20-year-old right-handed college baseball outfielder sustained a right shoulder injury 2 months ago while swinging baseball bat. He described his pain as sharp in quality, located at posterior shoulder. It was aggravated by swinging bat, reaching down to tie shoes, rotator cuff Theraband exercises, and alleviated by avoiding right-handed batting. He had no pain when he batted left-handed nor with normal right-handed throwing motion. However, he had pain when he dropped his throwing motion down to side-arm. Reports no loss of throwing speed.

PHYSICAL EXAMINATION: Shoulder normal to inspection and palpation with no tenderness bilaterally. Full active range of motion with no pain bilaterally. Strength 5/5 bilaterally. Negative empty can and cross arm adduction. Positive subscapularis lift-off and belly press. Sensation grossly intact bilaterally.

DIFFERENTIAL DIAGNOSIS: 1. Strain of subscapularis muscle. 2. Strain of supraspinatus muscle. 3. Batter's shoulder. 4. Scapular dyskinesis. 5. Tear of glenoid labrum.

TEST AND RESULTS: Musculoskeletal ultrasound of right shoulder: Partial subscapularis intra-articular side tear.

MRI of right shoulder: Partial intra-substance tear at cephalad tendinous level of subscapularis with suggestion of partial intratendinous subluxation of long head of biceps tendon into the subscapularis intra-substance tear. Nondisplaced superior labrum anterior posterior tear. Intra-articular long head biceps tendinopathy. Mild supraspinatus and infraspinatus tendinopathy and suggestion of shallow bursal surface fraying.

FINAL/WORKING DIAGNOSIS: Strain of right subscapularis muscle

TREATMENT AND OUTCOMES: 1. Therapeutic exercises to strengthen rotator cuff muscles and scapular stabilizers. 2. Pain-free activity, including throwing, lifting. 3. If pain-free, gradually progress over 3 weeks to hitting baseball off tee.

Spleen Injury- Lacrosse

Jacob M. Kempske, Towson University, Towson, MD
e-mail: jkemps1@students.towson.edu (Sponsor: Emily Hildebrand, Ph.D., LAT, ATC)

History: A healthy 18-year-old male high school lacrosse player was participating in a scrimmage during practice and while defending an attackman, he was hit in his left upper quadrant by the attackman's shot from approximately 10 feet away. The player attempted to block the shot with his lacrosse stick while his left arm was elevated, exposing his left upper quadrant without the protection of a rib protector. Upon impact, the athlete immediately fell to the ground due to pain in his left upper quadrant and walked without assistance to the athletic training facility to be evaluated.

Physical Examination: Examination by the athletic trainer revealed a relatively stable hemodynamic state other than short, rapid uncomfortable breaths and pallor facial features. The player did not note any nausea or vomiting. A lacrosse ball sized circular area with erythema over the player's left 9^{th} to 11^{th} ribs was observed. Palpation of the affected area revealed tenderness and increased firmness when compared bilaterally. The player noted a sharp pain in his abdomen and left shoulder which occurred without palpation. Following the initial evaluation, the player was sent to a nearby hospital where he was then transferred to a local shock trauma center.

Differential Diagnosis: (1.) Ruptured spleen (2.) Rib Fracture (3.) Abdominal Contusion (4.) Lung Contusion

Test and Results: Abdomen-pelvic computed tomography (CT) revealed at least a grade III splenic injury with a corresponding small hemoperitoneum and pulmonary contusion of the left lower lobe.

Final/Working Diagnosis: Grade III splenic laceration

Treatment and Outcomes: (1.) The patient underwent selective splenic artery catheterization and coil embolization of the main splenic artery approximately 15-hours following injury. (2.) He was discharged from the shock trauma center three-days following injury with a follow-up CT scan and doctor visit scheduled for eight-days post injury. (3.) The patient returned to non-contact activities nine-days post-injury after follow-up CT scan revealed no signs of hemorrhage and pseudoaneurysm. Non-contact activities included playing catch with a lacrosse ball and weight-lifting. (4.) He returned to contact activity three-weeks post-injury while required to wear a kidney guard for two-months from the date of injury.

Diffuse Nocturnal Muscle Pain in a High School Football Linebacker

Kenneth Lee, Drexel University, Philadelphia, PA.
email: Kenneth.Lee@Drexelmed.edu (Sponsor: Thomas Trojian, MD)

HISTORY: A 16 year old male football linebacker with history of Glucose-6-Phosphate Dehydrogenase Deficiency, presented with diffuse muscle cramps and pain after a full day of practice. He had muscle cramps before, but never diffuse, usually localized to the calves. He was doing ok during practice, but that night felt the above symptoms. Also, he admitted to poor oral hydration. Initially, he was admitted to the hospital for a Creatine Kinase (CK) level of 26,803, and treated with intravenous fluids and serial lab monitoring. Soon after discharge, he played sports again. Repeat labs by his primary medical doctor (PMD) showed CK increased to 24,000. He was readmitted and treated again for elevated CK. After discharge, he followed-up with sports medicine.

PHYSICAL EXAM: Examination in clinic revealed a well appearing male with normal vitals and mental status, full range of motion, no muscle tenderness to palpation, and was neurovascularly intact.

DIFFERENTIAL DIAGNOSIS:
1. Rhabdomyolysis - Acquired
2. Dehydration
3. Myositis
4. Myopathy- Congenital

TEST AND RESULTS:
Inpatient admission CK: 26,803. CK day of discharge: 5192
Sports medicine clinic labs: CK 1128→ 622→ 1455→ 471→ 1192→ 480. Electrolytes, creatinine, and urine analysis normal.

FINAL/WORKING DIAGNOSIS: Rhabdomyolysis

TREATMENT AND OUTCOMES:
1. In the sports medicine office, laboratory values were CK 1128, but complete metabolic panel and urine analysis were normal. A return to play for exertional rhabdomyolysis was started. Athlete was told to avoid strenuous activities/sports and to only continue with activities of daily living for 1 week. Weekly CK's were drawn with each follow-up visit.
2. Repeat CK improved to 622→ athlete was progressed to do daily light activities for 1 week.
3. Repeat CK increased to 1455→ athlete was instructed to reduce his exertion by 50%. Activities included jogging, foot work drills, but no pads and helmet.
4. Repeat CK improved to 471→ athlete underwent heat acclimatization and warm-up drills with an athletic trainer.
5. Repeat CK increased to 1192 (activities: running routes with shoulder pad/helmets and doing low level contacts)→ athlete's activities reduced to 1 a day practices, and to use shoulder pads/helmets.
6. Repeat CK improved to 480→ athlete cleared for full competition with repeat labs in 1 week.

Knee Pain – Soccer Player
James Kelley, Penn State University

HISTORY: A 17 year old soccer player sustained a knee injury in 2014 while performing a turn while playing soccer. She was diagnosed by an outside provider with a partial ACL tear, possible meniscal tear and medial collateral ligament injury, and placed in a hinged brace. Seen at Penn state, for second opinion, recommended physical therapy. On a followup she felt better, however one year after she returned with more right knee pain. She felt her knee "buckle" during soccers and had pain with impact with exercises. She was at first monitored, but then sent again to physical therapy when the pain worsened. Following initial improvement, followed by months of chronic pain, she was sent to the sports med team.

PHYSICAL EXAM: Well appearing 19 yo female. No significant effusion or deformity to her right knee. Nonantalgic gait. Range of motion of her right knee is from 0-140° of flexion. She has a negative Lachman, negative anterior and posterior drawer, negative varus and valgus stress testing at both 0 and, with minor right side discomfort at 30° with valgus stress testing. Positive McMurray test for reproduction of pain along the medial joint line. Medial joint tenderness.

DIFFERENTIAL DIAGNOSIS

- Meniscal Tear
- MCL Tear
- ACL tear
- PCL tear
- Mensical Cyst
- Fibromyalgia
- Intraarticular clot
- Knee Arthritis

TEST AND RESULTS

- **Right Knee MRI 2014**: grade III MCL injury
- **Right Knee MRI 2015**: Small fluid-filled cystic collection of the anteromedial tibial plateau
- **Right Knee MRI 2016**: Unchanged parameniscal cyst along the anteromedial tibial plateau with a possible vertical longitudinal tear of the periphery at the junction of the anterior horn and body of the medial meniscus
- **Right Knee Ultrasound 2016:** Medial meniscus triangular in shape, the anterior portion of her meniscus has a small tear on tibial side and a small para-meniscal cyst

FINAL WORKING DIAGNOSIS: Anteromedial and medial meniscal tear and parameniscal cyst refractory to conservative management

TREATMENT AND OUTCOMES: Aspiration of right sided parameniscal cyst, followed by

injection of 5 mL of autologous platelet rich plasma. On telephone follow-up one month after procedure, patient reported improvement in pain and satisfaction with the procedure, and has since been participating in intense soccer drills with only minor, sporadic discomfort.

Headache after MVA in physically active, health professional

Enayet Neak MD St Joseph's Family Medicine Residency
Sponsor Vanessa Lalley-Demong DO

HISTORY: A 35 year old female nurse practitioner with history of migraine headaches, presented to the ED 1 day after MVA, complaining of right-sided headache, nausea, and photophobia. The patient went off the road at approximately 30 mph, hitting a snowbank. She had a mild headache after the accident, saying her head whiplashed but denied hitting her head, or losing consciousness. She took an ibuprofen but woke up the following morning with the worst headache of her life, prompting her to the ED. Pertinent negatives included: No retrograde amnesia, phonophobia, blurred vision, eye pain, hearing loss, tinnitus, neck pain, extremity weakness, paresthesia, or dizziness.

In the ED, patient was told her eye dilated funny, but otherwise normal exam, labs. CT head was negative. GCS 15. Her symptoms improved with prochlorperazine, and diphenhydramine. She followed up in the office 2 days later, with continued symptoms. Office SCAT2 symptom score was 15/132. She was diagnosed with a concussion syndrome, and treated supportively, and given sumatriptan to help with her daily headaches. Over the course of the next several weeks to months, patient developed double vision, positional dizziness, neck pain, difficulty focusing, and difficulty performing her job.

PHYSICAL EXAMINATION: Initial physical examination immediately after her MVA – Vital signs were stable, and afebrile. Patient was well-developed, alert, oriented, and anxious appearing. She was normocephalic, atraumatic. Pupils were equal, round, and reactive to light. Extraocular movements were intact. Visual acuity: OU20/20, OD/OS20/25. Active and passive range of motion of the head and neck were normal. Cranial nerves 2-12 intact. Romberg test negative. Motor strength 5/5 across upper and lower extremities. Sensation intact.

Subsequent office visits revealed R neck pain to palpation, positive for tenderness, asymmetry along R levator and R trapezius muscles, with reduced range of motion.

DIFFERENTIAL DIAGNOSIS: Neck sprain/strain, post-concussive syndrome, BPPV, chronic migraine headache with aura, CN injury, malignancy/tumor, infection.

TESTS AND RESULTS: Initial CT head in the ED was negative for intracranial bleed. Symptoms progressed to double vision, R lateral neck pain without radiculopathy, and dizziness with position changes. X-ray cervical spine AP/lateral did not reveal any acute fracture, subluxation, or soft tissue mass/swelling. As symptoms continued despite PT/OT, non-contrast brain MRI was negative for midline shift, mass effect, or acute process. Dix Hallpike maneuver

did not reveal nystagmus, and she did not have symptomatic improvement. She received OMT for neck pain with mild improvement. While working with OT, patient noted to have horizontal saccades on lateral gaze along L eye, with lateral deviation of L eye, and difficulty accommodating. She was referred to neuro-optometry. She was diagnosed with CN3 palsy.

FINAL/WORKING DIAGNOSIS: Oculomotor (CN3) nerve palsy secondary to whiplash from MVA

TREATMENT AND OUTCOMES: 1) OMT clinic 2) Trigger point injection of R levator, R trapezius. 3) PT/OT and referral to neuro-optometry. 4) Optometry rehab, with ocular eye movement exercises – focusing on accommodation and tracking, and prism therapy. 5) Amitriptyline and melatonin to help with sleep. She was also given amantadine briefly to aid in sleep, and subsequently weaned off. 17 months after MVA, patient continues to have intermittent headaches, light and noise sensitivity, and trouble focusing. Her symptoms are exacerbated by overexertion, and fatigue. Her symptoms have lessened in the past 5 months with optometry rehab and prism lenses. Prior to her injury, patient was training with a physical trainer for a local 5K run. She resumed her training and exercise regimen. She ran the 5K successfully. However, she is not at her baseline prior to her MVA.

Title: Left Flank pain and abdominal fatigue: a cast study of an unusual neurologic injury

Laura Fink, Christiana Care

Case History

47 year old male presented to clinic for a 1 year history of intermittent left lateral flank pain and abdominal weakness. He was carrying a mattress when he slipped, twisted at his trunk, and developed the above symptoms. They were exacerbated after a second injury occurring 5 months later where he slipped on a patch of ice and caught himself prior to falling onto the ground. Heavy lifting, golfing worsened the pain and left abdominal fatigue. He additionally reported having irregular distension of his abdomen when he contracted his abdominal muscles.

Physical Exam

Alert and oriented
Abdomen soft, non-distended, bowel sounds present
Abdominal contraction demonstrated appropriate contraction of right abdominal wall, but bulging to left abdominal wall
No muscle definition to left abdominal wall
Decrease left sided abdominal reflex.
Sensation and reflexes were otherwise normal
Strength otherwise 5/5 diffusely

Differential Diagnosis

Radiculopathy
Intercostal Neuralgia
Multiple Sclerosis
Amyotrophic lateral sclerosis
Thoracic myelopathy
Transverse myelitis
Limb-girdle muscular dystrophy
Lyme Disease
Herpes Zoster, post herpetic neuralgia
Thoracic Nerve Neuropraxia

Test & Results

CBC, CMP, Vitamin B12, TSH, T4, ESR, Lyme IgG/IgM were negative.
CT abdomen found a small hiatal hernia, but was otherwise normal.
Thoracic MRI demonstrated a T7-T8 disc protrusion and several anterior thoracic vertebral osteophytes. EMG of thoracic spine and trunk demonstrated left sided denervation from T4-T11/12 (thoracic paraspinals).

Final/Working Diagnosis

Thoracic Nerve Neuropraxia

Treatment/ Outcome
Referred to peripheral nerve center, but did not follow up with specialist
Began formal physical therapy to re-strengthen and re-educate muscle
Completed formal physical therapy
Eventually had full resolution of symptoms
Returned to work and regular activities without restriction

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Knee Injury — Football

Vipul Sharma, Tiffany Tsay, Geisinger Wyoming valley Family Medicine, Wilkes Barre ,PA
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HISTORY: A 17-year-old male, high school football defensive line, sustained a left knee injury while tackling. After he tackled the opponent, he landed on his left leg with a plant and twist mechanism. He had immediate knee swelling. However, he was able to walk off the field. There was no numbness, tingling, weakness or radiation of pain. He did note stiffness of the left leg. He was seen the following day in Urgent care.
PHYSICAL EXAMINATION: Initial examination one day after the injury revealed limited flexion of the knee to 95 degrees secondary to pain, and no palpable or visible masses. Strength was also decreased 4/5 with flexion and extension. There was no joint line tenderness. All testing was limited due to guarding and knee swelling. McMurray, Anterior drawer and Thessaly tests were negative. Posterior drawer, Lachman, Sag, external rotational recurvatum tests could not be assessed secondary to pain and guarding. Pain with forced flexion was positive. Effusion was 2+.

Subsequent examination one week after the injury revealed 2+ effusion. Range of motion was 2-130 degrees. Lachman and anterior drawer were positive.

DIFFERENTIAL DIAGNOSIS: 1. Strain of ligaments (which ones?) 2. ACL tear 3. Avulsion Fracture 4. Knee Sprain

TEST AND RESULTS: Radiographs revealed supra-patellar knee joint effusion, small avulsion fragment off the lateral tibial plateau consistent with Segond fracture.
MRI showed complete tear at the mid portion of the ACL. Sprain of the MCL. Sprain of the posterior lateral corner.

FINAL/WORKING DIAGNOSIS: Segond fracture (avulsion fracture of lateral tibial plateau with complete ACL tear

TREATMENT AND OUTCOMES: 1. Immobilization with bracing. 2. Scheduled for ACL reconstruction using bone- patellar-tendon-bone autograft. 3. Planned for rehabilitation post ACL reconstruction with Physical Therapy for 6 weeks.

Elbow Injury - Crossfit

Tiffany Tsay, Geisinger Health System, Wilkes Barre, PA

e-mail: tstsay@geisinger.edu

Faculty Sponsor: David Ross, Geisinger Health System, Wilkes Barre, PA

History: A 58-year-old Crossfit athlete sustained a left elbow injury while performing a thruster (modified barbell overhead press) with a 190 pound barbell. He was a physically fit male with no known past medical history and denied the use of steroids or recent use of any other medications. In the middle of the maneuver he felt a pop in his left elbow and was immediately unable to sustain the position of the barbell. He rapidly developed swelling at the left elbow and noted an inability to straighten his arm. He presented to Orthopedics clinic on the day of his injury.

Physical Examination: Physical examination revealed a large fluctuant mass at the elbow, just proximal to the olecranon. There was tenderness to palpation at the posterior distal humerus. Manual muscle testing showed only trace movement in left elbow extension, but revealed full strength and range of motion in elbow flexion, pronation, supination, and wrist flexion and extension. Sensation was mildly decreased to light touch over the entire volar left hand but was otherwise intact. Radial pulses were 2+ and symmetric.

Differential Diagnosis: 1. Acute triceps tendon tear 2. Radial nerve branch injury 3. Triceps strain 4. Olecranon bursitis

Tests and Results: Left Elbow Ultrasound: large fluid-filled area at the posterior distal humerus and proximal elbow. Discontinuity of the triceps tendon. Left Elbow MRI: Full thickness tear of common (lateral and long) triceps tendon at insertion with 0.9 cm gap, additional partial thickness distal triceps muscle tears. Large volume fluid collection extending from olecranon bursa into triceps myotendinous muscle fibers.

Final/Working Diagnosis: acute left distal triceps tear

Treatment/Outcomes: 1. Urgent surgical repair of left distal triceps performed 4 days after the injury. 2. At postoperative day 14 follow-up, removed from splint and occupational therapy initiated. 3. Scheduled for 1 month post-operative visit.

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Study Title: Acute Knee Pain in a Professional Baseball Player

Patient Presentation: 32 year old African American professional baseball player, who was in competition, when he hit the ball and ran towards first base. As he decelerated to touch first base, he felt his knee buckle and fell face first to the ground. He proceeded to hop on one foot around the bases as he was unable to bear weight on the affected limb. He was placed in a compressive

Ace wrap and a locked hinged brace. Subsequently transferred to the hospital.

History: Patient is healthy other than ADHD on Adderall. Denied any numbness or tingling in his legs or other injuries. No loss of consciousness. No tobacco. No illicit drugs. No history of steroid or antibiotic usage. No surgery to affect leg.

Physical Exam: Inspection: Significant swelling and edema in the right knee compared to the contralateral side. Palpation: Both his thigh compartments as well as his calf compartments were soft. There was a palpable defect directly inferior to the patella. No other joint pain. ROM: Inability to extend knee or do straight leg raise. Special Test: ACL, PCL, LCL, MCL intact with good endpoints. He had 5/5 strength in dorsiflexion, plantar flexion as well as his EHL. He had 2+ dorsalis pedis and posterior tibial pulses and sensation were intact throughout the L3-S1 dermatomes. Unable to ambulate.

Broad Diagnosis: ACL rupture, quadriceps tendon tear, patellar tendon repair, meniscal tear, collateral ligament tear, muscular strain (grade I or II), patellar subluxation/ dislocation, fracture of the patella, severe patellar tendinosis, acute sickle cell crisis, gouty arthritis, septic joint.

Lab Studies: None

Other Studies: Three radiographs of the right knee do not demonstrate any fracture of dislocation. There is a notable patellar alta. Contralateral side intrasubstance calcific tendinosis.

Consultations: orthopedic surgery

Working Diagnosis: Complete rupture of the right patellar tendon from interior pole of the patella. The left knee exhibited intrasubstance patella tendinosis

Treatment: Repair of acute right patellar tendon rupture

Outcome: 1) Weeks 0-2 had locking hinged knee brace. Acute inpatient rehabilitation to improve mobility, transfers, ambulation with crutches, functional ADLs prior to return home. 2) Week 2-6 gentle supervised ROM progression up to 60 degrees of flexion based on intraoperative repair tension. Using Motrin for first 6 weeks for pain. The patient is to wear the brace locked in extension for ambulation. He can progress toward full range of motion after the 6 week mark. Expect 6-12 months to full recovery.

Author's Comments: The question for debate is in the follow-up... This case entails a common injury with uncommon presentation. In this case, the baseball athlete was healthy without prodrome complaints when he ruptured his patellar tendon during eccentric loading as he decelerated towards first base. His sport, as well as, his lack of prodrome complaints makes this case unique. Given that the patient has tendinosis on the other side the question remains if he requires therapies given it has now been identified that he is at risk for future injury.

References: 5 minute sports medicine consult

Exertional Calf Pain- Soccer

Sarah A. Vengal, University of Rochester Sports Medicine, Rochester, NY

Email: sarah_vengal@urmc.rochester.edu (Sponsor: Mark H. Mirabelli, FAAFP)

HISTORY: 16-year-old female soccer player initially presented with months of intermittent right calf pain. She described the pain as squeezing, throbbing, shooting, and tightness with high intensity sprints/agility and resolved with 5-10 minutes of rest. She noted numbness and tingling in her foot after 5-10 minutes of activity. She was initially treated with conservative measures including trial of complete rest, physical therapy and orthotics, but did not improve. She continued to have pain/numbness within 20 minutes of exercise. History of unknown ankle surgery prior to adoption. Unknown family history.

PHYSICAL EXAMINATION: Well-developed 16-year-old female, appeared stated age. Gait: nonantalgic. Right foot alignment within normal limits. No swelling, erythema, ecchymosis or deformity. Integument intact. No effusion, warmth. Nontender to palpation. Calf is soft and supple. Full range of motion including dorsiflexion, plantarflexion, inversion, eversion. 5/5 strength with resisted dorsiflexion, plantarflexion, inversion, eversion. Sensation intact. She was able to balance, single calf leg raise and hop 20 times on affected leg with mild discomfort in calf.

DIFFERENTIAL DIAGNOSIS: 1. CECS 2. Calf strain/cramping 3. PAES 4. Cystic adventitial disease of popliteal artery 5. Vitamin/mineral deficiency 6. Stress fracture 7. Vascular/neurogenic claudication

TESTS AND RESULTS: Tibia Fibular XRAYs AP, lateral: no acute osseous or soft tissue abnormality. Compartment testing of all 4 compartments, bilateral lower extremities: normal. MRI Right Knee, Tibia Fibula/Calf without and with contrast: Focal amorphous subcutaneous signal abnormality seen in the medial aspect of the leg proximally about 7 cm from the knee joint that most likely represents a subcutaneous hemangioma, less likely an AVM; no other gross abnormalities. HgB 8.3 Hct 30, Iron 13, TIBC 562, Iron Sat 2, Ferritin 3

FINAL/WORKING DIAGNOSIS: Iron Deficiency Anemia causing exertional calf pain

TREATMENT AND OUTCOMES:

1. One month of complete rest, PT, orthotics.

2. Oral iron replacement, repeat labs: HgB 13.4, Hct 41, Iron 157, TIBC 467, Iron sat 34, ferritin 9.

3. Vascular surgery consult obtained, and deemed unrelated.

3. Return to sports with resolution of symptoms and ability to meet demands of sport.

Title: Acute Atraumatic Shoulder Pain in a 39 Year Old Female

Sheila E. Taylor DO, Sports Medicine Fellow, Wellspan York Hospital Sports Medicine, York, PA

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Patient Presentation: 39 year old female presents to orthopedics with acute onset of severe left shoulder pain 8 weeks prior. She describes acute onset of shoulder pain with weakness. No history of trauma or prior shoulder injuries. Patient was seen by her PCP initially. Due to progressively worsening nature of pain, MRI was ordered prior to referral which revealed tears of supraspinatus, infraspinatus and biceps tendon. Xray revealed lysis of bone superficial to the articular cartilage of the humeral head.

History: Initially patient denied significant medical history. No history of diabetes or thyroid disease. After further repeated questioning, patient admitted to recent history of IV drug use and recent hospitalization for endocarditis and septic pulmonary emboli related to her IV drug use.

Physical Exam:

Gen: AAO x 3 in mild distress due to pain.

Left shoulder exam: Inspection: No significant erythema, or edema. No rashes or lesions. AROM: severely limited AROM in all planes due to pain. PROM: limited with pain. Strength: Diffuse weakness as compared to right side. Supraspinatus: 2/5, External Rotators: 2/5, internal rotators 4/5, Biceps: 3/5, Triceps: 4/5. Palpation: Tender to palpation over anterior shoulder, coracoid, long head of biceps and lateral deltoid. Negative Hawkins and Neers, Positive speeds. Equivocal Obrien's.

Broad Differential Diagnosis: Etiology of rotator cuff tear: Infectious- septic, osteomyelitis; trauma- bone bruise, contusion; degenerative; inflammatory- RA; ischemic- AVN; metabolic- hydroxyapatite deposition disease, gout; neoplastic- tumor; Iatrogenic- drug induced

Lab Studies: Fluoroscopically guided aspiration and culture that revealed pseudomonas,

susceptible to cipro, Elevated WBC, CRP, and ESR on original lab work. Positive RF, Negative ANA, Negative Lyme

Other Studies: Left shoulder arthroscopy, irrigation, debridement, humeral and synovial biopsy which revealed acute synovitis, culture positive for pseudomonas. Humeral bone biopsy negative for osteomyelitis.

Consultations: Infectious disease

Working Diagnosis: Rotator cuff tear secondary to chronic septic arthritis related to IV drug use

Treatment: Arthroscopic irrigation, debridement, IV antibiotics and subsequent prolonged oral antibiotics (pseudomonas culture and sensitivities revealed organism sensitive to cipro), Physical therapy, activity modification, cessation of IV drug use.

Outcome: Patient continues to have small improvements in her pain s/p above treatment. She is working with physical therapy. After antibiotics course, repeat negative culture and assurance of abstinence from IV drug use, there will be consideration for arthroscopic rotator cuff repair.

Author's Comments: This case entails a common complaint (acute shoulder pain and MRI revealing rotator cuff tear) with uncommon presentation and or mechanism. Patient had no history of trauma but rather a unique social history of IV drug use with prior serious complications. In this case, it is thought that her chronic septic arthritis eroded the insertion of her rotator cuff as evidenced by the lytic lesion seen on imaging and the soft bone found on arthroscopy. Moving forward, the question is when and if to repair her rotator cuff given her high risk of future illicit drug use and increased risk of repeat infection.

Title: Atypical Sciatica in a Recreational Cyclist

Authors: Ryan M. Norton, Penn State Hershey Medical Center, Hershey, PA; Matthew Silvis, Penn State Hershey Medical Center, Hershey, PA

History: 36 year-old male with history of SLE presents to the office complaining of chronic low back pain and vague left lower extremity symptoms. He was recently diagnosed with left achilles tendinopathy. He is an avid cyclist who is now limited to 15-20 miles/week secondary to pain. A lumbar MRI in 2010 revealed degenerative changes L4-S1 and a right sided disc protrusion. Previously he received an epidural injection and underwent physical therapy through an outside facility which provided only temporary relief. An ultrasound of his achilles was normal.
At his follow-up visit he reports worsening left lower extremity radicular symptoms including weakness when pushing on the gas peddle, burning pain in his calf, and tingling down his lateral

calf/foot. He is now taking NSAIDs and occasionally opioids to sleep. A repeat epidural injection is performed by IR however this time he reports no relief.

Physical Exam: Non-antalgic gait. Appears uncomfortable in the seated position. Low back diffusely tender to palpation. Left buttocks tender to deep palpation (not initially but at subsequent visits). Left strait leg raise positive and reproduces lower leg pain. Left plantar flexion strength 4+/5. Sensation and strength otherwise normal. Reflexes +2. Hips full ROM.

Differential Diagnosis: Lumbar Disc Herniation, Piriformis Syndrome, Peripheral Nerve Entrapment (tibial vs peroneal), Lupus flare

Test and Results: **MRI Lumbar Spine #2**: Unchanged from prior (see HPI). **MRI Pelvis**: Abutting the sciatic nerve posterior to left acetabulum is a 1.3 cm T1 isointense T2 hyperintense lesion

Working Diagnosis: Sciatic Neuroma

Treatment and Outcomes: Patient referred to Neurosurgery for consultation. He underwent a successful surgical resection of the nerve sheath tumor. Pathology consistent with a Sciatic Schwannoma. Following surgery he reported complete resolution of his left lower extremity radicular symptoms. He is now cycling without difficulty.